

**ENERGY AND WATER DEVELOPMENT
APPROPRIATIONS FOR 2011**

HEARINGS
BEFORE A
SUBCOMMITTEE OF THE
COMMITTEE ON APPROPRIATIONS
HOUSE OF REPRESENTATIVES
ONE HUNDRED ELEVENTH CONGRESS
SECOND SESSION

SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT

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NOTE: Under Committee Rules, Mr. Obey, as Chairman of the Full Committee, and Mr. Lewis, as Ranking Minority Member of the Full Committee, are authorized to sit as Members of all Subcommittees.

TAUNJA BERQUAM, JOSEPH LEVIN, JAMES WINDLE,
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PART 7

DEPARTMENT OF ENERGY

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(II)

**ENERGY AND WATER DEVELOPMENT, AND
RELATED AGENCIES APPROPRIATIONS FOR
2011**

TUESDAY, MARCH 23, 2010.

NUCLEAR ENERGY FY2011 BUDGET

WITNESSES

WARREN F. MILLER, JR., ASSISTANT SECRETARY FOR NUCLEAR ENERGY, U.S. DEPARTMENT OF ENERGY

Mr. PASTOR [presiding]. The hearing will come to order.

Good afternoon. We have before us today Dr. Warren “Pete” Miller, Assistant Secretary for Nuclear Energy. This is his first time before this subcommittee. He brings impressive experience to this job, and we look forward to working with him. He will be presenting the President’s fiscal year 2011 budget request for the Office of Nuclear Energy.

The Office of Nuclear Energy comes to us today proposing a revised portfolio for fiscal year 2011. The President’s request includes \$824 million for nuclear energy, \$37 million above fiscal year 2010. However, these figures are misleading without considering that all activities related to Yucca Mountain are included in the Office of Nuclear Energy, albeit at a drastically reduced level, and the Nuclear Power 2010 program has been completed. The proposal includes research into nuclear reactor enabling technologies, small modular reactors, and advanced reactor concepts.

While we have yet to see the Nuclear Energy Strategic Plan promised to us—how long has the promise been? Since our bill last year, I guess, the promise was made—we hope to see it soon.

This budget proposal raises questions regarding the administration’s approach to nuclear energy. On its face it appears that the administration is spreading its investment into a growing number of activities at the possible expense of making substantial progress on anything. I look forward to your defense of the choices made.

The most significant revision proposed for the Office of Nuclear Energy is its leading role in nuclear waste disposal. The administration’s termination of Yucca has created a great deal of uncertainty when it comes to how the Nation will dispose of its nuclear waste. To say the least, the administration could have communicated this major policy decision in a more forthright manner.

Your organization, Dr. Miller, will be responsible for executing the Department’s responsibility under the Nuclear Waste Policy Act and forming the Blue Ribbon Commission that will be looking at alternatives for the back end of the nuclear fuel cycle. We have

questions regarding how your organization will support the termination process and the path forward.

Your full written testimony is entered into the record. After the hearing we may have some questions for you to answer for the record. Assistant Secretary Miller, I ask that you ensure your responses and any supporting information requested by the subcommittee are delivered in final form no later than 4 weeks from today. If Members have additional questions that they would like to submit for the record, please provide them to the subcommittee by 5 p.m. tomorrow.

Mr. PASTOR. With these opening comments, I would like to yield to the Ranking Member.

Mr. FRELINGHUYSEN. Dr. Miller, good afternoon, and congratulations on your appointment. To say the least, it is pretty interesting times for all things nuclear, so we are very pleased to have you with us this afternoon.

Your experience in the military—and I note you are a West Point graduate, Vietnam service—academia, and during your long career at Los Alamos obviously give us some full testimony that you have come to the job well prepared, and we recognize that. It is great to have somebody with your background at the helm.

I said to Secretary Johnson last week that as our Nation drives towards the development of clean energy solutions, it must be an all-inclusive approach. That simply must include the responsible expansion of nuclear power.

Unlike last year's request, which left this committee having to carry the water for many nuclear programs, this budget appears to reflect a results-oriented approach. It appears that the programmatic maker of the Office of Nuclear Energy supports that notion as well. Take the Next Generation Nuclear Plant as one example. Last year no funding was requested for the program despite the potential to move forward towards new nuclear technologies. This year the program is back in the request at \$105 million.

Programs like the Next Generation Nuclear Plant, though recently concluded the Nuclear Power 2010 program, and now the newly proposed Small Modular Reactor Program, can move us more quickly forward towards increasing our nuclear power share of electricity production beyond its current 20 percent.

During these tough times it should not be the government's role to create jobs, but rather to provide the opportunity. I think many have been confused on this point. I believe that nuclear power offers one such opportunity. With estimates that each new power plant will generate as many as 2,400 construction jobs, nearly \$40 million in labor income, and over \$100 million in local, State and Federal tax revenue, this must be one of the solutions.

Dr. Miller, while I am encouraged by what I have seen so far of your request, I feel I must also call your attention to the picture on the far wall on my left. I think you may be familiar with it. That is not the face of the Moon, it is an aerial shot of where Yucca Mountain is. That photo hangs in this hearing room as a rather frank reminder of where this committee stands on Yucca Mountain.

Last week Mr. Pastor and I made our opinion of the administration's position on Yucca Mountain quite evident. We will have time with Secretary Chu tomorrow to get at this issue, but this request

proposes to eliminate the Office of Civilian Radioactive Waste Management and move its remaining functions under your office. I understand that all of the employees have received notice of expected separation. The Deputy Secretary of Energy has identified these employees, over 180 of them, as surplus. I find that—and I think we probably find that—pretty troubling. I intend to discuss this in greater detail with Secretary Chu when he appears before us tomorrow. I also hope that we can have at least some level of candid discussion on this important policy decision as we discuss the details of your budget request.

Thank you for your appearance.

And, Mr. Chairman, thank you for the time.

Mr. PASTOR. Assistant Secretary Miller.

Mr. MILLER. Thank you. Vice Chairman Pastor, Ranking Member Frelinghuysen, members of the committee, thank you for the opportunity to appear before you today to discuss President Obama's fiscal year 2011 budget request for the Office of Nuclear Energy.

The administration is committed to restarting our domestic nuclear industry. President Obama recently announced conditional commitments for more than \$8 billion in loan guarantees to build two new nuclear reactors, potentially the first new reactors ordered and constructed in the United States in more than 30 years. As the President has said, to meet our growing energy needs and prevent the worst consequences of climate change, we need to increase our supply of nuclear power.

The President's fiscal year 2011 budget request further supports nuclear power by requesting an additional \$36 billion in loan guarantee authority. This would bring the total to \$54 billion. In addition, the President's budget request totals \$912 million for the Office of Nuclear Energy, including \$495 million to support a robust research and development program. This \$495 million will provide a firm, broad foundation for the future of nuclear power by engaging the country's intellectual capacity both to overcome the challenges in front of us and to train the workforce of tomorrow.

Mr. Chairman, my written testimony covers our budget request in detail, so with my remaining time I will focus on a few important themes.

Our proposed cross-cutting research activity, called Nuclear Energy Enabling Technologies, is intended to galvanize the applied research communities at universities, national laboratories, and the private sector to tackle those issues that, if resolved, could be game changers for future deployment of nuclear energy. These range from novel nuclear fuels to radiation-resistant structures, to advanced computational modeling to create virtual simulations of existing and future reactors. It is critical that we establish a strong research effort to regain U.S. nuclear energy leadership through increased engagement of our science and engineering communities.

In February, the Department of Energy established a Blue Ribbon Commission on America's Nuclear Future to conduct a comprehensive review of the back end of the nuclear fuel cycle. The Commission will produce a final report within 2 years that will provide recommendations for developing a safe, long-term solution to managing the Nation's used nuclear fuel and nuclear waste, and my office will provide support as requested. While the Commission

is working, we will continue our strong research program on fuel cycle technologies.

I would like to call to your attention our new Modified Open Cycle program. Over the past several years, our country has been engaged in a debate over whether to continue with our once-through strategy or move to full recycling of our used nuclear fuel. Each of these options has advantages, but also significant drawbacks. It is important to understand that there is a wide range of promising technical options in between these two possibilities that should be explored and considered.

Modified open cycle research will encourage creative approaches to managing our used fuel in ways that extend our fuel resources while reducing our radioactive waste burden, thus providing future policymakers with a wider array of options from which to choose.

Finally, our budget request would support new reactor designs, including the Next-Generation Nuclear Power Plant for industrial process heat, and long-range R&D on small module reactors. The SMR program would also support near-term deployment activities up to and including design certification cost sharing.

Smaller reactors offer potential advantages in the way they are sited, licensed, financed, manufactured and built. If successfully deployed, they offer the United States a tremendous opportunity to position itself as a world leader in nuclear energy, bolster our manufacturing sector, create thousands of good-paying jobs, and to build a new generation of reactors that are made in the USA.

President Obama has said, "The nation that leads the world in creating new sources of clean energy will be the nation that leads the 21st century global economy." I believe that our nuclear energy R&D budget will help ensure that nuclear energy is part of that clean energy mix.

Mr. Chairman, thank you for the opportunity to appear before the committee, and I am pleased to take any questions now.

[The information follows:]

**Statement of Warren F. Miller, Jr.
Assistant Secretary for Nuclear Energy
U.S. Department of Energy**

Before the

**Subcommittee on Energy and Water Development
Committee on Appropriations
U.S. House of Representatives**

**FY 2011 Appropriations Hearing
March 23, 2010**

Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's fiscal year 2011 budget request for the Office of Nuclear Energy at the Department of Energy.

In his State of the Union address earlier this year, President Obama said, "To create more of these clean energy jobs, we need more production, more efficiency, more incentives. And that means building a new generation of safe, clean nuclear power plants in this country." On February 16, the President announced conditional commitments for more than \$8 billion in loan guarantees for that very purpose.

The President's fiscal year 2011 budget request also supports nuclear power by requesting an additional \$36 billion in loan guarantee authority for new nuclear plant construction. In addition, the budget request includes \$912 million for the Office of Nuclear Energy, a \$42 million increase over the fiscal year 2010 appropriation of \$870 million. Of the fiscal year 2011 request, \$495 million is for research and development to continue to make major improvements in the economic competitiveness, environmental performance, and proliferation resistance of nuclear energy deployed in the United States and abroad. This research budget will help build a foundation for nuclear power's future in the United States. We must further engage the country's intellectual capacity to find new solutions to the challenges in front of us.

President Obama has said that, "The nation that leads the world in creating new sources of clean energy will be the nation that leads the 21st century global economy." I share this view and believe that nuclear energy must be part of our clean energy mix. The construction of new nuclear reactors, such as those that we have provided loan guarantees for, will create thousands of good paying jobs in the United States and produce electricity to power our economy.

PROGRAMS

We have re-organized our research budget into three main programs: (1) Reactor Concepts Research, Development and Demonstration, (2) Nuclear Energy Enabling Technologies, and (3) Fuel Cycle Research and Development. The Office of Nuclear Energy has also put in place coordinating entities to prevent research duplication among program activities and to ensure that the activities complement one another.

Reactor Concepts Research, Development and Demonstration

The fiscal year 2011 budget includes \$195 million for the Reactor Concepts Research, Development and Demonstration (RD&D) program. The mission of this program is to develop new and advanced reactor designs and technologies to broaden nuclear energy's applicability, improve its competitiveness, and ensure its lasting contribution in meeting our nation's energy and environmental challenges.

Small Modular Reactors

The high capital cost for new nuclear reactors has been a challenge for private entities to finance. Smaller reactors would carry lower investment risk, and offer potential advantages in the way they are sited, licensed, financed, manufactured, and built. Modular reactors could be linked together to create a larger power plant. This would allow the owner of a reactor the flexibility to incrementally add power in response to rising demand.

Also, SMRs can provide power for applications where large plants are not needed or may not have the necessary infrastructure to support a large unit such as smaller electrical markets, isolated areas, smaller grids, or restricted water or acreage sites. I think small modular reactors represent an important opportunity to grow U.S. manufacturing and support a new generation of nuclear power plants that would provide many good paying jobs.

The fiscal year 2011 budget request includes \$39 million to support small modular reactor research and development, and includes an effort to consider and identify the most cost effective, efficient, and appropriate mechanisms to support further development of the technology.

Next Generation Nuclear Plant

The 2005 Energy Policy Act authorized the Next Generation Nuclear Plant (NGNP) project. Since then, the Department has coordinated a public - private partnership to demonstrate a high-temperature gas reactor technology.

As we address the issues of climate change, it is useful to understand and consider options for nuclear energy to safely and economically contribute to reduced carbon emissions outside the electricity sector

High temperature gas reactors like NGNP could potentially generate large quantities of low-carbon heat for highly efficient electricity generation and co-generation of process heat applications in industries such as petrochemical, petroleum, and fertilizer production.

The fiscal year 2011 budget request includes \$103 million for the NGNP project.

The project is being conducted in two phases. Phase 1 is comprised of conceptual design, development of licensing requirements, cost and schedule estimates for demonstration project completion and a business plan for integrating Phase 2 activities. The Secretary of Energy will use the information and data gathered in Phase 1 as a basis for determining whether the project should continue to Phase 2. Phase 2 would entail detailed design, license review and construction that would lead to a demonstration plant.

Earlier this month, the Department announced merit-based selections for Phase 1 awards to two teams led by Pittsburgh-based Westinghouse Electric Co. and San Diego-based General Atomics for conceptual design and planning work for the Next Generation Nuclear Plant. Negotiations are now in progress with these two teams which, if successful, will result in cost-shared awards of approximately \$40 million of Department funds.

Light Water Reactor Sustainability

The U.S. nuclear fleet has maintained a 30-year record of exceptional safety and performance. Industry has significant financial incentive to keep existing plants running. As a result, the utility owners of almost all of these plants are planning or have applied for license renewals that will extend the operating life of their plants from 40 to 60 years.

Over the last couple of years, the Office of Nuclear Energy, along with its lead laboratory, Idaho National Lab, as well as other national laboratories, has launched a research effort with industry aimed at providing the technical underpinnings for decisions on operating the Nation's existing fleet beyond 60 years. The fiscal year 2011 budget request includes \$26 million for the Light Water Reactor Sustainability program. Given the private sector incentives, cost sharing will be used the maximum extent possible.

Advanced Reactor Concepts

This program includes activities performed under the existing Generation IV research and development program but is expanded to also encompass reactor technologies beyond Generation IV. The program will focus on reactors that could dramatically improve performance in sustainability, safety, economics, security, and proliferation resistance.

Both advanced thermal and fast reactor systems will be investigated in the context of long-term waste management. The fiscal year 2011 budget request for advanced reactor concepts research is \$22 million.

Nuclear Energy Enabling Technologies

Secretary Chu has stated that “we have many technologies in hand today to begin the transition to a low-carbon economy, but we will need breakthroughs and better technologies to meet our long-term goals.” As we look forward to the next leap forward in nuclear reactor and fuel cycle technologies, a strong investment is needed in research and development that underpins and crosscuts nuclear energy technology requirements. In that spirit, the budget request includes \$99 million for the Nuclear Energy Enabling Technologies program, which will provide support for achieving those breakthroughs by funding innovative ideas related to any aspect of nuclear energy technology as well as focusing on specific areas of research where breakthroughs could have major impacts on a variety of reactor designs.

Crosscutting Technology Development

The fiscal year 2011 budget request includes \$43 million for Crosscutting Technology Development, which will support innovative research programs in the following areas

- Reactor Materials: New alloys and materials could enable transformational reactor performance
- Proliferation Risk Assessment: New tools and approaches could improve the understanding and management of proliferation risks and physical security risks for different fuel cycle options
- Advanced Methods for Manufacturing: Advanced manufacturing techniques, such as those employed in the oil, aircraft, and shipbuilding industries, could help bring down costs for new nuclear plant construction
- Advanced Sensors and Instrumentation: New sensors and instrumentation could enhance nuclear plant safety and performance

Careful screening of results will ensure that promising developments are considered in program and strategic planning and incorporated into reactor and fuel cycle ongoing programs as appropriate.

Transformative Nuclear Concepts Research and Development

A key element in the Office of Nuclear Energy’s effort to encourage out-of-the-box thinking and promote creative solutions to the universe of nuclear energy challenges and questions is the Transformative Nuclear Concepts Research and Development program. The fiscal year 2011 budget request includes \$29 million to support investigator-initiated projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration. This effort will be coordinated with Office of Science activities.

To encourage broad participation across national laboratories, universities, research institutions, and industry, solicitations would be open, competitive and peer reviewed. Increased emphasis will be placed on including applied scientists and engineers not routinely included in NE research programs. Awards would likely span 2-3 years, depending upon project scope. Peer reviews of applications will be carried out by a body of internal and external experts to help select promising concepts, and to ensure that activities are not duplicative of existing R&D activities. NE will monitor progress, utilize results to inform and adjust its program and activity planning and strategy development, and ultimately consider the outcomes of funded activities within the context of its mission-specific activities.

Energy Innovation Hub for Modeling and Simulation

The Energy Innovation Hub for Modeling and Simulation will be modeled after highly successful endeavors, such as Bell Labs and the Bioenergy Research Centers. It will utilize existing advanced modeling and simulation capabilities developed by the Department of Energy's Office of Science and National Nuclear Security Administration, and other Department of Energy research and development programs, as well as develop new capabilities.

A Funding Opportunity Announcement was released in early 2010 to initiate a competitive selection process. In fiscal year 2010, the Department expects to select an applicant and award a Cooperative Agreement contract for five years with the possibility of a five-year extension. The fiscal year 2011 budget request includes \$24 million to support the Hub's activities and provide for an ongoing review of the Hub's deliverables and performance. The modeling and simulation tools that will be developed will eventually be applied to perform virtual modeling of an existing, operating reactor and will be applicable to advanced reactors.

Fuel Cycle Research and Development

The fiscal year 2011 budget request includes \$201 million for Fuel Cycle Research and Development to perform goal-oriented, science-based R&D to provide options for decision-makers for future commercial fuel cycle management strategies. This will enable the safe, secure, economic, and sustainable expansion of nuclear energy while minimizing proliferation risks.

The program will conduct R&D related to three potential long-term fuel cycle scenarios—once-through, modified open, and full recycle—to provide future decision-makers with information to make decisions on how best to manage used fuel.

- **Once-Through:** In this scenario, nuclear fuel makes a single pass through a reactor, after which the used fuel is removed, stored for some period of time, and then directly disposed in a geologic repository for long-term isolation from the environment. DOE R&D related to this scenario would include the development of fuels for use in present and Generation III+ reactors that would increase the

efficient use of uranium resources and reduce the amount of used fuel for direct disposal.

- **Modified Open Cycle:** In this scenario, limited separations and fuel processing technologies would be applied to the used fuel to create fuels that enable the extraction of much more energy from the same mass of material, while at the same time accomplishing waste management goals. DOE R&D in this area focuses on the investigation of fuel forms, reactors, and fuel/waste management approaches that could dramatically increase the utilization of fuel resources and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed. Technologies will be considered that require at most limited separation steps and minimize proliferation risks.
- **Full Recycle:** In this scenario, fissionable and fertile elements of used fuel would be recycled in thermal- or fast-spectrum systems to reduce the radiotoxicity of the waste placed in a geologic repository while more fully utilizing uranium resources. In a full recycle system, only those elements that are considered to be waste (primarily the fission products) would be disposed. DOE's R&D in this area would focus on developing techniques that will enable specific elements to be repeatedly recycled and developing a cost-effective and low-proliferation-risk approach that would dramatically decrease the long-term challenges posed by the waste and reduce uncertainties associated with its disposal.

It is important to note that there many technical challenges in the modified open and full recycle scenarios. The full recycle fuel cycle has been the focus of the Fuel Cycle R&D program to date and the once-through fuel cycle is the current practice in the United States. The modified open cycle constitutes a range of technology options in between once-through and full recycle. The modified open cycle has not been studied in as much depth and that is why it is being introduced as a new focus area in fiscal year 2011. There are many exciting and plausible ideas that have emerged, leading to a request for substantial funding in this, its first year.

A key issue that cuts across all potential future fuel cycle scenarios is disposal of high level radioactive waste from reactors and fuel cycle facilities. No matter what fuel cycle is ultimately chosen, disposal will be required. The FY 2011 budget request demonstrates this priority by providing \$45 million for significantly increased R&D efforts in this area. NE will expand research and technology development to identify and analyze options for storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles.

The Administration has determined that the Yucca Mountain repository is not a workable option and has decided to terminate the Office of Civilian Radioactive Waste Management. The Department of Energy has submitted a motion to withdraw with prejudice its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste repository at the Yucca Mountain site. The Administration is committed to fulfilling its obligations under the Nuclear Waste Policy Act (NWPA);

funding to support the core functions and staff under the NWPA is included in the Office of Nuclear Energy's FY 2011 budget request.

Within the Fuel Cycle R&D program, funds are requested to support transfer of engineering and scientific expertise used for the Yucca Mountain Project from the Office of Radioactive Waste Management to the Office of Nuclear Energy. This expertise augments NE's ability to investigate alternative storage and disposal approaches, including the options for high-level waste disposition.

The Administration has established a Blue Ribbon Commission on America's Nuclear Future to conduct a comprehensive review of the back end of the fuel cycle, which is co-chaired by General Brent Scowcroft and Congressman Lee Hamilton. The commission will produce a final report within two years that will provide recommendations for developing a safe, long-term solution to managing the Nation's used nuclear fuel and nuclear waste. The Office of Nuclear Energy will provide support to the Commission as requested.

International Nuclear Energy Cooperation

The Office of Nuclear Energy, through the International Nuclear Energy Cooperation (INEC) program, will further its mission through bilateral and multilateral agreements and other mechanisms. The goals are to foster the safe, reliable, and environmentally sustainable use of nuclear energy and to minimize the risks of proliferation.

INEC will serve as the central coordinating program for international engagement within the Office of Nuclear Energy and will support the Office in international policy interactions with other government agencies and Departmental offices. INEC will work with the Office of Nuclear Energy's R&D programs, in coordination with other governmental entities as needed, on the development, negotiation, and execution of international bilateral and multilateral agreements; the provision of policy analysis and guidance on U.S. international civil nuclear activities; and support for international nuclear energy cooperation and initiatives. This may also include evaluation of domestic and international frameworks to engage other nations in civil nuclear energy cooperation and promote best practices in the safety, regulatory, and security issues associated with civil nuclear energy. The fiscal year 2011 budget request includes \$3 million for International Nuclear Energy Cooperation. The funds will support carrying out bilateral and multilateral agreements and in facilitating international discussion, negotiations, and related analyses on a range of international nuclear energy concerns.

RE-ENERGYSE

The fiscal year 2011 budget request for the Office of Nuclear Energy includes \$5 million for the Department of Energy's RE-ENERGYSE (Regaining our Energy Science and Engineering Edge) program to provide the education and training necessary to build a highly skilled clean energy workforce that will support nuclear power by solving current and future challenges.

RE-ENERGYSE supports university nuclear engineering programs through scholarships and fellowships. These fellowships will complement existing Federal efforts and will help ensure that the next generation of scientists and engineers are available to support existing and future nuclear energy generation capacity and provide necessary innovation.

In addition to RE-ENERGYSE funding, the Office of Nuclear Energy will designate up to 20 percent of funds appropriated to its R&D programs for work to be performed at university and research institutions.

Radiological Facilities Management

The fiscal year 2011 budget request includes \$67 million for the Radiological Facilities Management (RFM) program. Within the RFM budget, \$47 million is for the Space and Defense Infrastructure subprogram to support the production of radioisotope power systems (RPSs). This funding maintains specific nuclear facilities at Idaho National Laboratory, Oak Ridge National Laboratory, and Los Alamos National Laboratory. These facilities are managed by the Office of Nuclear Energy.

The Department of Energy has the unique statutory authority to design, build and furnish RPSs to federal users. These systems have enabled deep space exploration and national security applications for nearly five decades. RPSs convert the heat from the decay of the radioactive isotope plutonium-238 (Pu-238) into electricity. RPSs are capable of producing either heat or electricity for decades under the harsh conditions encountered in deep space. Pu-238 fueled RPS's have provided power for 26 different missions that NASA has flown over the years, most of which would not have been possible without the radioisotope power sources that require this particular fuel and they have proven to be safe, reliable, and maintenance-free.

Two new advanced RPSs that would use Pu-238 are under development at NASA: the Multi-Mission Radioisotope Thermoelectric Generator and the Advanced Stirling Radioisotope Generator. Both advanced RPSs could support missions in the vacuum of space or in planetary atmospheres.

In the past, the Department of Energy obtained Pu-238 from the Savannah River Site K Reactor, which was taken off-line in the late 1980s and is now shut down. More recently, the Department has augmented its available inventory for non-national security applications by purchasing Pu-238 from Russia, but those stocks are limited and Russia is no longer producing Pu-238. Only a limited amount of Pu-238 remains available for U.S. purchase under the current contract with Russia, however the ability to obtain this material is not certain and the contract expires in January 2013.

The Department of Energy maintains the statutory responsibility for the safe and secure operations to produce special nuclear material. Beginning in FY 2011, DOE and NASA will initiate a project to restart the production of plutonium-238 (Pu-238) for future NASA uses and potential national security applications. The DOE budget request for the

plutonium-238 Production Restart Project subprogram is \$15 million which is matched by another \$15 million in the NASA budget request.

Within the Radiological Facilities Management program, funding is also requested for the Research Reactor Infrastructure subprogram, which provides fresh reactor fuel to and removes used fuel from 26 operating university reactors.

Idaho Nuclear Infrastructure

The Office of Nuclear Energy focuses on supporting research with the most appropriate and best talent in the nation. Our programs are broad and wide, with participation from national laboratories, industry and universities. However it is important to have a lead institution. The Idaho National Laboratory (INL) serves as the center for U.S. nuclear energy research and development efforts. INL utilizes and incorporates expertise of government, industry, and academia into their laboratory programs dedicated to the development of advanced reactor and fuel-cycle technologies.

INL employs more than 3,900 personnel located primarily at the Idaho Site and in the city of Idaho Falls. In addition to its broad spectrum of nuclear energy and national security programs, the laboratory provides essential site services to DOE and other governmental agencies and private-sector companies doing business on the Idaho Site. INL conducts science and technology research across a wide range of disciplines.

Under the oversight of the Department's Office of Nuclear Energy, INL provides technical leadership to support long-term nuclear science and engineering R&D activities to address the Nation's energy and nuclear security goals. Key technical areas include nuclear fuel cycle science-based research, the development of alternative radioactive waste management strategies for the United States, and technology programs that support nuclear nonproliferation and other critical infrastructure protection.

INL also conducts R&D and technical integration support for the new Reactor Concepts Research, Development and Demonstration and the Fuel Cycle Research and Development program. INL is the lead laboratory for the Next Generation Nuclear Plant program and, together with Oak Ridge National Laboratory, is the principal laboratory responsible for the development of advanced gas reactor fuel and materials R&D. INL is also responsible for staffing the Technical Secretariat for the Generation IV International Forum.

INL provides technical support for cross-cutting technologies including advanced fuels, fabrication and construction methods, and proliferation risk assessment within the new Nuclear Energy Enabling Technologies program. INL has the lead on the development of advanced instruments and sensors for the existing light water reactor fleet.

Two programs support the nuclear infrastructure at INL:

- The Idaho Facilities Management Program maintains its research facilities in a safe, reliable, and environmentally compliant condition to support national nuclear programs. The fiscal year 2011 budget request for this effort is \$162 million. Through the National Scientific User Facility effort, the Office of Nuclear Energy has opened the Advanced Test Reactor and its Post Irradiation Examination Facilities to universities, national laboratories, industry and other federal agencies.
- The Idaho Site-Wide Safeguards and Security Program supports activities that are required to protect the assets of the Idaho complex from theft, diversion, sabotage, espionage, unauthorized access, compromise, and other hostile acts. This program is funded under the Other Defense Activities Appropriation. The fiscal year 2011 budget request is \$88 million.

Program Direction

Program Direction provides the Federal staffing resources and associated costs required to provide overall direction and execution of the Office of Nuclear Energy. The budget request for fiscal year 2011 includes \$91 million for Program Direction. In addition to these appropriated funds, the Office of Nuclear Energy also manages approximately \$70 million dollars annually in reimbursable funding from the National Aeronautics and Space Administration and the Department of Defense for the development of advanced radioisotope power systems for space exploration and national security missions.

Program Direction also supports the transition of management and oversight responsibilities for the Nuclear Waste Policy Act from OCRWM, including core functions pertaining to administration of the Nuclear Waste Fund, management of the standard contracts between nuclear utilities and the government, and management and oversight of R&D activities focused on used nuclear fuel disposition and high-level waste management.

CONCLUSION

Mr. Chairman, that concludes my written testimony. I appreciate the opportunity to appear before you to present the Office of Nuclear Energy's FY 2011 budget request, and I am happy to answer any questions that you or any other Members of the Committee may have.

Mr. PASTOR. As you have heard, we have a vote. We are going to go ahead and probably ask a few questions and then come back and do the remainder.

The question I have to start with will be the last bill you received monies for the hub, the nuclear hub. We are now almost 6 months since the bill was passed and became law. What is the status of the hub to this point?

Mr. MILLER. Starting in the fall, as soon as we received appropriations, we began first with workshops with the community that would compete for this hub. Then we issued a funding opportunity announcement. We have gotten responses, and we are in the midst right now of peer review of the response of the proposals that we have received. We hope to make a decision on the recipient of that process by the end of May and start working.

Mr. PASTOR. How many people turned in a proposal?

Mr. MILLER. So, unfortunately, the procurement process doesn't allow me to answer that question publicly.

Mr. PASTOR. Not even the number?

Mr. MILLER. I actually asked that question before coming, and I was told I wasn't supposed to answer that question. I am sorry, Congressman.

Mr. PASTOR. Maybe it is a sole-source bid, I don't know.

Mr. FRELINGHUYSEN. No, it is not a sole-source bid.

Mr. PASTOR. We know it is more than one then.

Mr. FRELINGHUYSEN. It is not a sole source.

Mr. PASTOR. Wow, that is interesting. Well, for this year you requested, I think, what, 24—?

Mr. MILLER. Yes.

Mr. PASTOR. And last year you received 22—.

Mr. MILLER. Yes.

Mr. PASTOR. We are almost 6 months into the year. Now, obviously you haven't spent \$11 million.

Mr. MILLER. No, we have not.

Mr. PASTOR. And by the time you get started, we are into May, so that is even further into the year. And startup costs are not going to take—so what are you going to do? Would it be practical for me to say you have \$22 million, and just because of following the rules, you are now into June before you even start actual work on implementing the hub, so you still have over two-thirds of the budget still available to you that you might be able to use this year and carry over to the following year.

Mr. MILLER. Yes. The scope of the hub that was planned was a 5-year program at approximately \$25 million a year.

Mr. PASTOR. Right.

Mr. MILLER. And the expectation was that we wouldn't get started for 6 months. So the expectation was to carry over some of that support or money into the next fiscal year. After that, if it looks like the program isn't going to spend that kind of money, we would make adjustments in 2012 or beyond, depending upon the scope of the actual work being done by the hub. So that is what the plan is.

Mr. PASTOR. What if the plan was, since you are going to carry over almost two-thirds of the money, why don't we see how much you can spend this year and next year and try to have a better esti-

mate so that we can see where we can fund other priorities that this administration has? That is another way of looking at it.

Mr. MILLER. Yes. Well, we did think of that, Congressman. And the President's plan is the plan that I just laid out of carrying over, and then going into the next year, and then making adjustments in following years. It is even possible in following years the Administration will request more than \$25 million.

Mr. PASTOR. Because I would say the other way of looking at it is they have two-thirds of the budget left over from this year, so why don't we see what is realistic in 2010 and then move it over to 2011, because there are other priorities that this President has asked for in DOE that we will also try to fund, especially under his other dictate of fiscal responsibility.

Mr. MILLER. I understand.

Mr. PASTOR. And so we have two competing responsibilities that the President has laid on us. So that is a possibility that I just bring out, so—Ranking Member.

Mr. FRELINGHUYSEN. I suspect a lot of people haven't voted though; is that right? If it is all right with you, Mr. Chairman, I will just proceed.

Dr. Miller, there are competing views on the role of the Federal Government in advancing nuclear power. Obviously some people would like us to do nothing, but we don't believe in that on this committee, nor does the President. There is an argument that government should incur the early risk and make up sizeable upfront investments in reactor research and development, design and demonstration. Then there is the counterargument. The counterargument is that industry needs to have skin in the game early in the project since industry will be the eventual beneficiary of taxpayer investments.

Currently, as all of us are aware, many projects are cost shared with industry, as required by law. How would you explain, what is your take on the proper role of the Department in terms of supporting research, development, design, licensing, demonstrations and the deployment of nuclear reactors? I know that is somewhat of a softball, but I think it goes to the core of what we are talking about here. What is your take on what we should be doing?

Mr. MILLER. I think I understand the question, Congressman.

Well, first let us talk about the Generation III reactors, the ones that we are hoping to begin deploying in the not-too-distant future. There it is clear that the government role is loan guarantees. There needs to be some help with the early movers, the earlier plants, in order to help with the capital costs associated with earlier plants. Then, on the other hand, when we get to the small modular reactors, we hope there to help with design certification of those reactors, and as yet it is not clear whether the Federal role needs to be any more than cost sharing up to design certification.

So I think it is going to depend on the reactor type. It is going to depend on the capital cost. It is going to depend on the market at the time. But there is clearly a limit to where the Federal Government ought to go. But when there is something to be gained for the American taxpayer, like deployment of the next-generation reactors, I think it is up to us to make sure that we provide the appropriate simulation to make sure it happens.

Mr. FRELINGHUYSEN. So the administration is, for many people, taking some bold action.

Mr. PASTOR. I would think so, sir.

Mr. FRELINGHUYSEN. That is a stake in the ground. How we are going to pay for it all, I don't know. But obviously, from our standpoint, I think we have to make sure that we support the President. We need to make sure we have the ability to pay for those loan guarantees.

Okay. Thank you, Mr. Chairman. I will get some other questions later.

Mr. PASTOR. Mr. Simpson.

Mr. SIMPSON. Following up on what Ranking Member Frelinghuysen was talking about, you and I talked the other day about the role of industry in all of this. And my concern, as I expressed to you, is that industry isn't involved. Eventually we are doing this research and development of reactor types to actually deploy them. We don't want to do it if industry doesn't want it. It is not going to make much sense.

So what role do we have with industry up front so that we know that what we are doing—as an example, what are the two designs that are going to be designed, one by Westinghouse, one by General Atomics? Are those two different designs? What is the role of industry, the end users, in these concepts and so forth?

And do we have any formalized, or should we have some formalized type of process by which the DOE and those that are going to be using whatever we develop can coordinate their activities and can talk about what is expected of industry to put up? Because for years, for the 8 years I have sat on this committee, every year we have talked about what industry thinks the government ought to do, what government thinks industry ought to do. It is the chicken and egg; nobody wants to jump off the cliff. And somehow we have got to have some type of way of sitting down and saying, listen, this is what we are doing, this is what we want to do, and this is going to be our commitment on the part of the government, and this is going to be our commitment on the part of industry. And I am not sure if there is any formalized sort of thing to do that. Is that something we should be doing?

Mr. MILLER. Thank you for that question. And it is an interesting discussion that we had.

So let me just speak about the general topic. First, you asked about the two designs. There are two different designs, Westinghouse and GA, for the NGNP. And so in that particular case, what happens is industry is not shy about coming to visit us. And so in that case, many times we have been visited by those who are interested, and they talk to us all the time about their concerns, their interests. And then there tends to be a period in which we can't talk to them, like we are in a period right now of negotiating the terms of these particular agreements. So then we have to pause and can't talk to them, and then we can start talking to them again. So one method that we do this is just they come in and talk to us, our door is open. So I have spoken to a wide group of industrial people interested in NGNP.

So then on the small module reactor, for example, we are going to do workshops where we are going to bring industry people in to

talk about what is the best way that the government—and most appropriate way—that the government can speed up the commercialization of these small module reactors? So that is another approach.

The other approach is for the Light Water Reactor Sustainability program. There we are working on trying to do, again, what is appropriate for the government to extend the life of the existing plants. There we have an advisory committee that actually has EPRI, which is an industry organization that is part of the advisory committee.

And so we have been using a wide range of approaches of involving industrial concerns in what we are doing, because, as you point out, Congressman, there is no sense for us working on a reactor that no one is going to commercialize. So I think it is very important that we consider all possibilities as far as different approaches to involving industry, and we are surely open to that.

Mr. SIMPSON. I was kind of surprised that we are now working on what the cost-sharing relationship is going to be with General Atomics and with Westinghouse on these proposed projects. I would have thought that—and this is, I guess, part of the planning I am talking about—that beforehand that determination would have been made. And as an appropriator, I am sitting here thinking, what is going to be expected of me if we decide to move forward with NRG? And we have put a lot of money into it so far, but as we move down the road 2, 4, 10 years, what is going to be expected of this committee in terms of appropriating money? And what can I expect industry to put on the table?

We need some determinations beforehand rather than letting out the plans and then saying, let's negotiate on what the price is. And that is, I guess, where I am coming from is that somehow we need to develop some type of working group with industry so that we are working as a team, both the government and industry, with the different industries, both the end users and those that are going to be building the reactors and so forth. And how is this all going to work?

And I will talk a little bit more when we get back about the budget. One of the things that is frustrating, I think, to all of us on the committee, not this administration, but the fact that every time we have a new Secretary, we redesign the entire budget. And so I would like to understand where the old budget is in this budget, things like what happened to Gen 4, and where is that money now? And what are we calling it, New Reactor Concepts? Have we just changed the name? We need some follow-through so that we have some longevity in terms of what we are appropriating money for.

But I will tell you, before we go over to answer the vote on this, I do compliment the administration. This is the first administration that has actually said that they supported and wanted to promote nuclear power, that has actually put a budget behind it that looks like they are serious about it. So I do compliment the administration for that.

Mr. PASTOR. We will recess to vote. [Recess.]

Mr. PASTOR. Mr. Rehberg, you want to throw a couple of questions?

Mr. REHBERG. Is it my turn?

Mr. PASTOR. Sure.

Mr. REHBERG. I had a fellow from DOE a couple of years ago that came up with a suggestion. As we look at coal sequestration, there may be an opportunity for a cogeneration facility to do something with the CO₂. Sequestration, of course, is a problem in the creation of any kind of electricity from coal. Is there anything going on in your neck of the woods, in your arena, that you are aware of at DOE having to do with a cogeneration opportunity with coal?

Mr. MILLER. I am sorry, Congressman, you mean nuclear with coal?

Mr. REHBERG. Yes, nuclear with coal.

Mr. MILLER. No, not that I know of. I don't know of anything like that. I will tell you where we cross with EM and with FE and NE is discussions of migration of materials underground; how do you retain materials that would seep, and how do you model that? That is where I connect a lot with Mr. Markowsky at FE, but I don't know of any activities we have about cogeneration, meaning at the same site having a coal plant and a nuclear plant.

Mr. REHBERG. It was just an idea they threw out, and they said because of the burning, it might have an opportunity to burn the CO₂, which seemed plausible, but it is way out there. I was hoping that maybe that idea had filtered through. It did not. Okay.

Mr. MILLER. No, but we will get back to you for the record, and I will check into it.

Mr. REHBERG. See if there are any studies that have been done or any opportunity along that line.

[The information follows:]

Mr. REHBERG. See if there are any studies that have been done or any opportunity along the lines of nuclear cogeneration with coal and the opportunity of nuclear burning CO₂ emissions.

Dr. MILLER. The Office of Nuclear Energy has not studied nuclear co-generation with coal or the potential use of nuclear power to "burn" CO₂ emissions from coal power plants. There are other applications in which nuclear energy and coal can be used together, *e.g.*, the use of nuclear heat to liquefy coal for transportation uses.

Mr. REHBERG. That is all, Mr. Chairman. Thank you.

Mr. PASTOR. When we did this bill, it was enacted in Title III, there is a paragraph that says, within 60 days of enactment—a report included in the House report detailing an implementation and progress measurement plan for each funded Energy Innovation Hub.

Sixty days would probably bring us, what, until about January? And I asked during the vote if we had received a report, and as of yet we have not received it for your hub.

Mr. MILLER. I am sorry, Congressman, I don't know about the report you are referring to, so I will have to get back to you. Several reports have been requested that relate to NE, but I don't know of one on the hubs.

Mr. PASTOR. Well, I will hand this to you.

And there was another plan I think you had to submit to the committee. And as I prepared for it yesterday, I said, where is it so I can be ready to chat about this plan? And they said, we haven't received it yet. I think that was, what, how many days after—end of January I think it was due.

Mr. MILLER. The nuclear R&D plan of which you are referring to, that one was due at the end of January. It is embarrassing that you don't have that plan yet, and all I can tell you—

Mr. PASTOR. Well, it is hard to do a budget when you don't have these—

Mr. MILLER. All I can tell you is various offices in the administration are working feverishly on that plan, trying to get convergence on that plan. I had hoped to hand it to you today, but I do not have it in my possession to hand to you today. But I hope you get it really soon.

Mr. PASTOR. Soon. Couple of months? Days? Weeks?

Mr. MILLER. No, sir. Soon, I hope, is days to weeks, not months.

Mr. PASTOR. Days to weeks, okay. All right.

Well, it is easier to work on a request on a budget when you know what the plans are, what you anticipate doing. And when we are just waiting for the plan and waiting for reports, it is very difficult to make decisions that will take us into the next fiscal year. So I just would encourage you as quickly as you can to bring it forward, because we are going to conclude the hearings probably the week after we return from the Easter break, and we will start looking at various requests from the Department of Energy. And so the later we wait, the more difficulty we are going to have in giving you a bill—

Mr. MILLER. Understood.

Mr. PASTOR [continuing]. That is fair to you. Rodney.

Mr. FRELINGHUYSEN. The scientific integrity of the review of nuclear waste alternatives is important to the committee, obviously. Last year Congress included statutory text that the Blue Ribbon Commission should, and I quote, "consider all alternatives to nuclear waste disposal," end of quotation marks. The charter of the Commission seems to include all alternatives. Currently that is our understanding.

The fiscal year 2011 budget request includes \$45 million, \$36 million above fiscal year 2010, for the Used Nuclear Fuel Disposition program. This program lists a broad set of activities in its proposals, including, and I quote, "rapid response or increase from the proposed Blue Ribbon Commission," end of quotes, and, and I quote, "a comprehensive understanding of the current technical basis for geological disposal of nuclear spent fuel and high-level waste," all within quotation marks.

Is it fair to say that this program will be investing in research to understand all alternatives to nuclear waste disposal?

Mr. MILLER. Thank you for that question.

The R&D program that we have in place, are planning—assuming whatever Congress decides—in NE will include a broad range of potential disposal pathways. And so starting in 2011, we are looking at lots of different geologic media in which high-level waste might be stored. Now, having said that, of course, we are also going to receive recommendations from the Blue Ribbon Commission, and that clearly will inform the future of the direction which we go, but in the meantime, we are looking at a broad range of media.

Mr. FRELINGHUYSEN. Yucca Mountain, to the committee's understanding, should be on that list. Is that your understanding?

Mr. MILLER. When we discuss this issue, we are talking about salt, we are talking about basalt; we are not talking about sites.

Mr. FRELINGHUYSEN. I understand there are a lot of different sites, but is it your understanding that Yucca is still on the radar screen as a potential disposal site?

Mr. MILLER. No, it is not on the radar screen. The President and the Secretary have decided that that is not a path forward for final disposal of waste. So, no, that particular site is not.

Mr. FRELINGHUYSEN. The Office of Civilian Radioactive Waste Management of which I spoke in my opening remarks is moving its functions to your office. Can you tell us a little bit about what is happening there? The people that have been working in this program, I am sure we could come up with a better term than “surplus.” I mean, just looking at what has been done, obviously you have people with a vast amount of experience. And I assume that institutional memory is something which we want to retain. What are your plans?

Mr. MILLER. Sir, when we are looking at the 2011 budget request—and, of course, it still all depends on what is appropriated—our plan is to look at the skill mix that had been funded by the RW program, for example, geochemists, geologists, people who do computational modeling of flow-through media, to look at that mix and to try to move appropriate personnel into NE in order to fulfill its requirements under the Nuclear Waste Policy Act.

So we are going to have several jobs. One is to do R&D, which is what we are talking about now, in NE. We are proposing to be responsible for the so-called “standard contracts” and administering those, and then the Nuclear Waste Fund. All three of those previous activities that had been managed at RW, the proposal is to move all of those to NE, so it includes that R&D that you are talking about.

Mr. FRELINGHUYSEN. So there is a separation afoot. So are you going to take a look at that to see whether some of these people can be retained?

Mr. MILLER. Yes.

Mr. FRELINGHUYSEN. So that is what you are telling us, that these people are going to be involved in some way, perhaps.

Mr. MILLER. I can't candidly tell you all of the people who had been involved will be included, no. I can't say everyone, but I can say we certainly are going to look at the appropriations, what the Congress has approved, and that which we are able to support within the budget, we certainly are going to look at that.

Mr. FRELINGHUYSEN. If there is a geological solution here, I would hope we do our level best to make sure that people with substantial knowledge—getting way beyond the billions of dollars that have been invested, certainly we would want to retain those individuals, not cast them into the wind somewhere.

Mr. MILLER. I share that sentiment.

Mr. FRELINGHUYSEN. I am glad to hear you say that.

Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Secretary, I just want to make a point here that as we were the writing the bill and had the bill go forward with the process in the House and the negotiations with the Senate, and finally the conference and signed by the President, all alternatives

for nuclear waste disposal, at least the intent of the House and the Senate as they provided the money for the Blue Ribbon Commission, was that all alternatives meant consideration of Yucca Mountain. So I just highlight it to you so that you can reference that the congressional intent for the Blue Ribbon Commission was that all alternatives meant that Yucca Mountain would be also included in all the considerations of the Blue Ribbon Commission.

Mr. MILLER. I understand.

Mr. PASTOR. Mr. Ryan.

Mr. RYAN. Thank you, Mr. Chairman.

Welcome. Thank you for what you are doing. I appreciate what the administration is doing with regards to nuclear energy.

I see you are from Chicago. I am not too far away in northeast Ohio, Youngstown area, Akron.

One of the issues, as I am just reading through and thinking about how important nuclear energy is and how much of the supply chain over the years we have lost to other countries, I only have one question at this point, and that is, I just want to ask, what do we need to do from the legislative side to help regrow our supply chain and the manufacturing component of the spin-off, the ripple effect that nuclear energy will provide? I think even if we do ramp up rather quickly, a lot of the components are going to be exported to other countries in the short term. But how do we ramp up, how can you help us ramp up, and what can this committee do to help our country ramp up so that the Chicagos and Youngtowns and Akrons of the world can benefit from this, even if they don't have a facility in their community?

Mr. MILLER. Thank you.

So first with the reactors for which we are requesting authority for loan guarantees as well as the loan guarantees that we have just announced, those vendors that are providing those reactors have discussed with us about where are they going to get the components that they are using and the workforce that they are using in building the plants, and they expect the majority of them to be from here, from the United States. Some of those companies—for example, AREVA is actually building facilities within the United States. So we expect those new plants to have a significant number of U.S. components in them.

And then the second one is the small module reactors, which I am excited about as a possibility for getting the United States back into the game of actually being vendors for power reactors. And there, as I said in my opening comments, we hope to have reactors that are built in the U.S. with American vendors again.

Now, there are American vendors as partners in these larger companies that are building the Gen III+ reactors, but these will be a new start for the United States in the nuclear business.

If it proves to be something that industry wants to deploy, you know, we can't overpromise anything, but there is enough hope there that we ought to do what we can to make sure we see for sure whether we can make these things go.

Mr. RYAN. I know it wouldn't be necessarily through the Department of Energy, but are there tax incentives that we can help on the private sector side to help let them know that it is okay to start

making some of these investments? Because a lot of these foreign countries do provide a level of subsidy for that kind of thing.

Mr. MILLER. It is out of my depth. I don't know much about tax incentives.

Mr. RYAN. You have a powerful voice in Washington. Loan it to the cause.

Mr. MILLER. We certainly can think about it and get back to you, but I am not prepared right now to talk about it.

Mr. RYAN. Just if you can express the need for those kinds of things. Thank you.

Thank you, Mr. Chairman.

Mr. SIMPSON. Thank you, Mr. Chairman.

As far as Yucca goes—I don't even want to talk about Yucca, it is what it is—but you are going to send up a letter or have sent up a letter requesting reprogramming money; is that right? I understand it goes into NE?

Mr. MILLER. No.

Mr. SIMPSON. Where does it go?

Mr. MILLER. You are talking about for 2010 now?

Mr. SIMPSON. Yes.

Mr. MILLER. In 2010, my understanding is a letter was sent to Congress informing Congress of what is planned for the 2010 activity that had been allocated or appropriated for Yucca Mountain. It is our understanding that the senior leadership of DOE is working with the RW leadership and the general counsel and CFO on this whole issue of how to close out, if you will, the Yucca Mountain activity, but the 2010 activity is not an NE part. We start in 2011 is when the responsibility shifts to us.

Mr. SIMPSON. EM takes over Yucca Mountain at that time, right?

Mr. MILLER. The plan is that EM would have the physical facility at Yucca Mountain, and NE would have responsibility for the Nuclear Waste Policy Act and implementing that act.

Mr. SIMPSON. You are not aware of what the reprogramming request is to use those funds that were originally going to be used for the licensing process? They are going to have to reprogram those if they want to use them for something else.

Mr. MILLER. Correct.

Mr. SIMPSON. But you are not sure what the proposal is for that.

Mr. MILLER. Well, there is a letter that was sent that there was intent to reprogram, and there was intent to close out the program, to work with employees, to work with the site records—for example, retention of all the records. So that has been sent, that is my understanding.

Mr. SIMPSON. Okay. One other thing. This committee has been very supportive of—and one of the things I don't think we have spent enough money on in years gone by is infrastructure. If we are going to retain and bring the best research scientists to work at our national labs, we have to have the scientific facilities for them to work in. And as you know, out in Idaho, some places were in old grocery stores and garage doors and everything else. But the committee has been very supportive of increasing that budget for infrastructure improvements.

It looks like in your NE research and development budget, it is kind of a makeover of the old budget with some new programs, new

initiatives, such as the Small Module Reactor program. These new initiatives may add to the overall research and development effort and an increase in demands on the infrastructure.

Last year the committee put in \$173 million last year into the NE budget, the infrastructure budget, in Idaho, which, as you know, they have done some great work out there in building labs and equipment and so forth. This year's request is \$10 million less. Does this request fully support the upgrades to the scientific and testing capabilities at the INL that may be needed to implement the expansion of the new NE programs?

Mr. MILLER. Thank you, Congressman. This is, again, an extremely interesting question.

I had an opportunity to be in Paris for the conference that President Sarkozy had on civil nuclear energy, to talk to my Japanese, Russian and French colleagues about investment in nuclear energy R&D, and there is no question that ours isn't up to what some other countries invest in nuclear energy R&D. But having said that, only about 10 years ago we were at zero, and we have come up to now a request of \$500 million. I think that is pretty darn impressive with what we have done.

So as we look at this balance of \$500 million, and we struggle with the balance between infrastructure, intellectual capability, and people who are doing research and theory and computation and experiment, the experimental facilities, they have what they need, it is not easy to make that balance. We have done the best we can. We think in the future the balance is likely to move toward investment more in infrastructure.

Of course, it would be nice if we had a much greater budget, but we are here to defend the President's budget. We think it is a solid budget. And we have spent considerable time trying to think through this thing of infrastructure and people and students in the next generation, so it is the balance we came up with. I think it is a strong budget, and I am supporting it.

Mr. SIMPSON. Couple of quick questions. On the Advanced Test Reactor, it is 40 years old. Last year we fenced off \$12 million for the ATR Life Extension. How much is being requested in the fiscal year 2011 for the Life Extension project at the ATR?

Mr. MILLER. Well, the ATR is a component, as you point out, of the facilities infrastructure budget, Idaho National Laboratory. I don't have the exact number with me for what fraction of that is for ATR. We can get that number for you.

[The information follows:]

Dr. MILLER. The Fiscal Year 2011 budget request includes approximately \$12.3 million to continue ATR LEP activities. ATR LEP projects will continue to focus on reconstitution of the safety basis and replacing aging components to improve operational reliability and support the growing demand for this world-class irradiation research and test reactor. This investment will help extend the life of this national asset in its support of national security, energy, and material research missions, and prepare for the Core Internal Changeout scheduled in the 2014–2015 timeframe.

Mr. SIMPSON. Okay. In Oak Ridge, Congress provided \$10 million for the Radiochemical Engineering Development Center at the Oak Ridge National Laboratory. Did this investment complete the maintenance for that facility? Because none has been requested this year, I understand.

Mr. MILLER. Yes. Thank you for that question also, Congressman Simpson.

So in the best of all worlds, we would also be investing in facilities at Oak Ridge National Laboratory, and we would be investing in facilities at other national laboratories. I think that the overall facilities is appropriate for the size of the program of \$500 million. But of course, yes, it would be nice if we could also invest in those. But we think we have done the right balance for the size of the budget.

Mr. SIMPSON. But as far as the Radiochemical Engineering Development Center, it doesn't need any additional money for its maintenance, or is it just that there was not any to request this year?

Mr. MILLER. They could use money, it just didn't make it in the cut of our requests.

Mr. PASTOR. Mr. Fattah.

Mr. FATTAH. Thank you, Mr. Chairman.

General, how are you?

Mr. MILLER. Fine, sir. How are you?

Mr. FATTAH. I am doing well.

Senator Webb and Senator Alexander have a proposal before the Senate, I have offered it as a companion bill in the House, that would essentially launch a nonincremental approach to trying to jump-start or restart our pursuit of nuclear energy focused around small module reactors—there are some other features to the bill, obviously, and investments in solar and some other renewables, but really the main focus is on nuclear. You have been doing some work. The 2005 act obviously allowed for investments in some next-generation plants, and I note that a Pennsylvania company—I represent Pennsylvania—Westinghouse has been one of the competitively awarded grants under that. Today, Bill Gates has announced a major partnership with Toshiba to move forward on some small nuclear reactors. So I know that we are all headed in the right direction, the compass is correct, I mean, the country is moving.

Gallup yesterday released a poll that shows 62 percent of Americans believe that nuclear has to be a central part of the energy mix going forward. Unfortunately, over the last 30 years we have had a dearth of energy, if you will, around nuclear, but things seem to be starting to be aligned in the right direction.

So your proposals, in terms of this year's budget, if the committee was looking for where there are additional needs relative to where we would like to get to—and in keeping with your responsibilities to OMB and all of that—are there areas that you would think that additional investments could be aptly utilized? The administration should be congratulated on getting the first loan guarantee deals out, and I have been a major proponent of the loan guarantee program, but I would be interested in any answer that could be forthcoming about what is left to be done that is not yet represented in the request.

Mr. MILLER. Thank you very much, Congressman, for that question. I believe the President's budget supports the priorities of the Office of Nuclear Energy.

Mr. FATTAH. I support the President's budget, and otherwise. I just wanted to get your expertise since there seems to be a growing

consensus both among the public and among policymakers—and obviously Secretary Chu testified before this committee last year and said absolutely nuclear is going to be a significant part of what we are doing. And we have been outpaced by countries like France and others who have moved quickly. So let me thank you for your response.

Mr. MILLER. Thank you very much, sir.

Mr. REHBERG. Thank you, Mr. Chairman.

Normally we, as elected officials, like to see programs end because they never really do, but in the case of Yucca Mountain—again, I don't want to beat a dead horse, but we have spent 25 years on it and \$10 billion, so we ought not just flippantly ignore the closure or the discounting it as a solution.

Is anything being done that cannot be undone by the next administration, Republican or Democrat, that might have a different philosophy? Because I haven't heard any objective reason as to why it is unacceptable; most of it has been subjective. And I respect the right of the President and/or the Secretary to make that determination, but that doesn't necessarily mean that we have to agree. We might want to undo it in the future.

My question is, are you doing anything at the site that is going to preclude a different philosophy in a different administration?

Mr. MILLER. Thank you very much.

Let me first again say that the President and Secretary have stated that Yucca Mountain is not going to be pursued as the repository. And let me also repeat that I said that we are doing everything to retain all of the records. We are required by law to retain written as well as physical records.

And then let me also say that now that we are moving in a different direction, Yucca Mountain was selected, down selected, during a period of time in which the country had basically decided that we weren't going to pursue nuclear energy, we weren't going to build any more plants, we were going to allow those plants that exist to live out their life, we were going to take the used fuel, we were going to put it away, we were going to close it up, and that was the end. Well, this is a new world now, and it is a new opportunity for us.

Mr. REHBERG. I think that explains, though, why there was a limitation on the amount that was going to be able to be restored. And if I remember correctly, the concept was that there should be a place in the West and a place in the East.

There will always be a necessity to do something with waste, and it just seems like we have wasted a lot of years to change directions. And so, trust me, you don't have to repeat the company line, I got it, you said it three times already, I understand that, but my question is is anything being done at the site—it would be like taking a tank and filling it with cement—are you doing something at the site that cannot be undone?

Mr. MILLER. Not that I know of.

Mr. REHBERG. Thank you.

Mr. PASTOR. I believe I heard this, and you can correct me if I am wrong, that in the reprogramming request, the letter that is here that you think—it is your opinion that some of that money

may be used for the archiving of the documentation as a result of Yucca Mountain?

Mr. MILLER. That is my understanding.

Mr. PASTOR. And in 2011, then, you will have that responsibility.

Mr. MILLER. That is right.

Mr. PASTOR. So in your budget for 2011, are there monies that you have in the budget that—

Mr. MILLER. Yes, I understand. The answer is that there are no dollars actually specified in the budget for that purpose, but it is our intent to fulfill that responsibility in 2011. It will be part of our responsibility. I don't think we have actually written it down in so many words, so if it requires us to come back and discuss it with the committee, we will. But that responsibility just has to be carried out by law.

Mr. PASTOR. That is what I am getting to. In your budget, to see a line item that says to continue the archiving, and it was difficult to find. We know that that is something that needs to be done, and it is already going to start, hopefully, in the next couple of months. I don't know how much money from the reprogramming is going to go to that effort. And we agree with you that the archiving is very important, but we are trying to determine how you are going to accomplish that in 2011. And I guess that is where I want to get to.

Mr. MILLER. Mr. Chairman, I am happy to get back to you in detail as to how much we believe that will cost. And we have every intention of doing it in 2011.

[The information follows:]

Dr. MILLER. The Department is committed to preserving the relevant scientific knowledge gained from the Yucca Mountain Project. Records generated by the OCRWM in the course of activities at Yucca Mountain are managed and archived in accordance with the requirements of the Federal Records Act and related regulations.

Mr. FATTAH. Mr. Chairman, can I just say something, one thing on Yucca?

Mr. PASTOR. Sure.

Mr. FATTAH. I understand the concerns of my colleagues, and I share many of them. I do want to say that we have arrived at a point in our country where there is cynicism and there are a lot of concerns. Politicians run for office, they make commitments. The President made a commitment not to proceed with Yucca Mountain. And so we, I think, understand and should understand that the administration is following through on a commitment that was made to the American people about what the policy would be. So even though there should be appropriate archival, we should also understand that this policy was ratified in an election that took place in 2008 vis-a-vis what we would do relative to Yucca Mountain.

Mr. PASTOR. What activities will you have with the Blue Ribbon Commission?

Mr. MILLER. My assigned role in the charter is to respond to any requests or any assistance that they ask of us. So we are just responding to any information they ask of us.

Mr. PASTOR. And do you have a line item that allows you to do that, or will you take from this program or that program? How do

you anticipate—I don't know what the cost is going to be, so I ask that question.

Mr. MILLER. In fiscal year 2010, there was \$5 million requested in the RW budget request, and so there isn't any in our request for 2011. The hope is that the 2010 will be enough, the \$5 million will be enough. If not, we will have to work with everyone to try to make sure they are supported, and that people understand what we are doing to support them, and from what budget we are supporting them. But we have to continue to respond to their requests.

Mr. PASTOR. And you are right, you are correct, the \$5 million was aired, and so was the language, "All alternatives will be looked at."

What was the anticipation of the administration in terms of how long this Blue Ribbon Commission was going to exist and be funded by the \$5 million?

Mr. MILLER. Well, I think the \$5 million request came considerably before the charter was established for the Blue Ribbon Commission, but the charter says 18 months, an initial report; 24 months, the final report. That is what is in the charter.

Mr. PASTOR. And where are they at in terms of organizing and beginning deliberation?

Mr. MILLER. So the Commission has been announced, the members have been announced. The first meeting is this week, the 25th and 26th, I believe. So they are off and running.

Mr. PASTOR. I was going to ask you if your opinion was that they would do the work for 18 months, but I know you have to stay with the charter language, so I won't ask you the questions.

Mr. MILLER. Thank you, Mr. Chairman.

Mr. PASTOR. What activities involving the Nuclear Waste Policy Act will your organization support in fiscal year 2011?

Mr. MILLER. Three items I would mention. One is our responsibility for what is called the standard contracts, which basically means United States Government takes responsibility for used fuel and understands it takes responsibility for used fuel. The second is the Nuclear Waste Fund. And the third is the broad R&D responsibility for looking at a disposal site, an ultimate disposal site, for used fuel.

Mr. PASTOR. Rodney.

Mr. FRELINGHUYSEN. I talked a little bit earlier about the broad list of activities that relate to the Used Nuclear Fuel Disposition Program, and I went over some of them. One of the new activities is to inform policy decisionmaking regarding the management of nuclear spent fuel and waste. What mechanism can you tell us, formal or informal, will be used to inform the Commission?

Mr. MILLER. Again, we believe our responsibility is to respond to requests from the Commission, not proactively inform them. So we will respond to requests that the Blue Ribbon Commission comes to us with. We will coordinate the requests with, for example, EM, which certainly has—

Mr. FRELINGHUYSEN. You have a lot of information at your command, a lot of institutional memory here. You are going to let them go and sort of reinvent the wheel here? There is quite a lot of information that has been gathered that would be, I think, extremely

beneficial to their deliberations, determinations, and perhaps their eventual recommendations.

Mr. MILLER. Well, we believe we will have the resources to respond to the requests we will get from the Blue Ribbon Commission from the point of view of tapping the scientific community as well as the Federal workforce.

Mr. FRELINGHUYSEN. Let me tackle, and let me do it respectfully of Mr. Fattah, for whom I have worked, this whole notion that this decision to close Yucca Mountain has somehow been ratified by a Presidential election. I mean, before we get too excited about the building of new nuclear reactors and, should we say, smaller versions, somebody needs to be focusing on what is going to happen to what is produced here. Either it is going to have to be reused, or it is going to have to be restored, or we are going to have to maintain it at a variety of different sites.

You are familiar with all the things. You spent many years at Los Alamos. I mean, there is a lot going on out there. So I sort of worry here that we are—the whole issue of cradle to grave, we talk about the cradle because that is somewhat politically attractive, but we don't talk about the grave. So I am not sure I need a reaction from you, but I feel very strongly about this, and I don't view it in a partisan way. Huge amount of investment here, ratepayers, all sorts of things that people are counting on for some sort of a solution.

I want to get your comments on—I assume you joined Deputy Secretary Poneman in Paris. I looked at his statement. Obviously we are all concerned about nuclear proliferation. What did you take away from that conference that related to the whole issue of financing? I have already commended the President for what he is doing. And President Sarkozy is looking for some sort of resources from the International Monetary Fund, but what did you come away with, the sort of bigger picture of financing?

You look at some of our European allies, they are way ahead of the curve. And let me say parenthetically, you talk about vendors, we have sort of a Buy America policy around here, but my constituents often tell me at town meetings, we don't make a lot around here. I know there is a notion that we have some great companies that are involved, as Congressman Simpson has mentioned, but a lot of the stuff that we are looking for, the components, actually we don't make anymore. We have a workforce that is aging. I guess part of that conference focused on how we have a trained workforce for the future for whatever we build.

What were some of your takeaways from Paris besides the securing of nuclear materials and smuggling and things which would obviously have catastrophic consequences? But did you come away with anything on the financing picture, what they are doing that perhaps we could emulate, or are they struggling the same way we are in terms of balancing risk of the companies, or even others that you mentioned?

Mr. MILLER. The conference that you are referring to was an international conference; it didn't focus at all on the French or the French experience. There were 65 countries represented from all over the world. It was actually more focused on aspiring nuclear countries than it was on countries such as France or Japan. There

were several roundtables that discussed various aspects of nuclear energy. The financing part focused much more on how countries that are emerging that desire nuclear energy, how would they go about financing their first purchases of nuclear energy. So the financing focused on the World Bank, and it focused on those kinds of instruments that such countries would use. It didn't focus so much on loan guarantees or the kind of thing that we are looking at here in our country.

Another takeaway had to do with infrastructure. It is critically important that these countries understand that buying a reactor means also buying into the equivalent of a Nuclear Regulatory Commission, buying into all of the infrastructure associated with education of a workforce.

Mr. FRELINGHUYSEN. And disposal.

Mr. MILLER. And disposal. And disposal.

So I think a takeaway for me, I think, is many countries were enthusiastic, some countries were quite enthusiastic, but other countries I thought left with a little realism about what they would be buying into if they were to become part of the nuclear energy world.

Mr. FRELINGHUYSEN. I am excited about the potential of what we could do in this country. I think we all are. I mean, that is non-partisan, bipartisan, and I commend the administration. It just takes so long to get anything done around here. I mean, it is not just you, there is everything. The Nuclear Regulatory Commission, you have got all sorts of standards that have to be met, obviously. Those are important. But we are raising an expectation here, and I worry about our ability to deliver when we see what is happening in China with their progress—of course, they can do just about anything they want because they seem to accelerate, but in reality they will face disposal issues as well. They may be able to moderate the populace in terms of their apprehensions because of the nature of their government. But I appreciate your reaction to my question. Thank you.

Thank you, Mr. Chairman.

Mr. PASTOR. I am just going to announce that probably at 3:45, 4 o'clock, we have three votes. So what I would like to do is not keep you any longer for this series of votes, so we will try to get as many questions and comments.

Mr. FATTAH. This is my last question or comment for the day.

Mr. PASTOR. Mr. Fattah.

Mr. FATTAH. I think the Ranking Member should understand that I actually support, I think almost in total, his view about Yucca Mountain, that there was a major investment, we had agreed that is where the depository would be. I supported that in every way. That needed to be demonstrated over my years here.

I am just saying that it is not a surprise that we are here at this moment. There was an election contest in which this was a subject matter, and which the winning candidate said that the country was going to go into a different direction. So inasmuch as we are concerned about policy, we are also concerned about the American public not being cynical about the political process and how we go about moving things forward.

So even though I don't agree that we should move away from Yucca Mountain or that it would not have been the appropriate place, I just wanted to put on the record that it is not by happenstance that we have arrived at this moment, that there is a process that we all could see that led us to where we are right now. Thank you.

Mr. PASTOR. Thank you.

In some of the comments and some of the questions from the Members here, you probably got the sense there is some frustration in terms of over the years we have been here, you have seen administrations come, or you see Secretaries come in the same administration, and priorities change, and sometimes very quickly. And I will give you an example, the hydrogen fuel cell. A couple years ago the hydrogen fuel cell was the mantra. And then we have now a new administration, a new Secretary who said, well, I don't think we ought to go there, but yet we invested money, and people invested time.

I ask that question because here we have seen changes come, and sometimes very quickly, after we have spent a lot of money in doing the research. As I looked at your budget, you have a broad research agenda. When I looked at it, I said, wow, this is an aggressive agenda. But then I began to wonder, are we investing a lot into many things, and whether, knowing how things change, that maybe this Secretary ought to concentrate on a few things so that we can fund them for a period of time to make sure that the money is used more effectively. And so I would ask you to talk about your budget agenda in the context of my comments.

Mr. MILLER. Yes. Thank you.

So as I mentioned before, we went, in our country, from zero funding in nuclear energy R&D where now we have a nice healthy program of research. And my observation is the real competitive advantage we have is our intellectual capability. The national laboratories, the universities, small companies, we have some great capability here in our country, and we need to galvanize that in nuclear energy.

So what we did in this budget is, first, there is one big component that talks about reactor designs, and it is both near term, all the way from loan guarantees through looking at reactor types that aren't that different, significantly different, but like the one that was mentioned before that Mr. Gates is investing in, the Traveling Wave Reactor. We have ideas at the laboratories that are somewhat like the idea he has. It is really important, I think, that that portfolio of reactor designs include both near-term activities and long-term activities where we engage this intellectual capability that we have in this great country of ours.

And then on the other side we are talking about fuel cycle. We are looking at opportunities to look at how can we use this used fuel and get more uranium utilization out of this used fuel? What are the ways in which we might be able to do that? And we have some time owing to the safety of dry cask storage—we have some time to look at that. And we are engaging some really smart people to start thinking again about that.

And then in the middle, there are just so many things that cross. Structural materials. The material problems we are having in some

of our reactors owing to embrittlement is because we haven't stopped to basically understand the materials issues associated with some of these reactors.

So we think we have thought this through very carefully of reactor designs, fuel cycles, and cross-cutting technologies like structures, like fuels, that go across these so that we can position the United States so that we won't be here again looking back and saying, well, the whole world is ahead of us. We should leapfrog this world, And we have the capability of doing it. That is what our investment is intended to do.

Mr. PASTOR. Thank you.

Mike.

Mr. SIMPSON. Mr. Chairman, just a couple of things. The Blue Ribbon Commission meets Thursday and Friday?

Mr. MILLER. Yes, sir.

Mr. SIMPSON. Is that open to the public; i.e., could I go?

Mr. MILLER. Let's see, if I remember correctly, for the agenda, a portion of the meeting is open to the public. But the agenda is on the Federal Register, so it says which ones are public and what part is public and what part is not.

Mr. SIMPSON. Okay. Thank you.

Has or will the administration submit legislation for amending the Energy Policy Act of 2005? And will that include waste confidence?

Mr. MILLER. Okay. When you first asked the question, I thought you were referring to the part that dealt with NGNP.

Mr. SIMPSON. Well, that and the waste confidence issue.

Mr. MILLER. Okay. So on the legislation, as you know, Congressman, it deals with NGNP, has some verbiage in it that has kind of been overtaken by events. We need to get together soon in the administration to propose legislation that would correct some of those issues.

I don't know of any discussion about waste confidence and legislation related to waste confidence. So that question kind of takes me by surprise, and I would have to think about that.

Mr. SIMPSON. Well, take the message back that we need to legislate waste confidence. If we don't, we are going to bring the nuclear industry to a standstill, because if we don't have a permanent geological repository, you can't really say you have waste confidence. And the NRC is going to say—I am afraid anyway.

Mr. MILLER. I understand.

Mr. SIMPSON. One other thing. The defense authorization bill reduced the GPP, the general plant project, limit from \$10 million to \$5 million for NNSA labs in 2011. We supported a \$10 million limit in this committee because it actually gives more flexibility to the labs to do some of the projects, and I have seen the results of it out in Idaho with some of the things that they have done.

Do you support keeping the GPP limit at \$10 million for the non-NNSA labs?

Mr. MILLER. I do support that. And I believe Under Secretary Koonin said a similar thing for the Office of Science lab.

Mr. SIMPSON. One last question. One of the very important programs that you are working on is the Light Water Reactor Sustainability program. Talk about the importance of that, the importance

to our energy future, and what we hope to gain of that. And what are our 2011 goals for this program?

Mr. MILLER. First, if the existing fleet of 104 reactors, if the vast majority of them, let's say 100, have license extension for 60 years—which seems like it is going to happen, half of them already have been approved by the Nuclear Regulatory Commission—then in the year 2029, the first of those will go off line, their 60-year life will be over, and the last one in 2050. So that is 20 percent of our electricity that will go off line—

Mr. SIMPSON. Of our green electricity.

Mr. MILLER [continuing]. And 70 percent of our green electricity will go off line. Most proposals or most predictions of Gen III reactor deployment and even small module reactor deployment, it will be very difficult to make up that complete loss of the existing fleet. And so we think it is in the country's interest to participate with industry on dealing with issues that the Nuclear Regulatory Commission will ask—if they were to ask for a further extension, a further license extension, up to, let's say, 80 years.

And so there are aging issues, materials issues, issues related to nondestructive evaluation. How would you, for example, use instruments to go in a reactor, portions of a reactor, internals, to try to assess in real time what is the behavior, how is it aging?

We think it is extremely important that the Federal Government participate in this when it is sure that it is the more long-term issues and the issues that go across reactor types, so that it is not getting into private things or proprietary things, that kind of thing, with industry. So we think the program is extremely important.

Mr. SIMPSON. Thank you. And thanks for the job you are doing. I look forward to working with you on these important projects for Idaho and for the country.

Mr. PASTOR. Rodney.

Mr. FRELINGHUYSEN. In terms of our R&D, how would you characterize our position in terms of research on advanced nuclear concepts? We talked in a previous hearing about some of the things that are happening abroad and appear to be accelerating abroad. Where are we? And how do we strengthen our position vis-a-vis what others may be doing?

Mr. MILLER. We have some great ideas out there. I will just throw one out at you. A former colleague of mine—I used to be on the faculty at UC Berkeley—has an idea of using molten salt—that is not a brand new idea, but his approach is using molten salt with fuel elements that look like the fuel in NGNP. And it is a new concept of a reactor that really has a tremendous amount of potential. First, it could potentially use thorium as the fuel as opposed to uranium, which would greatly extend our supplies of nuclear fuel. Because it uses these trivalent elements, it is probably going to get very high burn-up, very high uranium utilization out of it, and you can do it at higher temperatures, higher efficiency.

See, it is one of these ideas where it is a game changer, it is not just an incremental change. And under advanced concepts, that is the kind of thing we want to do is to look at real game changers, bright new ideas.

Mr. FRELINGHUYSEN. Are other countries looking at game changers as well? What do we know about other countries, what they are doing? We give credit to our scientists, but—

Mr. MILLER. I think, Congressman, we have been dealt a darn good hand, and the reason is we just have some really creative people, and we have the advantage or disadvantage, whichever way you want to say, of those other countries being kind of locked into decisions they have made. They have made long-term—

Mr. FRELINGHUYSEN. We have made a few decisions we are locked into as well.

Mr. MILLER. That is true, but we do have some flexibility of some new ideas in which we could deploy something new without necessarily being constrained by having decided, for example, we are going to deploy a large liquid metal reactor by year 20-whatever. This flexibility we need to take advantage of, and advanced concepts is going to help us do that.

Mr. FRELINGHUYSEN. It may not be fair to say this, but we focused a little bit last week on the migration of some of our best minds abroad, I mean, literally establishing factories and technological centers, which I assume would be a critical mass for some pretty smart people; in other words, people we might have actually trained.

Mr. MILLER. In nuclear we are going to turn that around.

Mr. FRELINGHUYSEN. We are. You are giving us that vote of confidence?

Mr. MILLER. Yes, sir.

Mr. FRELINGHUYSEN. Well, on that note, thank you very much, Mr. Chairman. And that is for the record, too. Thank you.

Mr. PASTOR. What is interesting is that a couple of years ago we went to China, and we went to one of their—I guess equivalent to the lab in Beijing, and they were showing us the pebblebed reactor. And all the young scientists—when I first went in, I said, we are going to have a problem in the translation. That was my thought in terms of—

Mr. FRELINGHUYSEN. Everybody speaks English.

Mr. PASTOR. Well, they spoke excellent English, and they are all trained and graduated from universities here in the United States—MIT, Stanford, Berkeley. It was very interesting to see how before they may have stayed here, and you would have found them working in industry here or labs here or universities here, but the migration now is that as we have trained them and educated them here, they have decided to go back to their home and now are doing well in terms of—in this case in China. So it was very interesting.

Mr. Secretary, thank you very much. I look forward to seeing you again with the plan in hand.

Mr. MILLER. Yes, sir.

Mr. PASTOR. And don't forget to tell the Blue Ribbon Commission that all alternatives include Yucca.

Thank you very much for being here.

This hearing is adjourned.

QUESTIONS FOR THE RECORD
ENERGY AND WATER DEVELOPMENT SUBCOMMITTEE
HOUSE COMMITTEE ON APPROPRIATIONS

DEPARTMENT OF ENERGY: OFFICE OF NUCLEAR ENERGY
BUDGET HEARING
MARCH 23, 2010

Sustaining a Nuclear Energy Research Agenda

Q1: The Department's nuclear energy research and development has suffered as a result of shifting agendas over the years. This has caused research and projects to make progress for a few years before being abandoned. Is there a way to gain some continuity in this research agenda so that taxpayer investments are not wasted?

This budget request supports a broad research agenda. Does it risk spending too little funding in a lot of areas instead of investing sufficiently in a few initiatives that would show results? Please explain.

This budget request includes a number of new or renewed research areas—e.g. the Modeling and Simulation Hub, Small Modular Reactors, and Nuclear Energy Enabling Technologies, among others. Are you confident these can be sustained over the near to mid-term and produce tangible results? Please explain.

A1: We have worked to define a comprehensive nuclear energy research agenda that we believe includes all the necessary elements to support technology advancement and make progress on important and fundamental issues. The research plan we will be delivering to Congress details those elements that we think will be important for many years to come, and we think the program organization is sustainable for the foreseeable future. To ensure that these efforts provide tangible benefits, research must be goal-oriented. The research plan has been developed with the end in mind to ensure that the linkage between research and solution is clear.

While the research agenda is broad, we think that the funding requested for each program is sufficient to accomplish specific, important goals. Each of the programs is tied to some short-term or long-term need to support nuclear energy's future.

Yes, we are confident that these programs can make progress and will certainly produce tangible results.

Overall Role of Industry in Nuclear Power

Q2: There are competing views on the role of the federal government in advancing nuclear power. There is an argument that the government should incur the early risk and make sizable up-front investments in reactor research and development, design, and demonstration. The counterargument is that industry needs to have skin in the game early in a project since industry will be the beneficiary of taxpayer investments. Currently, many projects are cost-shared with industry as required by law.

How would you explain the proper role of the Department in supporting research and development; design; licensing; demonstrations; and the deployment of nuclear reactors?

A2: The respective roles between federal government and industry will depend on a number of factors including technical maturity, economics, time horizon and policy considerations. Generally speaking, industry has sufficient capability and financial motivation to develop and deploy technologies that will provide a competitive edge or produce a tangible near-term return on invest at an acceptable level of risk. An appropriate role for federal government is research in longer-term or higher risk areas that have the potential for significant public benefit. This could include R&D related to reactor technologies or innovative concepts that industry can not pursue. However, as a primary beneficiary of R&D results, the private sector should share in the costs associated with conduct of that R&D. Appropriate interface and coordination is needed on the research and development process between government research agencies, regulators to the degree appropriate, technology vendors and end-users to assure that the technologies ultimately satisfy performance, economic and public policy goals.

Industry Involvement in Research Agenda Planning

Q3: The Department's new ARPA-E program has involved industry at a very early stage in developing its program plans. Industry, not the federal government, will ultimately move technologies toward commercialization. How would you describe the industry role in nuclear energy research and development planning?

A3: Commercial deployment of nuclear power will be done by industry. Private sector vendors will market the technology and private sector entities will be the end-users. Our research program acknowledges the crucial role that industry will play in the successful deployment and long-term operation of reactor technologies. Input from industry is encouraged at the front end of the development process to gain perspectives and inform our planned activities, resource allocations and priorities. Industry input can include technology development needs and priorities, application requirements and perspectives on scale up. In addition to industry, our program will continue to engage universities and other stakeholders as well as regulators if appropriate to seek and understand their perspectives. We anticipate that this broad engagement will also help to spur innovation and improve U.S. competitiveness in the global marketplace.

Nuclear Energy Strategic Plan

Q4: The Committee directed the Department to submit a strategic plan for its nuclear energy research and development programs but it has not received it. When can the Committee expect to see the plan? What are the priorities within the plan?

How does the strategy balance investing in nearer-term deployment, like small modular reactors, and longer-term research?

A4: The Nuclear Energy Research & Development Roadmap was delivered to Congress the week of April 12, 2010. The roadmap contains a number of priorities, which include extending the lifetime and improving the performance of the existing nuclear reactor fleet, develop improvements in the affordability of new reactors, developing a sustainable fuel cycle, and understanding and minimizing proliferation risk. There is a balance in the roadmap between near-term and longer-term elements to restart the domestic nuclear industry now, train the workers of tomorrow, and provide the technological breakthroughs needed for the future.

Nuclear Energy Spending at Universities

Q5: The fiscal year 2011 budget request states that up to 50% of funding will support university research. Does this 50% goal apply to all research activities or a subset of activities in the Office of Nuclear Energy?

How much funding did your office provide to universities, from all Nuclear Energy accounts, during fiscal year 2009 and what is your estimate for fiscal year 2010?

Do you use a peer-review process to determine university awards, similar to what the National Science Foundation uses? If not, why not?

A5: The Office of Nuclear Energy (NE) University Program (NEUP) consists of a variety of efforts which provide funds to universities. A small fraction of the university activity is directly funded to support programs. The large majority of the funds are competitively awarded and peer reviewed. In FY 2009, NE invested over \$87 million to support universities through the NEUP. The following table describes NE's FY 2009 and 2010 university investments. As noted in the table, NE plans to invest over \$79 million of its appropriation to fund universities in FY 2010. Likewise in FY 2011, NE plans to continue to support universities up to 20 percent (not the 50 percent mentioned in the question) of its R&D budget to support R&D, reactor upgrades, and laboratory equipment at universities.

FY 2009 NE University Funding		FY 2010 NE University Funding	
NE University Program (20% R&D Contribution)	\$70,700,000	NE University Program (up to 20% R&D Contribution)	\$55,268,000
Research Reactor Infrastructure	\$6,146,000	Research Reactor Infrastructure	\$10,000,000
Direct Programmatic University Support (Generation IV Nuclear Energy, Nuclear Hydrogen Initiative, Fuel Cycle Research & Development)	\$10,258,000	Direct Programmatic University Support (Generation IV Nuclear Energy, Fuel Cycle Research & Development)	\$14,142,838
Total	\$87,104,000	Total	\$79,410,838

The NEUP R&D Program uses a two-stage peer review process similar to the National Science Foundation (NSF) to judge both the relevancy and technical quality of submitted proposals. The first stage, which is not utilized by the NSF, is based on a pre-application submission which reviews proposals for program relevancy to NE's mission. Proposals that meet relevancy requirements are forwarded to a second stage which includes a semi-blind, peer-review procedure to determine the overall technical capabilities of the proposal including budget, research team, and university infrastructure. Full proposals are reviewed by at least three peers independently. Ranked summary scores and review comments are submitted to the selection board consisting of Federal Program Managers and Laboratory Directors (The NSF does not use independent reviewers to review and rank proposals; they typically use one peer panel to review all proposals).

After the peer review is completed, a final combined score for each proposal includes the relevancy score and the peer review technical score. The selection board provides a list of recommended projects based upon the final scores and availability of funding within each technical work scope area within NE programs. The recommended list of proposals is evaluated for geographic distribution, participation of minority institutions, and other balancing criteria. Lastly, the NE selection official reviews the

recommended list of proposals and provides final approval.

The NEUP peer review process is different than NSF in that NE, as a mission agency, must first be assured that the proposed university research fits with the programmatic needs of NE (first stage of review mentioned above). NSF does not have this restriction. Second of all, the NEUP university community is relatively small, but with very distinct research needs in specialized areas. Hence, peer reviews of full proposals must be individually requested of specialists from around the country (second stage mentioned above). The large number of over 40,000 proposals that NSF receives allows them to convene panels of experts at one location to review proposals as a group. The added advantage of the NEUP individual reviewer process is that anonymity of reviewers and principal investigators during the semi blind process can be maintained to eliminate bias. This is especially important because of the small relative number of university nuclear energy researchers.

Note that NE also funds university undergraduate scholarships and graduate-level fellowships in nuclear science and engineering fields via the Integrated University Program (IUP) in coordination with the Nuclear Regulatory Commission and the National Nuclear Security Administration. In FY 2009 and 2010, NE was provided \$5 million to support IUP activities. However, in FY 2011, NE is terminating the IUP but will consolidate its activities as part of the REgaining Our ENERGY Science and Engineering Edge (RE-ENERGYSE) Initiative announced by the President in April 2009. RE-ENERGYSE is a joint initiative by the Department of Energy and the NSF that will inspire tens of thousands of American students to pursue careers in science, engineering, and entrepreneurship related to clean energy and empower young men and women to invent and commercialize advanced energy technologies that will enable sustained energy supply from nuclear, solar, wind, and other renewable energy sources, high-efficiency deployment of power across "smart grids," and carbon neutral commercial and residential buildings.

RE-ENERGYSE and Nuclear Education

Q6: The Committee has supported the Integrated University Program in recent years to provide scholarship and fellowship grants in nuclear science and engineering at \$5 million per year. The fiscal year 2011 request proposes no funding for the Integrated University Program but requests \$5 million for RE-ENERGYSE, which also provides scholarships and fellowships. What is the difference, other than in name, between these two programs?

A6: Through FY 2010, support for research and development as well as fellowships to universities has been accomplished through the Integrated University Program (IUP), an effort localized to the Office of Nuclear Energy (NE). The RE-ENERGYSE initiative, a joint initiative by the Department of Energy and the National Science Foundation (NSF) to inspire tens of thousands of American students to pursue careers in science, engineering, and entrepreneurship related to clean energy, is the new program under which NE will continue to support university fellowships and scholarships in FY 2011. The RE-ENERGYSE initiative is different from the NE IUP effort in that it is a comprehensive education initiative that includes energy education efforts not only through NE, but through the Office of Energy Efficiency & Renewable Energy, and the NSF. Because of this comprehensiveness, the RE-ENERGYSE initiative will provide greater visibility and support to energy education than the NE IUP.

Support for Licensing

Q7: Fiscal year 2010 completed the government's contribution to the Nuclear Power 2010 initiative. The Department has explained and justified the Nuclear Power 2010 program as supporting those who pioneer regulatory procedures for Early Site Licensing and combined Construction and Operating Licensing. Was this effort successful?

Are there any follow-up efforts that will be required?

A7: No, there are no follow up actions for the Nuclear Power 2010 program. The program was established to help demonstrate the revised and untested nuclear regulatory process and has achieved its intended purpose. It will be brought to closure by the end of FY 2010.

Between 2002 and 2007, the Department supported three industry cost-shared Early Site Permit demonstration projects that culminated with the Nuclear Regulatory Commission (NRC) approval of sites for new nuclear plants at Dominion Energy's North Anna site near Mineral Virginia; Exelon's Clinton site near Clinton, Illinois and Entergy's Grand Gulf site near Port Gibson, Mississippi. As a result of these projects, industry guidance was developed and implemented. These projects also generated lessons learned that have been recently factored into revised industry guidance for new early site permit requests.

The Nuclear Power 2010 program also supported industry cost-shared projects focused on development and NRC review of Combined Construction and Operating Licenses (COLs) and the design certification for two advanced reactor technologies. These COL applications may serve as the reference applications for other power company applications for the two specified reactor technologies. The specific projects were with Dominion Energy for a license to build and operate the General Electric Economic Simplified Boiling Water Reactor at the North Anna site and with the NuStart Energy Development consortium to build and operate the Westinghouse AP1000 reactor at Southern Company's Vogtle site in Georgia. These efforts helped demonstrate the new NRC design-centered approach. Currently, 14 power companies have 17 COL applications submitted and under NRC review. These applications represent 26 new nuclear units.

Coordination with the Office of Science

Q8: From modeling and simulation to material science there are areas where the Office of Science could work with the Office of Nuclear Energy (NE) on research challenges. Please describe the NE projects and research areas that are coordinated with the Office of Science (SC).

A8: The Office of Nuclear Energy (NE) actively collaborates with the Office of Science (SC) to enhance its research and development (R&D) resources. In the case of modeling and simulation, NE was able to take advantage of the SC-funded Jaguar supercomputer at Oak Ridge National Laboratory to simulate the neutronics of a full fast reactor core. The simulation was run on over 140,000 processors and was named a finalist for the prestigious 2009 Gordon Bell Prize at the 2009 SC conference. In addition to the use of computers, NE is also utilizing SC and NNSA-developed software, including tools such as iMesh and CubIT for mesh generation; MOAB, Common Component Architecture and Sierra for interoperability frameworks; and Visit for visualization.

In materials development, NE is building off scientific advances and related technologies developed by SC. This includes oxide dispersion strengthened steels, nano-engineered steels, and friction stir welding. Many of the material models that are being developed to support NE advanced modeling and simulation were first developed using NNSA and SC experimental capabilities. NE also depends on many SC facilities for experimentation and examination, including the Advanced Photon Source, High Flux Isotope Reactor, and state-of-the-art materials properties testing and high resolution characterization equipment. The award of three SC Energy Frontier Research Centers in the area of irradiated material performance is another example of coordination between the two offices. NE and SC have also collaborated on workshops to ensure that research is well-focused and designed for results.

Forecast Size of Nuclear Reactor Fleet

Q9: For all the investments we are making in nuclear research and financial support to the nuclear industry, how many new reactors will we see, and will those replace aging reactors so the size of our fleet stays constant, or will the size of our fleet grow?

Given this forecast for our future reactor fleet, how much spent fuel will they generate annually after the year 2010?

A9: The size and technology mix in any future nuclear fleet will be determined solely by industry. There are many parameters that factor into any consideration of future nuclear deployment levels, including fleet size and composition, capital cost, uranium resource requirements, used nuclear fuel inventories and radioactive waste. Any analyses must consider a number of factors and assumptions relative to the timeline for insertion of new technologies, life extension of the existing fleet, U.S. energy demand and the contribution from other energy sectors (renewables, energy efficiency, clean coal, etc.). Currently there are 17 applications under review at NRC, which cover 26 new reactors. The schedules for review and deployment of these reactors are uncertain. New nuclear power plant schedules are uncertain largely because the need for power in many areas of the country and the cost of reactors relative to other sources of generation (e.g., natural gas) is in flux.

Cost Competitiveness of Nuclear Energy

Q10: The capital construction costs of large Light Water Reactors, along with a host of uncertainties ranging from politics to licensing, make nuclear power relatively expensive when compared to coal and renewable energy generation. What are the key research and development activities in the Office of Nuclear Energy that will contribute to making nuclear power more cost competitive?

A10: Currently, the capital costs of all new nuclear power plants are the most significant contributor to the unit cost of electricity produced. However, once nuclear plants are licensed and operating, the production costs are quite favorable.

Reducing capital cost is a key area of focus for Nuclear Energy's research program. We are approaching this on a number of fronts. Capital costs are directly tied to commodity costs, and many commodity prices have risen appreciably. The use of smaller, simpler components and improved materials can reduce commodity costs. While all plant designs must be robust, safe and reliable, there is a significant level of conservatism that is incorporated into nuclear plants to account for uncertainty. Our research program, including improved nuclear data and the use of advanced computing, modeling and simulation provides an opportunity to reduce or eliminate the unnecessary conservatism that increases capital costs, without sacrificing safety, reliability or performance. Research on modular reactor concepts and long-lived cores could lead to reduced fabrication and construction costs or provide options to new customers looking to avoid the upfront financial outlays associated with large monolithic plant designs.

Reactor Concepts Research, Development and Deployment

Q11: The fiscal year 2011 budget request includes \$199 million for a newly focused Reactor Concepts Research, Development and Deployment program. Please explain why you have built this new program and why you have stepped away from the Generation IV Nuclear Energy Systems Research and Development.

A11: The proposed Reactor Concepts Research, Development and Demonstration (RD&D) program consolidates previous Generation IV Nuclear Energy Systems activities with the development of other reactor concepts in a single budget element. This was done as part of a larger effort to improve the management and efficiency of our nuclear research activities. For similar reasons, we are reorganizing the Office of Nuclear Energy to consolidate reactor technology activities under a single Deputy Assistant Secretary.

We have not stepped away from the activities formerly included under the Generation IV Nuclear Energy Systems budget element and continue our international collaboration activities as part of the Generation IV International Forum (GIF). The Reactor Concepts RD&D program will allow us to better coordinate and effectively integrate our research activities associated with the Next Generation Nuclear Plant Demonstration, Small Modular Reactors, Advanced Reactor Concepts and Light Water Reactor Sustainability programs.

Nuclear Energy Enabling Technologies

Q12: The fiscal year 2011 budget request includes \$99 million for a new Nuclear Energy Enabling Technologies program. This program would advance new concepts and solutions to a variety of challenges in nuclear energy technology. It will use open competition to solicit the best capabilities in the country to solve these challenges. Since this a new program, what is the expected timing in terms of developing a solicitation, selecting, and awarding funds for the portion that would be competitively awarded?

A12: The new Nuclear Energy Enabling Technologies (NEET) program includes two sub-programs that will have competitive solicitations: the Crosscutting Technology Development program and the Transformative Nuclear Concepts Research and Development program.

The Crosscutting Technology Development program includes development of advanced materials, research on innovative nuclear manufacturing methods, new sensor technologies for monitoring material and equipment conditions in existing reactors, and creative approaches to further reduce proliferation risks. The program plans to initiate competitively selected high-potential research and development (R&D) activities with universities, industry, and laboratories in some or all of these areas. Some specific areas where competition is envisioned are in hybrid gas metal arc and laser welding; automated non-destructive examination techniques such as digital radiography and phased array ultrasonic; steel concrete composite structures; and prefabricated modular rebar assemblies among other topics.

The Transformative Nuclear Concepts Research and Development program plans to support, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy generation—reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, nonproliferation, and so forth—ensuring that good ideas have sufficient outlet for exploration.

The Department of Energy plans to hold a NEET workshop in mid July 2010 to gather stakeholder's input on the crosscutting and transformative research and development. Based on the workshop results, the NEET program will develop its solicitations, work scopes, and schedule for FY 2011 R&D awards. The goal is to issue the competitive solicitations early in the fiscal year, pending appropriation; make project selections in the late fall 2010; and target completion of award negotiations for mid-February 2011.

Progress on the Next-Generation Nuclear Plant

Q13: The Committee has strongly supported the Next-Generation Nuclear Plant (NGNP). NGNP holds tremendous potential in providing process heat for industry and, by extension, reducing the carbon emissions of industry. We asked for a detailed plan for the NGNP. This was to be delivered within 90 days of enactment, which would have been late January. When can the Subcommittee expect the Department to submit the plan?

Will the project execution plan provide a detailed strategy for the NGNP project's licensing and completion schedule?

In your best estimation, what do you think the out-year funding requirements will be, and are we on track to meet the 2021 completion date? If not, what needs to be done to stay on cost and on schedule? Unlike many electricity producing reactors, the NGNP will be tailored to the needs of a variety of industrial sectors. There are concerns that the implementation plan for NGNP is not sufficiently including the industrial sectors most likely to use the reactor. Is this true?

A13: The NGNP Report to Congress was transmitted on April 5, 2010. The NGNP Report to Congress describes the licensing strategy and schedule for NGNP. As described in the Report to Congress, our cost estimates are based on pre-conceptual design. A better estimate will be available after conceptual design has been completed. Industry has been a partner and industry users are represented in the NGNP Alliance. DOE has worked with industry to examine the market for gas-cooled reactors and assess end-user needs and interface requirements for the reactor. Industry will continue to be a critical cost-share partner if the NGNP Project is approved for Phase 2 activities.

Funding Opportunity Announcement

Q14: A \$40 million Funding Opportunity Announcement (FOA) was announced a few months ago dealing with the development of NGNP designs. Two companies were recently selected. Does this FOA function as a down-select of companies likely to build the demonstration reactor?

Congress provided \$169 million for NGNP in fiscal year 2010, does the execution of this FOA slow other work on NGNP?

A14: Awards for the current conceptual design FOA do not constitute a down-select and do not limit the companies or the designs that can be offered in any future offerings by the Department of Energy for the Next Generation Nuclear Plant.

Design detail is needed to reach finality on R&D and in licensing. The awards for conceptual design do not slow down other NGNP work, and in fact, enhance our ability to conduct essential R&D and licensing activities.

Modeling and Simulation Hub

Q15: The fiscal year 2011 budget request includes \$24 million for the Modeling and Simulation Hub. This Hub will provide a variety of user access to models and simulations to test reactor concepts and performance. The Committee provided \$22 million in fiscal year 2010. The Funding Opportunity Announcement (FOA) for the Hub closed on March 18th. When do you expect to make a selection?

The FOA describes the Hub in general terms, suggesting the actual shape of the Hub is not clear. Can you provide some clarity on the hub?

A15: The FOA for the Office of Nuclear Energy Modeling and Simulation Hub closed on March 8, 2010. The selection is expected to be announced in late May or early June. A team of outside technical experts and a federal merit review panel are reviewing the applications. They provided initial recommendations to the source selection official in late March, and site visits are occurring in April.

The FOA for the NE Modeling and Simulation Hub states: "The mission focus of the Hub is to apply existing and/or newly developed modeling and simulation capabilities to create a user environment that allows engineers to simulate an operating reactor, as chosen by the applicant that will act as a "virtual model" of that reactor." The "virtual reactor" will be used to address current generation Nuclear Energy technology issues such as fuel performance and reactor vessel and internals integrity.

The applicants to the FOA were asked to identify a specific physical reactor that would be the focus of the "virtual reactor;" the specific approach to building the "virtual model;" and the team of industry, university and national laboratory researchers who would be involved. The outside technical reviewers and the merit review panel are reviewing the applications according to the criteria described in the FOA.

Safety and Extending the Life of Current Reactors

Q16: Many operating reactors are in the process of extending the licenses to operate another 20 to 30 years. You have requested \$26 million for Light Water Reactor (LWR) Sustainability, an increase of \$16 million from fiscal year 2010. I commend you for recognizing the importance of this program, as it will help us develop much needed data to support the license extensions for the existing fleet of LWRs. And given the capital costs of building new nuclear plants, it seems to be a very good return on investment to extend the life of these reactors.

The budget documents describe the increase as “expanding the experimental suite across all research pathways.” Please provide the specific pathways you propose to research.

What specific aspects of aging LWRs are guiding your research?

A16: The Light Water Reactor Sustainability Program has at its core five research pathways: (1) Nuclear Materials Aging and Degradation; (2) Advanced LWR Nuclear Fuel Development; (3) Advanced Instrumentation, Information and Control Systems Technologies; (4) Risk-Informed Safety Margin Characterization; and (5) Efficiency Improvement.

There were several areas of specific concern in the aging of LWRs that are guiding our research and led to the development of the five research pathways. A primary concern is that the aging and degradation of LWR systems, structures and components, such as reactor pressure vessel, core internals, concrete, cables and buried pipes, may impact the plant safety and performance in the future. There are also formidable fuel performance issues and failures still confronting the operating plants. Another area of specific concern is that analog instrumentation and control systems have become obsolete. In addition, significant licensing challenges are confronting life extension with aging plants. The vintage modeling and simulation tools developed in 1980’s for reactor systems safety need to be modernized to better support aging components. Finally, plant cooling water issues have been impacting plant performance. Technologies to enable extended and ultra-high power uprates have the potential to add significant additional generating capacity to the existing fleet.

Small Modular Reactors

Q.17: There are a number of designs for Small Modular Reactors (SMR)—e.g. high-pressure light-water, sodium or lead cooled, and high-temperature gas-cooled, among others. The fiscal year 2011 request includes \$39 million for SMR research and development. This proposed program would select and support two research designs for a cost-share on design activities. In the Committee's experience, this is the sort of program that will be a multi-year commitment. How many years will this program run and what will be the out-year funding commitment?

This program is dedicated to design activities. Do you envision the program evolving into a demonstration program, like the Next Generation Nuclear Plant, or a licensing partnership, like the NP 2010 program?

A.17: This is not a demonstration program or project. The SMR program funding will be used to support research and development of a range of SMR designs as well as limited cost-share partnership funding with selected SMR vendors with a view toward design certification.

DOE is conducting an SMR Workshop on June 29-30, 2010, that will be used to obtain information from SMR vendors and suppliers, potential utility customers, national laboratories, universities, NRC, and interested stakeholders on priorities, activities and projects that will inform our SMR strategy. As noted in the Budget, the Administration will evaluate potential priorities in the context of the appropriate Federal role to identify the most cost-effective, efficient, and appropriate mechanisms to support further development.

Advanced Reactor Concepts

Q.18: The budget request for Advanced Reactor Concepts, formerly Generation IV energy systems, is \$22.1 million. The requested program expands beyond the six reactor designs in international Gen IV to explore more advanced concepts. How would you divide the resources between Gen IV concepts and longer-term advanced reactor concepts?

What is the Department's current view on Generation IV technologies, which have received a significant investment of taxpayer dollars in recent years?

A.18: The current U.S. focus addresses the technical barriers for a range of reactor designs that offer long-term benefits to proliferation resistance, safety and economics. This approach will continue to leverage international collaboration through the Gen IV International Forum (GIF) as well as other bilateral or multilateral international collaborations.

The Advanced Reactor Concepts R&D program is broadened to consider truly innovative reactor concepts and technology features. New ideas for advanced reactor concepts that include innovative features and/or significant performance benefits will be encouraged; and concept development studies will be conducted to assess the system performance and R&D needs of new concepts.

For example, key research on the fluoride-cooled high-temperature reactors will be evaluated in FY2011. This molten salt cooled concept has favorable performance attributes and investigations and trade studies of this reactor concept are a logical leverage of extensive U.S. investment and progress in graphite fueled high temperature reactors. Longer-term R&D for all reactor concepts is difficult to project, but DOE and its national laboratories will prioritize these projects on an annual basis consistent with budgets. Priority strategies will focus on obtaining leverage from international collaborations and R&D on innovative technologies that benefit many reactor concepts.

Overall, DOE views its investment in Gen IV technologies as a reasonable and appropriate expenditure of time and resources to advance reactor technologies that offer enhanced safety, performance, operations, and proliferation resistance attributes over Gen III technologies. This is a balanced and leveraged investment between DOE, its national laboratories, industry, universities and international partners.

Fuel Cycle Research and Development

Q19: The fiscal year 2011 request states the fuel cycle research and development program is shifting toward longer-term solutions to the back-end of the fuel cycle. More specifically, how is the fiscal year 2011 request in this area different from prior years in terms of emphases and specific activities? Which programs or activities from fiscal year 2010 would no longer be continued in fiscal year 2011?

A19: Because near-term implementation is no longer the focus of the Fuel Cycle Research and Development (FCR&D) program, future emphases will be on long-term, goal-oriented, science-based R&D activities. The fiscal year 2011 budget request includes \$201 million for FCR&D to research technologies for future fuel cycle management strategies. Specifically, the program will conduct R&D related to three potential long-term fuel cycle scenarios—once-through, modified open, and full recycle—to provide future decision makers with information to make decisions on how best to manage used fuel. This will also enable safe, secure, economic, and sustainable use of nuclear energy while minimizing proliferation risks.

The full recycle fuel cycle has been the focus of the FCR&D program to date and the once-through fuel cycle is the current practice in the United States. The modified open cycle constitutes a range of technology options in between once-through and full recycle. The modified open cycle has not been studied in as much depth and that is why it is being introduced as a new focus area in fiscal year 2011.

The transition away from the domestic component of the Global Nuclear Energy Partnership began in fiscal year 2009 and will be completed in fiscal year 2010. Fiscal year 2010 activities that will not be continued in 2011 include: (1) Coupled End-To-End demonstration project—a separations processing demonstration for potential short-term implementation, and (2) Prototypic irradiation efforts for supporting a fast reactor demonstration in the advanced fuels R&D area. In addition, activities in the Systems Analysis area will be redirected to significantly focus its efforts to support development of credible implementation plans that can achieve major new nuclear energy contributions to the U.S. economy by mid-century.

Proliferation Concerns and the Fuel Cycle

Q20: The fiscal year 2011 request for the Office of Nuclear Energy, as well as the review by the Blue Ribbon Commission, will be looking at a broad spectrum of technology options dealing with the back-end of the fuel cycle, including reprocessing/recycling. These technologies pose a variety of nonproliferation concerns that will need to be addressed. How will you be addressing these proliferation concerns as you conduct this research agenda?

How does the Department work with the Nuclear Regulatory Commission to identify and manage proliferation concerns? Are there ways to strengthen this process?

A20: The budget request includes \$7.8 million for Material Protection, Accountancy, and Controls for Transmutation within Fuel Cycle Research and Development. This will continue the work started in fiscal year 2010 to develop technologies and analysis tools to enable next generation nuclear materials management for future U.S. nuclear fuel cycles to prevent diversion or misuse, thereby, reducing proliferation risks and enhancing confidence and acceptance of nuclear energy.

The Office of Nuclear Energy is working closely with the Nuclear Regulatory Commission (NRC) on identifying and addressing special nuclear material safeguards issues pertaining to advanced fuel cycles. Under an interagency agreement that was initiated in August 2007, the Office of Nuclear Energy has been providing the NRC with about \$800,000 per year to fund NRC technical staff labor and travel costs in order for the NRC to maintain its technical expertise in safety and safeguards pertaining to advanced fuel cycle technologies and facilities. For example, in December 2009, NRC technical staff visited Japan to conduct technical discussions with the pertinent regulatory agencies and operators of the Rokkasho and Tokai reprocessing plants in the area of material control and accounting of special nuclear material and safety/risk assessment.

In addition, DOE staff and NRC staff continue to exchange technical information in the area of safeguards for reprocessing/recycling facilities. For example, over the past few years, DOE has kept the NRC staff engaged in evaluating the attractiveness of special nuclear material that may be associated with a reprocessing/recycling facility. Such interactions related to identification and management of proliferation concerns will continue as DOE continues its research and development activities in advanced fuel cycles and the NRC considers its regulatory framework for reprocessing/recycling facilities.

Expanded Used Nuclear Fuel Disposition Program

Q21: The fiscal year 2011 request includes \$45 million, \$36 million above fiscal year 2010, for the Used Nuclear Fuel Disposition program. This expanded program has a long list of activities ranging from informing the Blue Ribbon Commission, to modeling, to evaluating canisters, among many other activities. Please provide a detailed break-out of how the fiscal year 2011 request would be spent by activity.

A21: The following table provides a preliminary conceptual outline of activities and associated funding for the Used Fuel Disposition Program in fiscal year 2011 as conceived in the budget request.

Activity	Estimated Cost (\$M)
Science Programs transferred from RW to NE, such as: Infiltration and soil processes Contaminant transport in unsaturated media Thermal/hydrologic/mechanical/chemical studies Thermal load management studies Waste form degradation Engineered material performance Contaminant transport in saturated media Regional geology/tectonic hazard assessment System-level performance assessment analysis Criticality analysis Regulatory analysis	12
University research related to Used Fuel Disposition	9
RW Science Program closeout costs, such as: Maintaining license application baseline information Archiving historical information Site management activities Material management at offsite locations Lessons learned	8
Disposal evaluations and experiments, such as: Evaluations of potential disposal environments Evaluations of natural disposal system analogs Evaluations of engineered barrier system concepts Models to evaluate generic disposal systems Experimental programs - Disposal	8
Storage and transportation evaluations and experiments, such as: Evaluations of storage system options Advanced concepts for security Investigate advanced transportation concepts Experimental programs - Storage	6
External interactions and collaborations, such as: Responses to requests from Blue Ribbon Commission Interface with other agencies and industry Interface with foreign organizations	1
Used Fuel Disposition Campaign Management	1
Total	45

The Economics of Recycling/Reprocessing

Q22: Current technologies for recycling and reprocessing pose proliferation concerns and the economics do not make sense. The costs of constructing reprocessing or recycling outweigh any benefits based on forecasted uranium prices. In short, fabricating new fuel is considerably cheaper than recycling and reprocessing. Exploring advanced technologies that could address proliferation concerns and be economical seems worthwhile. Will you be conducting research with or without considering the costs of the prospective technology?

A22: We believe that researching advanced fuel cycle technologies is worthwhile and, in so doing, we will include consideration of, among other things, economics, proliferation resistance and physical protection.

Once-through, Closed Full Recycle, and Modified Open Fuel Cycles

Q23: The fiscal year 2011 budget request for Fuel Cycle Research and Development proposed a broad look at the back-end of the nuclear fuel cycle. This means the Department will be looking at once-through open, closed full-recycle, and modified open cycle technologies. Will you be applying the same emphasis to these three areas?

- If not, how will you be emphasizing your research among the three areas?
- Doesn't this risk not accomplishing anything in the pursuit of everything?

A23: The full recycle fuel cycle has been the focus of the Fuel Cycle Research and Development (FCR&D) program to date and the once-through fuel cycle is the current practice in the United States. The modified open cycle has not been studied in as much depth and that is why it is being introduced as a new focus area in fiscal year 2011. Although the emphases vary among these three approaches, we have developed focused research priorities for each approach.

For the once-through approach, research emphasis would include the development of fuels for use in the present and Generation III+ reactors that would increase the efficient use of uranium resources and reduce the amount of used fuel for direct disposal. Under the modified open cycle approach, limited separations and fuel processing technologies could be applied to the used fuel to create fuels that enable the extraction of much more energy from the same mass of material. Research in this area will focus on the investigation of fuel forms, reactors, and fuel/waste management approaches that could dramatically increase the utilization of fuel resources and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed. Technologies will be considered that require at most limited separation steps and minimize proliferation risks. Research emphasis for the full recycle approach would focus on developing techniques that will enable specific chemical elements to be repeatedly recycled and develop a cost-effective and low-proliferation-risk approach that could decrease the long-term challenges posed by the waste, while concurrently reduce uncertainties associated with its disposal.

By gathering key science and technology underpinnings for all three approaches, the Department will be positioned to provide critical information to decision-makers for future fuel cycle decisions.

Modified Open Fuel Cycle Research

Q24: The challenges of the open and closed fuel cycle are well known. Open cycle generates the waste problem and inefficient energy usage we have today. A closed fuel cycle is expensive, poses proliferation risks, and requires additional technology and material development. The fiscal year 2011 request has expressed growing interest in a modified open fuel cycle. Could you share with the Committee what such a direction would look like in terms of the technologies deployed?

- How significantly could a modified open cycle reduce the waste stream and proliferation concerns compared with our current open cycle?
- What waste and proliferation advantages does a modified open fuel cycle have compared to a closed fuel cycle?

A24: Under modified open cycle, limited separations and fuel processing technologies would be applied to the used fuel. The objective is to create fuels that enable the extraction of much more energy from the same mass of material, while at the same time accomplishing waste management goals. Examples include using high temperature gas reactors and liquid metal or molten salt cooled reactors. Some reactors can operate at much higher thermal temperatures and may achieve significantly higher energy generating efficiencies. Since less fuel materials were used per unit of electricity generated, less fission products (wastes) were generated.

Modified open cycle has the potential to reduce the total quantity of waste compared with the current open and closed fuel cycles. Spent fuel is discarded after further fuel reuse is no longer desirable and/or possible. Modified open cycle has the potential to reduce the proliferation risk since it only requires fuel modification and/or treatment. Modified open fuel cycle options using fast spectrum reactors can consume the actinides generated from non-fissioning neutron absorptions. More efficient consumption of fuel will leave less U-235 and Pu-239 in the spent fuel. Thus, the fuel becomes less attractive from a proliferation perspective.

Nuclear Infrastructure

Q25: In recent years, this Subcommittee has supported increased investments to sustain and, I hope, revitalize our nuclear research and development capabilities. And, the Office of Nuclear Energy's (NE) research and development (R&D) budget, as a whole, has received a rather significant make-over, both in structure and substance. The request includes a couple of new initiatives, such as the Small Modular Reactor program, that would seem to add to the overall R&D effort and increase the demands on infrastructure.

The fiscal year 2011 request for Idaho National Laboratory (INL) Infrastructure is \$163.4 million, \$10 million less than the fiscal year 2010 enacted level.

Does this request fully support upgrades to the scientific and testing capabilities at INL that may be needed to implement this expansion to the NE program?

A25: The Fiscal Year 2011 budget request appropriately funds infrastructure and ongoing operational capabilities at the Idaho National Laboratory to fully support research and development program requirements as outlined in the 2011 Budget. The reduction from FY 2010 enacted level to the FY 2011 budget request reflects the completion of a number of one-time activities such as equipment purchases, projects, and detailed planning to support decontamination and decommissioning of surplus facilities.

Idaho's Advanced Test Reactor Life Extension Program

Q26: With the Advanced Test Reactor (ATR) being over 40 years old, this Committee fenced \$12 million in fiscal year 2010 specifically for the ATR Life Extension Program (LEP). Can you discuss the LEP and how much is being requested in fiscal year 2011 for this program?

A26: The Fiscal Year 2011 budget request includes approximately \$12,300,000 to continue ATR LEP activities. ATR LEP projects will continue to focus on reconstitution of the safety basis and replacing aging components to improve operational reliability and support the growing demand for this world-class irradiation research and test reactor. This investment will help extend the life of this national asset in its support of national security, energy, and material research missions, and prepare for the Core Internal Changeout scheduled in the 2014-2015 timeframe.

Planned ATR LEP projects in FY 2011 include:

ATR Console Display System/Distributed Control System Replacement Project (complete in FY 2011);
ATR Design Basis Reconstitution to establish "current state" of engineering design data and documents;

Material Condition and Aging Management Program and Deficiency Resolution projects to identify aging equipment and repair or replace prior to failure; and

Safety Margin Improvement projects to update Documented Safety Analysis to modern industry standards.

Oak Ridge Nuclear Infrastructure

Q27: Congress provided \$10 million in fiscal year 2010 to support the maintenance of the Radiochemical Engineering Development Center at Oak Ridge National Laboratory. This funding provided corrective and targeted maintenance on the facility. The fiscal year 2011 request did not include funds for Oak Ridge nuclear infrastructure. Did this investment complete the maintenance for this facility?

What is the funding source for the continued operations of this facility if no funding is requested?

A27: The Fiscal Year 2010 appropriation included unrequested funding for infrastructure that was used to support maintenance activities in the Radiochemical Engineering Development Center (REDC), including refurbishment of a safety class electrical system and safety significant filter housing.

REDC receives funding through various departmental research and development programs conducting work in the facilities, supplemented by indirect funds collected by Oak Ridge National Laboratory.

Plutonium-238 Production Re-start Project

Q28: The isotope Plutonium-238 is used as an energy and heat source for deep space satellite missions. The supply of Pu-238 is running short and the fiscal year 2011 request included \$15 million to re-start its production. The National Aeronautics and Space Administration (NASA) has also requested \$15 million for this program since it is the primary end-user of Pu-238. If the Department of Energy is not the primary user of this material, then why have you proposed a 50% cost-share with NASA? Shouldn't the cost share be lower?

Congress asked for an execution plan for the re-start project to be submitted with the budget. When can the Committee expect to see the plan?

Do you have an estimate for the life-cycle cost of this program?

Understanding that the answer may be classified, what is the percentage of the Defense need compared to NASA's?

A28: NASA is expected to be the primary user of the Pu-238 produced. The 50% allocation provides an appropriate level cost-sharing with NASA and is consistent with the Department's responsibilities for acquisition management of facilities that it operates. NASA and other Federal user agencies do not have the statutory authority to build and operate nuclear facilities for the production of special nuclear material. The Department of Energy is solely responsible for the safety, security and operability of these facilities.

The Pu-238 production start-up plan was transmitted to Congress on June, 21, 2010. The plan calls for an annual average production rate of 1.5 kilograms, with a total production capacity of up to 2 kilograms annually. This production rate is less than what was described in the FY 2011 budget submittal and reflects a revised understanding of projected as well as potential future user needs.

New Pu-238 production will require funding for the project to reestablish a capability over a five to six years and ongoing operations for an indefinite period. The preliminary cost range estimate to establish the production capability is \$75 to \$90 million, with \$30M (\$15M each from DOE and NASA, respectively) required in FY 2011. The execution plan for the restart includes additional information on the project cost estimates as well as detail on work that would be accomplished in FY 2011 to execute this project.

National security users have not identified a known need for the rest of this decade. However, demand in this area has generally been less predictable than NASA's and it is possible that additional national security applications could emerge.

The Department has estimated the total future need for Pu-238 based on NASA's needs plus a small margin for other potential customers.

Domestic Enrichment Activities

Q29: Domestic Enrichment Activities: The United States Enrichment Corporation (USEC) has indicated that its advanced enrichment operation may not be viable without financial assistance from a third party or from the Federal government. USEC has experienced setbacks in terms of performance.

Q29(a): What is the status of the Department supporting USEC? Are you proposing to transfer uranium tails in order to support technology development with USEC?

A29(a): On March 23, 2010, the Department entered into a cost-shared \$90 million cooperative agreement with USEC to provide support for the continued development and demonstration of the promising American Centrifuge technology. The agreement provides for the manufacturing and operation of advanced centrifuges in a cascade configuration to demonstrate the commercial viability of USEC's American Centrifuge Plant. The Department of Energy's share of the cost will be met by taking title (but not immediate possession or custody) to a quantity of USEC's depleted uranium thereby enabling USEC to free up to \$45 million of USEC funds that are required as financial assurance to the NRC for the disposition of depleted uranium. The Department is also proposing to make available up to \$4 billion in loan guarantee authority for the construction of new U.S. uranium enrichment plants utilizing innovative technology. The Department proposes to use up to \$2 billion of the \$4 billion FY 2007 authority for front end nuclear fuel facilities (including uranium enrichment plants) under the 2008 Solicitation for Front End Nuclear Fuel Facilities, and to use the balance of the FY 2007 authority for loan guarantees for eligible project applicants under the 2006 Solicitation for fossil, energy efficiency and renewable energy systems projects that employ innovative technologies.

Q29(b): What are the implications for U.S. energy policy and national security if USEC cannot maintain an economically viable enrichment operation?

A29 (b): Should USEC demonstrate that the American Centrifuge Plant is economical, it will contribute to a diversified and competitive fuel supply for domestic reactors to support the growth in nuclear energy as a clean electricity-generating technology. The market anticipates the added capacity of all planned additions to enrichment capacity, including USEC's American Centrifuge Plant, would meet future fuel requirements. In the absence of USEC's American Centrifuge Plant, new enrichment plants would have to be expanded beyond the capacities currently planned to meet anticipated U.S. reactor fuel requirements. Because USEC has the license to the only domestic commercial uranium enrichment facility to use U.S.-origin advanced technology, some consider the American Centrifuge Plant important for national security. However, analyses have indicated that supplies of critical national security materials are met by current and projected sources for decades to come. Thus, the continued viability of USEC's enrichment operation is not a national security requirement.

Closure Activities

Q30: No funding has been requested for Yucca Mountain in fiscal year 2011. The decision to terminate, however, means closure activities will continue into fiscal year 2011. What specific activities do you expect to be overseeing in fiscal year 2011 involving Yucca's closure?

Do you have a total cost estimate for closure?

A30: It is my understanding the Department has reprogrammed \$115 million in the FY 2010 Office of Civilian Radioactive Waste Management (OCRWM) budget to support the closure of the Yucca Mountain Project and OCRWM. The Department's intent is to complete the closure of the Yucca Mountain Project and the Office of Civilian Radioactive Waste Management in FY 2010.

Interaction with the Blue Ribbon Commission

Q31: The fiscal year 2011 request includes \$45 million, \$36 million above fiscal year 2010, for the Used Nuclear Fuel Disposition program. One of the new activities is to inform policy decision-making regarding the management of nuclear spent fuel and waste. What mechanism, formal or informal, will be used to inform the Blue Ribbon Commission (BRC)?

How much funding is requested specifically for supporting the BRC? If none, how will you balance requests from the BRC for support with programs for which you have requested funds? Do you foresee re-programmings to meet these requests?

A31: As the Blue Ribbon Commission on America's Nuclear Future (the Commission) moves forward, the Department will respond to requests for information or services from the Commission. The Secretary has appointed a career Federal employee as the Designated Federal Officer (DFO). The DFO is the single point of contact within the Department for the Commission and will manage the flow of information between the Commission and the Department. No specific amount of funding was requested in the FY 2011 budget; however, as the Budget Request notes, responding to the Blue Ribbon Commission will be supported under the Used Nuclear Fuel Disposition subprogram. Requests for information and support from the Commission will be a Department priority.

Execution Plan for Blue Ribbon Commission Funds

Q32: Please provide an execution plan for how the BRC plans to spend the \$5 million provided in the fiscal year 2010 bill.

A32: The Blue Ribbon Commission on America's Nuclear Future (the Commission) staff is developing an action plan that will describe the activities of the Commission necessary to prepare and submit to the Secretary an interim report no later than July 2011. The Commission will release more details when the action plan is developed.

Nuclear Waste Policy Act Support

Q33: In fiscal year 2011, the request proposes that the Office of Nuclear Energy be responsible for the Department's activities supporting the Nuclear Waste Policy Act. What specific activities will be continued and supported?

A33: The Administration is committed to using advanced knowledge learned by scientists and engineers in our country and abroad over the past two decades about effective strategies for managing nuclear material to meet the Government's obligation under the Nuclear Waste Policy Act to dispose of our Nation's used nuclear fuel and high-level radioactive waste. Funds have been requested in the Department's FY 2011 budget for the Department to continue ongoing activities under the Nuclear Waste Policy Act. The activities for which funding in FY 2011 has been requested include managing standard contract activities, determining fee adequacy, maintaining and archiving records, and conducting research and development activities in the areas of used fuel disposal, transportation, and storage. The research and development activities to be conducted will be sufficiently flexible and adaptable so as to accommodate any potential fuel cycle option for used fuel management. Specifically, the Department will:

Provide technical expertise to inform policy decisions regarding the management of used nuclear fuel and radioactive waste that would be generated under existing and potential future nuclear fuel cycles.

Develop a comprehensive understanding of the current technical bases for storing used nuclear fuel and high-level nuclear waste to identify opportunities for long-term research and development.

Develop a comprehensive understanding of the current technical bases for disposing of used nuclear fuel, low-level nuclear waste, and high-level nuclear waste in a range of potential disposal environments to identify opportunities for long-term research and development.

Continue development of models for the evaluation of disposal systems in a variety of generic concepts and environments.

Headquarters Yucca Staff Migration to Nuclear Energy

Q34: The fiscal year 2011 budget request for the Office of Nuclear Energy includes \$91 million for program direction, \$18 million above fiscal year 2010. Some of this increase is due to the migration of staff formerly in the Office of Civilian Radioactive Waste Management (OCRWM) to the Office of Nuclear Energy. Please provide a detailed description of the program direction increase.

A34: NE's FY 2011 request for Program Direction includes \$10.7M to support federal management and oversight responsibilities currently assigned to OCRWM. These funds are split between management and oversight support for carrying out responsibilities under the Nuclear Waste Policy Act (NWPA), as amended, as well as the used nuclear fuel and high-level waste disposition R&D activities described above.

Of the \$10.7M request, approximately half will be used to support 15-20 federal positions to continue the core functions established by the Nuclear Waste Policy Act of 1982 (NWPA), as amended, that pertain to the Nuclear Waste Fund and the management of the standard contracts with nuclear utilities and the government. These include:

- Act as the Contracting Officer for all matters that relate to the Standard Contracts with nuclear utilities;
- Manage the fee collection process with the nuclear utility industry in accordance with the standard contract, including the annual fee adequacy assessment for the Secretary and management of fee verifications and projections for the Department;
- Provide technical expertise in all utility settlement negotiations and meetings with Justice and utility lawyers on terms of the agreements; and assist U.S. Department Justice attorneys in approximately 50 court cases against the government, including testifying on behalf of the Government and acting as the Government representative at each trial.
- Review all annual cost claims submitted by utilities to the U.S. Department of Justice. To date, approximately 35% of the nuclear utility industry have settled and submitted annual claims for reimbursement. Each year the Department reviews the claims proposed by utilities and provides technical expertise on the validity of the costs of each claim as agreed upon under the settlement agreements;
- Manage the Nuclear Waste Fund, including the investment strategy and supporting the Department financial statements and audits.

The other half of the \$10.7M will support approximately 20-25 federal positions responsible for providing federal management and oversight of used nuclear fuel disposition and high-level waste management R&D activities, as described above. These positions will be located in both Washington, DC and Las Vegas, NV. Because the focus is shifting from the Yucca Mountain Project to a broad-based R&D program, the Department is developing position descriptions that reflect required expertise needed to support R&D activities. These position descriptions include expertise requirements in the following areas:

Criticality
Geotechnical Engineering
Metallurgy
Structural Engineering
Subsurface Engineering
Systems Analysis
Systems Engineering
Waste Forms
Biosphere and Climatology
Features, Events, and Processes
Geochemistry
Radionuclide Transport
Subsurface and Surface Hydrology
Tectonics

In FY 2010, NE plans to fill the positions described above through a combination of competitive hiring of, and direct transfers for, current OCRWM personnel.

Jobs Affected by Yucca Closure

Q35: How many jobs will be affected by the closure of the Yucca Mountain Waste Repository in Nevada, Department of Energy headquarters, and other contractors?

What workforce transition plans are being developed?

What is the status of headquarters action to reassign displaced workers?

A35: There are currently approximately 200 federal employees and 400 contractor and laboratory personnel working on the Yucca Mountain project. The Deputy Secretary authorized a Career Transition Assistance Program for the federal workers, to assist in transitioning the workforce to open Departmental positions. OCRWM federal employees may apply for positions and if qualified receive priority selection throughout the Department of Energy. This pre-existing commitment was excluded from the Department's agreement that was made in its April 14, 2010, filing to take no further action to effectuate a shutdown. If and when federal employees receive a Reduction in Force Notices, they also will be entitled to the Inter-Agency Career Transition Assistance Program, which allows priority consideration for all U.S. government positions for which they are qualified.

Preserving the Scientific Knowledge of Yucca Mountain

Q36: Billions of dollars have been invested and hundreds of thousands of pages of studies have been produced to support the Yucca Mountain project. Preserving all of the scientific knowledge accumulated over the last two decades will inform future nuclear waste disposal efforts. Will you commit to preserve all of the scientific knowledge associated with Yucca Mountain?

How much funding is included in the request for the purposes of archiving and preserving the scientific knowledge of Yucca Mountain?

A36: The Department is committed to preserving the relevant scientific knowledge. Records generated by the OCRWM in the course of activities at Yucca Mountain are managed and archived in accordance with the requirements of the Federal Records Act and related regulations.

Expertise in Repository Engineering and Design

Q37: There is a unique expertise that has worked on geological repositories at the Waste Isolation Pilot Plant in New Mexico and Yucca Mountain. This expertise is likely to be called into service once a new approach is charted. What steps are you taking to preserve this expertise during this time of uncertainty?

A37: The Office of Nuclear Energy's FY 2011 budget request includes \$10.7 million to support federal management and oversight responsibilities under the Nuclear Waste Policy Act as amended, currently assigned to OCRWM. The budget will support approximately 35-45 federal positions to support management and oversight of used nuclear fuel disposition and high-level waste management R&D activities, management of the Nuclear Waste Fund and support for the standard contracts with nuclear utilities. DOE plans to fill these positions through a combination of competitive hiring of, and direct transfers of, current OCRWM personnel. OCRWM funds are planned to be used to support these positions in FY 2010.

The Nuclear Fuel Disposition Program

Q38: The scientific integrity of the review of nuclear waste alternatives is important to the Committee. Last year, Congress included statutory text that the Blue Ribbon Commission (BRC) should “consider all alternatives to nuclear waste disposal.” The charter of the BRC seems to include all alternatives.

The fiscal year 2011 budget request includes \$45 million, \$36 million above fiscal year 2010, for the Used Nuclear Fuel Disposition program. This program lists a broad set of activities in the proposed program, including “rapid response for inquiries from the proposed BRC” and “a comprehensive understanding of the current technical bases for geological disposal of nuclear spent fuel and high-level waste.” Is it fair to say this program will be investing in research to understand all alternatives to nuclear waste disposal?

A38: The mission of the Used Nuclear Fuel Disposition technical area is to identify alternatives and conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles.

International Leadership in Advanced Nuclear Concepts

Q39: In terms of research and development, how is the United States positioned in terms of research of advanced nuclear concepts?

What needs to be done to strengthen the U.S. position?

What are the costs of falling behind in this area?

A39: With the substantial science and technology base at our universities, laboratories, and industries, the United States is well-positioned to lead the research and development of advanced nuclear concepts. The intellectual research and development resources that exist in these various sectors are widely recognized throughout the world as second-to-none. The recognition is reflected in the leadership role of the United States in the Generation IV International Forum for developing the next generation reactors. The Office of Nuclear Energy (NE) plans to continue engaging governments, industry, and the research community worldwide in a broad ranging collaboration to further develop advanced nuclear energy concepts.

The Reactor Concepts Research, Development and Demonstration Program proposed in the fiscal year 2011 budget request, which encompasses existing reactor technology programs such as Gen IV as well as new efforts such as the Small Modular Reactor program, will develop new and advanced reactor designs and technologies. The program seeks to improve nuclear energy's competitiveness and ensure its lasting contributions in meeting our Nation's energy and environmental challenges. Funding for this program will strengthen the intellectual research and development resources that exist in our national laboratories, universities, and industries. NE also plans to incorporate modern modeling and simulation capabilities into research of advanced nuclear concepts. Modern modeling and simulation tools will help designers optimize their plants for higher efficiency and lower costs while maintaining and even improving on plant safety. These modern tools and methods also have the potential for lowering the cost of R&D by shifting some of the R&D burden from expensive experimentation into less costly simulation. Finally, use of modern simulation tools and methods holds promise for a future regulatory regime that is more streamlined and less dependent on deterministic conservatism.

The FY 2011 Budget establishes an appropriate set of investments in advanced nuclear research and development capabilities.

International Cooperation on Nuclear Energy Research

Q40: The fiscal year 2011 request includes \$3 million for international nuclear energy cooperation. Please provide a list of partners and the nature of the collaborative activities with these partners in nuclear energy research.

A40: The INEC budget request of \$3M would be largely applied to policy and technical support necessary to implement and establish the bilateral and multilateral agreements and implementing arrangements to carry out cooperative technical research and development (R&D)-based activities with countries including Argentina, Brazil, China, India, Kazakhstan, and the Republic of South Africa and possibly other countries as U.S. international policy is developed. Typically, before collaborative work with these countries is initiated, expert-level meetings with foreign counterparts take place to establish the policy, technical and legal parameters of cooperation. Once these are established, assessments of capabilities and technology requirements are typically conducted to identify the most mutually beneficial areas of cooperation. It is in these initial steps of laying the foundation for cooperation that much of the INEC budget request would be applied.

The Office of Nuclear Energy (NE) collaborates on a bilateral and multilateral basis with a wider array of countries, including Japan, Russia, the Republic of Korea, France, Ukraine and others, but the implementing arrangements for cooperation with these countries are already in place. In such cases, NE's Office of International Nuclear Energy Policy coordinates the technical activities performed by the DOE National Laboratories as they assist NE in implementing bilateral Action Plan technical activities through workshops, technical meetings, or visits by foreign officials, scientists and engineers. This coordination role also ensures that technical results are consistently integrated into the R&D funded by NE's technical programs.

Examples of potential civilian nuclear energy collaboration with our partners include, but are not limited to: research, development, testing, and evaluation of advanced nuclear reactor systems; advanced nuclear fuel and material irradiation and use of experimental facilities; technical expert exchange programs to share best practices at civilian nuclear power plants; small and medium-sized reactor development and deployment options; reactor life sustainability; probabilistic safety assessments and risk analyses for operating reactors; improvements in reactor fuel burn-up efficiencies; and, together with other global partners, the exploration of ways to enhance the international framework for civil nuclear cooperation so that countries can access nuclear power for peaceful purposes while minimizing the risks of proliferation.

Comparison of Worldwide Research and Development Programs

Q41: The number of reactors worldwide under construction or planned to be constructed is well known. The investments made into nuclear energy research and development is a little more difficult to quantify. How does the quality and size of the U.S. investment in research and development compare to China, India, Europe, Japan, Russia and South Korea?

A41: It is very difficult to compare the "size" and "quality" of the U.S. investment in civilian nuclear energy research and development (R&D) with that of other countries. The "quality" and ways by which these investments are tracked and accounted for, and the definitions of what constitutes "R&D", are so varying and subjective that comparisons are generally not meaningful. As such, the following information on nuclear spending shouldn't be compared to our domestic investment.

According to Japanese Government officials, Japan includes in their federal R&D budget the sum of individual budgets from the ministries as well as those of their national laboratories. Data suggest that Japan spends approximately \$2 billion annually on civilian nuclear energy R&D, with the majority of these funds going to the Japan Atomic Energy Agency, which is their main national nuclear R&D agency.

It is even more difficult to estimate France's investment since the Government's role in nuclear energy is so intertwined with commercial nuclear industries and utility. Anecdotal evidence suggests that up to \$1B is spent annually, not including funds dedicated by Electricite de France, the world's largest utility.

Recent presentations by Government officials from the Republic of Korea suggest that their R&D investment in 2009 was \$182M, 80% of which came from taxes on the nuclear utilities.

As for Russia, in mid-2009 the Russian government said that it planned provide more than the equivalent of \$3.9 billion from 2010 to 2012 for a new program devoted to R&D on the next generation of nuclear power plants. It identified three priorities for the nuclear industry: improving the performance of light water reactors over the next two or three years, developing a closed fuel cycle based on deployment of fast reactors in the medium term, and developing nuclear fusion over the long term.

The estimate of civilian nuclear energy R&D spending in India in 2009 was \$1.6B. No estimate is reportable for China.

Global Nuclear Energy Partnership

Q42: What international activities from the former Global Nuclear Energy Partnership are still underway and how much funding is in the request to support these activities?

A42: Although the U.S. domestic GNEP program has been restructured as an R&D initiative, the United States continues to support the objectives of the international GNEP initiative. GNEP is still a very active multilateral global forum made up of 25 partner countries, 31 observer countries, and 3 permanent international nongovernment observers that share the common vision of the safe and secure development of nuclear energy for peaceful purposes worldwide.

At its most recent meeting in Beijing in October 2009, the GNEP Executive Committee agreed that global developments since the Partnership was established in 2007 have necessitated the transformation of GNEP to provide a broader scope with wider participation. Therefore, the GNEP Executive Committee has decided to explore some Partners' proposals to rename the Partnership and examine a draft vision statement, acceptance of which would be the sole action required of states to participate in future activities.

In addition, the GNEP Executive Committee agreed to explore ways to enhance the international framework for civil nuclear cooperation called for by President Obama earlier that year in Prague.

The GNEP Steering Group will meet on April 21 and 22, 2010 in Accra, Ghana, and respond to proposals to change the name of the Partnership to the International Framework for Nuclear Energy Cooperation (IFNEC) and to replace the current Statement of Principles with a broader Statement of Mission. GNEP partners will also discuss the development of an enhanced international nuclear framework that could include discussion of nuclear fuel service arrangements.

GNEP's Working Group on Reliable Nuclear Fuel Services (RNFS) will continue to meet under France's new chairmanship and active engagement by other GNEP partners. Its Infrastructure Development Working Group will also continue to convene with attendance from developed and aspiring nuclear nations, but with reduced participation from the DOE Office of Nuclear Energy.

A small portion of the \$3M budget request may be used to support the U.S.'s continued active participation in the GNEP Steering Group and Ministerial-level Executive Committee meetings as well as the GNEP RNFS Working Group.

WEDNESDAY, MARCH 24, 2010.

DEPARTMENT OF ENERGY FISCAL YEAR 2011 BUDGET

WITNESS

HON. STEVEN CHU, SECRETARY, U.S. DEPARTMENT OF ENERGY

Mr. PASTOR [presiding]. The committee will come to order. Good afternoon, Dr. Chu. Good afternoon, everyone. We have before us today Secretary of Energy, Dr. Steven Chu. He is here to present the administration's fiscal year 2011 budget request for the Department of Energy. Mr. Secretary, congratulations on your first year and we look forward to your insights into this budget request.

As the Nation continues to discuss the merits and structure of a comprehensive energy policy for the 21st century, the Department of Energy must take a leadership role in the transformation of our energy sector. I firmly believe and support the principle that innovation, technology, and research and development should be at the very core of our national effort to this end. I do believe that we can invent and invest our way out of our energy problems and that government should help lead the way. This is not to say that government is the answer. This is to say that government's role must be structured to complement the role of the private sector.

As the debate over the policies and initiatives for smarter energy consumption and a more robust energy mix continues, the ultimate outcome of that discussion will be irrelevant if strong leadership and fundamental management reforms are not forthcoming at the Department of Energy. This committee has been front and center in pushing the Department toward more robust management of its portfolio, including project management and cost estimating.

Mr. Secretary, we hope you will take a strong leadership role in transforming these practices at the Department to ensure that the taxpayer gets the most of their hard-earned money. I would note that over 60 percent of the Department's funding is associated with maintaining and securing the nuclear stockpile, and cleanup associated with the legacy of radioactive waste.

While I understand that the Nuclear Posture Review is further delayed, this committee continues to insist on a comprehensive and enduring policy foundation for our nuclear arsenal.

I am hopeful that this administration will answer the questions posed by the subcommittee in 2007, placing the requirements of its weapons complex in the context of our future military requirements.

This subcommittee continues to have concern about the President's decision regarding Yucca Mountain. Given the absence of a repository will affect not only our energy portfolio for the future, but also the cleanup of radioactive waste at DOE sites and disposal of spent fuel from military operations. Several of these sites are

represented by members on this subcommittee. So please rest assured that we intend to be involved in any decisions affecting the disposal of spent nuclear fuel and defense waste.

Mr. Secretary, I look forward to hearing from you today about the fiscal year 2011 budget request, how you will address the energy and national security challenges we face, and how your management plans will ensure efficient planning and execution. I expect we will be working together to address the challenges ahead, but I also again remind you that cooperation and respect is a two-way street. We will continue to have the dialogue. There will be differences and there will be concurrences. So we look forward to working with you in a cooperative effort to ensure the best budget result.

Mr. Secretary, I would ask that you ensure that the hearing record responses to the questions for the record and any supporting information requested by the subcommittee are delivered in final form to the subcommittee no later than 4 weeks from the time you receive them.

I also ask that if members have additional questions, they will submit for the record, and that they please do so to the subcommittee by 5:00 p.m. this afternoon. And with these opening comments, I would like to yield to our Ranking Member.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman.

Dr. Chu, welcome back to the committee. I have served on this committee for most of my time in Congress. And I don't think I have ever had less contact with an Energy Secretary or with your Department. Even correspondence I have sent you on Yucca Mountain and on your proposed reprogramming of funds goes unanswered until the day before you are scheduled to appear before us. While the timing may be coincidental, it sets a tone that you only need to respond to the committee to forestall criticism. In the future, I hope we can build a more constructive, positive relationship. I know you are busy, but that lack of contact makes me wonder if you understand our role as appropriators.

As an example, I note your op-ed penned in yesterday's Wall Street Journal where you wrote, and I quote: And with the new authority granted by the President's 2011 budget request, the Department of Energy will be able to support between 6 and 9 new reactors, end of quotation marks.

Mr. Secretary, let me be perfectly clear. There will be no authority granted unless Congress grants it. The dollars we appropriate are not yours, nor the President's, but belong to the people we represent. This committee by law will determine how they are spent.

Moving on to the matter before us, I am generally pleased by the priorities in your 2011 request, especially the Defense portion, "Renewables and the Nuclear Energy Portfolio," which signals support for near-term expansion of this critical clean power source.

Mr. Secretary, I am also gratified to see the request for \$36 billion in additional loan guarantee authority for nuclear power plants. But I ask why the administration has failed to include the \$360 million that the committee must set aside to cover this new authority.

That omission, plus an ill-considered repetition of a proposal which was rejected by Congress last year to reopen contributions

to the Uranium Enrichment Decommissioning and Decontamination Fund leaves this subcommittee with a \$560 million hole. By any gauge, that is a challenge that will be difficult to address.

While I am generally supportive of your priorities, I regret that the request is nearly 7 percent more than last year. Mr. Secretary, more than 92 percent of the Stimulus Act funding you were given last year has yet to be spent. I know there is a difference between spending and obligating. Those are borrowed dollars that have raised our Federal debt to unprecedented levels. Frankly, my constituents want to see some restraint in the size of government, not continued growth. They want private sector jobs, not public sector ones.

Mr. Chairman, this may be the only time we have you before us. I must request your indulgence to ask once again about Yucca Mountain. Mr. Secretary, this subcommittee and the public are owed answers on recent developments surrounding that license application. Last year's House-Senate conference provided clear, unambiguous language to the Department to continue the license application through this fiscal year. And last year, the full House voted overwhelmingly not to eliminate funding for it; yet the Department has filed to withdraw the license application "with prejudice" in quotation marks.

If this is approved, no future administration will be able to refile the license application, even if it is found by the Blue Ribbon Commission or others, that the Yucca Mountain repository is truly the best option for long-term waste storage. This decision could quite possibly expose U.S. taxpayers to billions of dollars in liabilities. And it cedes our international leadership role in the scientific and technical development of a deep geological waste repository to countries like Sweden and Switzerland that are actively working for it on a specific site. This administration has unilaterally halted the program, I believe; established unsound science, and has done so with absolutely zero consultation with Congress.

And I continue to be disturbed by the Department's, quote "game plan," as you articulated in a recent conversation with the Wall Street Journal's managing editor, Robert Thompson. Permit me to read one of your quotations. And I quote, "While it is fair to say that the whole history of Yucca Mountain was more political than scientific, but also very truthfully I can say that given what we know today, the repository looks less and less good. So now we are in a situation where it can't move forward. When Yucca Mountain was being established in the early 1980s, the idea was that the nuclear industry was going to tail off. Now because of climate change, we do want to restart the nuclear industry. Because of that, the statutory limit of Yucca Mountain would have been used up in the next couple of decades. So we need to take a fresh look at everything."

Perhaps I come from the old school in which \$9 billion is actually a lot of money. But I understand your rationale. We have known for years that a second repository was going to be needed, but that shouldn't make us throw away billions of taxpayer and ratepayer dollars dedicated to building the first one. And we have known for years that other geological formations might be even better for a repository. But the consensus scientific opinion was that Yucca

Mountain was a good choice. From where I am sitting, the scientific consensus hasn't changed one bit, nor has the expressed will of Congress or this subcommittee. It is politics that has changed and that is leading the administration to throw away the work of decades, adding to the cynicism that comes when politics trumps sound science.

Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Secretary.

Secretary CHU. Thank you, Mr. Chairman and Ranking Member Frelinghuysen. Let me go through my prepared remarks as quickly as I can and get to the question-and-answer period. So I want to discuss the budget request from the Department of Energy.

President Obama stated that the Nation that leads the world in creating new energy and clean sources will be the Nation that leads in the 21st economy. And this is primarily what this budget is about. I couldn't agree more with that. It is going to create new, clean energy jobs, expand the frontiers of science, reduce nuclear dangers, and help curb the carbon pollution that threatens our planet.

The budget request includes an investment of \$2.4 billion in energy efficiency and renewable energy. And through this budget, we are going to increase research, demonstration, deployment of wind, solar, geothermal energies, make buildings and homes more efficient, develop energy-efficient vehicles, and pursue carbon capture and sequestration.

Our budget request also includes an additional 36 billion in loan guarantee authority in the nuclear power sector, as well as 495 million for nuclear energy research and development.

The Department of Energy is also focused on the safety and security of our people. The Department is requesting a significant increase, more than 550 million, in new funding for the NNSA Defense Nuclear Nonproliferation program to help meet the President's goals of securing all vulnerable nuclear materials around the world in 4 years.

We also ensure the safety, security and effectiveness of our nuclear stockpile. With the \$7 billion in funds we have requested, we can upgrade our infrastructure that has been allowed to decay in the past decade, support the work of our national labs, and recruit the skilled workforce we will need.

The budget also protects public health and safety by supporting commitments to clean up the environmental legacy of the Nation's nuclear weapons program. I have included a detailed description of these and other key programs in my prepared statement for the record.

But during this time today, I want to focus on one of my key priorities in the Department, the integrated set of research and development initiatives that are critical to accelerating clean energy breakthroughs, the Energy Innovation Hubs, Advanced Research Projects Agency-Energy, and the Energy Frontier Research Centers. I believe it will take all three of these efforts to discover and commercialize energy breakthroughs we all need.

So let me describe each of them briefly.

The Energy Frontier Research Centers constitute small groups of researchers focused on breakthroughs in science. They are mostly

university-led teams working to solve specific scientific problems that are blocking clean energy development. For example, one EFRC is working to improve our scientific understanding of the chemical reactions in battery electrodes. When you think of the EFRCs, think about a collaborative team of scientists such as Watson and Crick who gave us the structure of DNA and the protein crystallographers in that same research unit that founded molecular biology. As one of my colleagues have said, the partnership of Watson and Crick, represented marvelous resonance between two minds in a state where 1 plus 1 didn't equal 2, it equaled more like 10. So the Department proposes expanding the Energy Frontier Research Centers to capture emerging opportunities and new materials in basic research for energy needs.

ARPA-E, the Advanced Research Project Agency-Energy, funds small groups focused on breakthroughs in technology. This is primarily in the private sector. These are using highly entrepreneurial funding models to support specific technologies where short-term R&D efforts could lead to game-changing results.

For example, the ARPA-E project is developing a technology to capture emissions from power plants that were inspired by the way the human body captures and disposes of carbon dioxide. When you think of ARPA-E, you think of the visionary risk-takers launching new technologies, startup companies out of their garages, of Bill Hewlett and David Packard pioneering a new audio oscillator that ended up jump-starting an entire new industry in what is now called Silicon Valley. The fiscal year 2011 budget request includes 300 million for ARPA-E.

The Energy Innovation Hubs are different than these other two. They are large, multidisciplinary, highly collaborative teams of scientists and engineers working over a longer period of time to achieve specific high-priority goals. For example, one of the hubs is focused on cost-effective ways to create transportation fuels directly from sunlight. They are led by top researchers with the knowledge, resources, and authority to nimbly guide the efforts, seizing new opportunities or closing off unproductive lines of research. When you think of the hubs, think of large mission-oriented research efforts such as the Manhattan Project at Los Alamos or the type of projects that AT&T Bell Laboratories, which discovered the transistor.

The Department will continue funding three innovation hubs introduced in fiscal year 2010. But in addition, we are proposing a new hub to dramatically improve batteries and energy storage. We don't know where the big energy breakthroughs are going to come from, but we do know what has worked before. To reach our energy goals, we must take a portfolio approach in R&D, pursuing several research strategies that have proven to be successful in the past.

But I want to be clear: This is not a kitchen-sink approach. This is coordinated, prioritized, with a full view of where we are going to have to put these pieces together. Discovering new energy solutions will take smart collaborators pushing the frontiers of science. It will take risk-takers working out of their garages. It will take robust research teams on a mission. And it will take a Department of Energy that brings together the different parts of this research

strategy to accelerate the innovation process. That is my unwavering commitment to you.

I am looking forward to working with you as we pursue new solutions to the energy problem and create a generation of clean energy jobs. I will be happy to take questions at this time.

Statement of Secretary Steven Chu
U.S. Department of Energy
Before the
Subcommittee on Energy and Water Development
Committee on Appropriations
U.S. House of Representatives

Hearing Regarding the FY 2011 Budget Request
March 24, 2010

Vice Chairman Pastor, Ranking Member Frelinghuysen, and Members of the Committee, thank you for the opportunity to appear before you today to discuss the President's Fiscal Year 2011 budget request for the Department of Energy.

President Obama has stated, "The nation that leads the world in creating new sources of clean energy will be the nation that leads the 21st century global economy." I fervently share this view. The President's FY 2011 budget request of \$28.4 billion will help position the United States to be the global leader in the new energy economy. The budget request makes much-needed investments to harness the power of American ingenuity. This request will create clean energy jobs, expand the frontiers of science, reduce nuclear dangers, and help curb the carbon pollution that threatens our planet. As part of this Administration's commitment to fiscal responsibility, the Department of Energy is also proposing several program reductions and terminations.

American Recovery and Reinvestment Act

The FY11 budget request builds on the investments in the American Recovery and Reinvestment Act. Through the \$36.7 billion the Department received from the Recovery Act, we are putting Americans to work, while helping to build a clean energy economy, spur energy innovation, and reduce our dependence on oil. We've begun to make our homes and offices more energy efficient, modernize our grid, and invest in key renewable energy projects. Getting this money out the door quickly, carefully, and transparently has been and will continue to be a top priority for me.

FY11 Budget Supports Strategic Priorities

To continue the progress we have made, the FY11 budget request supports the Department's strategic priorities of:

- Transitioning to a low-carbon economy by developing and deploying clean and efficient energy technologies, increasing generation capacity and improving our transmission capabilities;
- Investing in scientific discovery and innovation to find solutions to pressing energy challenges and maintain American economic competitiveness; and
- Enhancing national security by ensuring the safety, security and effectiveness of the nuclear stockpile without testing. The budget request also includes funds to

work with our international partners to secure vulnerable nuclear material around the world within four years, and advance our nuclear legacy cleanup.

These strategic priorities will be enabled by a continued commitment to improving the management and fiscal performance of the Department.

Energy

To transition to a low-carbon future, we must change the way we generate and use energy. The President's budget request invests in clean energy priorities, including an investment of \$2.4 billion in energy efficiency and renewable sources of energy. It also promotes innovative energy efficiency and renewable energy projects through \$500 million in credit subsidy that will support \$3 to \$5 billion in lending. It expands the Advanced Manufacturing Tax Credit by \$5 billion to help build a robust domestic manufacturing capacity for clean energy technologies. Through this budget, we will increase research, demonstration, and deployment of wind, solar and geothermal energies; make buildings and homes more efficient; develop energy efficient vehicles; and pursue carbon capture and sequestration.

Nuclear energy must also be a part of our clean energy mix. During his State of the Union address, President Obama said, "To create more of these clean energy jobs, we need more production, more efficiency, more incentives. And that means building a new generation of safe, clean nuclear power plants in this country." The President and I are committed to restarting our domestic nuclear industry. Our budget request includes an additional \$36 billion in loan guarantee authority for the nuclear power sector to help construct the first new nuclear plants in decades, as well as \$495 million for research and development to support the competitiveness, safety and proliferation resistance of nuclear energy in the United States and abroad. On February 16, President Obama announced conditional commitments for more than \$8 billion in loan guarantees for what will be the first U.S. nuclear power plant to break ground in nearly three decades.

Innovation

We have many technologies in hand today to begin the transition to a low-carbon economy, but we will need breakthroughs and better technologies to meet our long-term goals. The budget request invests in basic and applied research and puts us on the path to doubling funding for science, a key presidential priority. We are also requesting \$55 million to start the RE-ENERGYSE initiative to help educate the next generation of scientists and engineers.

The budget request also supports the Department's three new, complementary approaches to marshalling the nation's brightest minds to accelerate energy breakthroughs.

The first approach is the **Energy Innovation Hubs**. The Hubs are multidisciplinary, goal-oriented, and will be managed by top teams of scientists and engineers with enough resources and authority to move quickly in response to new developments. They are to be modeled after laboratories such as MIT's Radiation Laboratory, which developed radar during World War II, and Bell Laboratories when it invented and developed the transistor. Ideally, this

work will be conducted under one roof. The Department will continue funding the three Energy Innovation Hubs introduced in FY 2010. In addition, we are proposing a new Hub to dramatically improve batteries and energy storage.

The second approach is the **Energy Frontier Research Centers**. The EFRCs are mainly university-based, problem-oriented research. We have identified key scientific barriers to energy breakthroughs, and we believe we can clear these roadblocks faster by linking together small groups of researchers across departments, schools, and institutions. The Department proposes expanding the Energy Frontier Research Centers to capture emerging opportunities in new materials and basic research for energy needs.

The third funding approach is the **Advanced Research Projects Agency – Energy (ARPA-E)**. ARPA-E is technology-oriented. We are seeking the boldest and best ideas for potentially transformative energy technologies and funding them to see if they work. The FY 2011 budget request includes \$300 million for ARPA-E. ARPA-E is also dedicated to the market adoption of these new technologies.

Security

In addition to the health of our economy and our planet, the Department of Energy is focused on the safety and security of our people. Last April in Prague, President Obama outlined an ambitious agenda to address the greatest threat to global security – the danger of terrorists getting their hands on nuclear weapons or the material to build them. The Department is requesting a significant increase in the budget – more than \$550 million in new funding – for the NNSA Defense Nuclear Nonproliferation program to help meet the President's goal of securing all vulnerable nuclear materials around the world in four years.

The President has also made clear that, as long as nuclear weapons continue to exist, it is essential that we ensure the safety, security and effectiveness of our nuclear stockpile. With the \$7 billion in funds we have requested, we can upgrade our infrastructure that has been allowed to decay in the past decade, support the cutting-edge work of our National Labs, and recruit the skilled workforce we need today and in the future. Over the next five years, we intend to boost this funding by more than \$5 billion. Even in a time of tough budget decisions, we must make this investment for the sake of our security.

The budget request also protects public health and safety by cleaning up the environmental legacy of the Nation's nuclear weapons program. In 2010 the Department will discontinue its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain.

Both the President and I have made clear that Yucca Mountain is not an option. To deal with our nuclear waste management needs, the Administration has brought together a range of experts to conduct a comprehensive review of the back end of the fuel cycle. The Blue Ribbon Commission announced recently, and co-chaired by General Brent Scowcroft and Congressman Lee Hamilton, will provide recommendations for developing a safe, long-term solution to managing the Nation's used nuclear fuel and its nuclear waste.

As part of our comprehensive strategy to restart the nuclear industry, we also propose breaking down artificial stovepipes and merging the Office of Civilian Radioactive Waste Management into the Office of Nuclear Energy.

Management

Finally, in order to transform the way Americans generate and use energy, we must transform the Department itself. As part of the Obama Administration's reform agenda, the budget request includes \$2 million to establish a new Management Reform initiative to provide strategic direction, coordination and oversight of reform initiatives. This initiative will report directly to me and will receive close personal attention. We made important reforms when we began to implement the Recovery Act, and now we need to institutionalize those reforms and apply them across the Department.

Additionally, we are committed to being good stewards of the taxpayers' money. As we developed the budget, we looked to eliminate or reduce programs where we could. For example, we eliminated more than \$2.7 billion in tax subsidies for oil, coal and gas industries. This step is estimated to generate more than \$38.8 billion in revenue for the federal government over the next 10 years.

Building a clean energy future won't be easy, but it is necessary for our economy and our security. As a scientist, I am an optimist, and I believe that we can meet this challenge and lead the world in the 21st century.

HIGHLIGHTS OF THE FY2011 DEPARTMENT OF ENERGY BUDGET

The Department's Fiscal Year (FY) 2011 budget request of \$28.4 billion, a 6.8 percent or \$1.8 billion increase from FY 2010, supports the President's commitment to respond in a considered, yet expeditious manner to the challenges of rebuilding the economy, maintaining nuclear deterrence, securing nuclear materials, improving energy efficiency, incentivizing production of renewable energy, and curbing greenhouse gas emissions that contribute to climate change. Together with the American Recovery and Reinvestment Act of 2009 (Recovery Act) and FY 2010 budget, the FY 2011 budget request supports investment for a multi-year effort to address these interconnected challenges.

The FY 2011 budget builds on the \$36.7 billion in Recovery Act funding. By the end of FY 2010, the Department expects to obligate 100 percent and outlay roughly 35-40 percent of Recovery Act funds. In developing the FY 2011 budget request, the Department has taken these investments into account. Recovery Act investments in energy conservation and renewable energy sources (\$16.8 billion), environmental management (\$6 billion), funds supporting loan guarantees for renewable energy and electric power transmission projects (\$4 billion), grid modernization (\$4.5 billion), carbon capture and sequestration (\$3.4 billion), basic science research (\$1.6 billion), and the establishment of the Advanced Research Projects Agency - Energy (\$0.4 billion) will continue to strengthen the economy by providing much-needed

investment, by saving or creating tens of thousands of direct jobs, cutting carbon emissions, and reducing U.S. dependence on oil.

The President's FY 2011 Budget supports our three strategic priorities:

- **Innovation:** Investing in science, discovery and innovation to provide solutions to pressing energy challenges
- **Energy:** Providing clean, secure energy and promoting economic prosperity through energy efficiency and domestic forms of energy
- **Security:** Safeguarding nuclear and radiological materials, advancing responsible legacy cleanup, and maintaining nuclear deterrence

These strategic priorities will be enabled by a continued commitment to management excellence:

- **Management:** Transforming the culture of the Department with a results-oriented approach

Innovation: Investing in Science, Discovery and Innovation to Provide Solutions to Pressing Energy Challenges

As President Obama made clear in his remarks to the National Academy of Sciences in April 2009, the public sector must invest in research and innovation not only because the private sector is sometimes reluctant to take large risks, but because the rewards will be broadly shared across the economy. Leading requires assembling a critical mass of the best scientists and engineers to engage in mission-oriented, cross-disciplinary approaches to addressing current and future energy challenges. To develop clean energy solutions and maintain nuclear security, the Department must cultivate the science, technology, engineering, and mathematics workforce of the next generation. The FY 2011 budget request of \$55 million for RE-ENERGYSE (Regaining our ENERGY Science and Engineering Edge) supports K-20+ science and engineering education.

With every initiative the Department undertakes, sound science must be at the core. In FY 2011 the Department will increasingly emphasize cross-cutting initiatives to link science throughout the Department, specifically with energy and national security programs. These cross-cutting initiatives will enhance science capabilities to create knowledge and innovative technologies that can be brought to bear on national energy and security issues, leverage world-class science and engineering expertise to establish global leadership as clean energy innovators, and employ use-inspired research to reduce the cost and time to bring technologies to market at scale. The Department believes that it will deliver solutions more quickly and efficiently through our efforts to break down the traditional stovepipes and operate in a more integrated and coordinated manner. The FY 2011 Budget continues to address the President's priorities in an integrated and efficient manner, and to deliver results for the American taxpayer.

The Department continues its strong commitment to basic research and supports the President's Plan for Science and Innovation by requesting funding for the Office of Science at \$5.1 billion, a 4.4 percent or \$218 million increase from FY 2010. The FY 2011 budget request will support

the training of students and researchers in fields critical to national competitiveness and innovation, and will support investments in areas of research essential for a clean energy future. The President's Plan commits to doubling Federal investment in basic research at select agencies. The Department supports an overarching commitment to science by investing in basic and applied research, creating new incentives for private innovation and promoting breakthroughs in energy.

To help achieve the game-changing breakthroughs needed to continue leading the global economy, the FY 2011 budget request includes \$300 million for the Advanced Research Projects Agency – Energy (ARPA-E). Introduced in FY 2009, ARPA-E is responsible for enabling specific high-risk and high-payoff transformational research and development projects. Beyond simply funding transformational research that creates revolutionary technologies, ARPA-E is dedicated to the market adoption of those new technologies to meet the Nation's long-term energy challenges. This funding, along with the \$400 million made available through the Recovery Act, will provide sustained investment in this pioneering program.

The Department will continue funding the three Energy Innovation Hubs introduced in FY 2010 to focus on developing fuels that can be produced directly from sunlight, improving energy efficient building systems design, and using modeling and simulation tools to create a virtual model of an operating advanced nuclear reactor. In addition, DOE is proposing a new Hub to focus on batteries and energy storage. Each of these Hubs will bring together a multidisciplinary team of researchers in an effort to speed research and shorten the path from scientific discovery to technological development and commercial deployment of highly promising energy-related technologies.

Complementing the Hubs, the Department proposes expanding the Energy Frontier Research Centers in FY 2011 to capture new, emerging opportunities by furthering its scientific reach and potential technological impact by competitively soliciting in two categories: discovery and development of new materials critical to science frontiers and technology innovations, and basic research for energy needs.

Energy: Providing Clean, Secure Energy and Promoting Economic Prosperity through Energy Efficiency and Domestic Forms of Energy

In Copenhagen, President Obama emphasized that climate change is a grave and growing danger. The imperative now is to develop the capacity to confront the challenges climate change poses and seize the opportunity to be the global leader in the clean energy economy. Meeting the Administration's goal to reduce carbon emissions by more than 80 percent by 2050 will be achieved by addressing supply and demand through increased energy efficiency, renewable generation, and grid modernization, as well as improvements in existing technologies and information analysis. An important tool that will continue to be used to address these issues will be loan guarantees. The Department's FY 2011 budget request, building on the FY 2010 budget and the Recovery Act, invests in the research, development, and deployment of technologies that will position the United States to lead international efforts to confront climate change now and in the future. The long-term economic recovery will be sustained by these continued investments in the new energy economy.

- **Loan Guarantees**

The Loan Guarantee Program Office (LGPO) is a vital tool for promoting innovation in the energy sector across a broad portfolio of clean and efficient energy technologies. In FY 2011, the Department is requesting funding and authority to support approximately \$40 billion in additional loan authority for innovative energy technology development. During FY 2010, the LGPO streamlined the application review process. The new authority requested will help the Department will to encourage and accelerate the availability of loans to leverage private sector investment in clean energy projects that will save and create jobs and stimulate the economy.

- **Energy Efficiency**

In August 2009, President Obama said, “If we want to reduce our dependence on oil, put Americans back to work and reassert our manufacturing sector as one of the greatest in the world, we must produce the advanced, efficient vehicles of the future.” In FY 2011, the Department will promote energy efficiency in vehicles technologies, at \$325 million. No less important to achieving the President’s stated ambitions is decreasing energy consumption through developing and advancing building technologies (\$231 million) and industrial technologies (\$100 million). Federal assistance for state-level programs, such as State Energy Program grants (\$75 million, a 50 percent increase from FY 2010) and Weatherization Assistance grants (\$300 million, a 43 percent increase from FY 2010), will help States and individuals take advantage of efficiency measures for buildings and homes, lower energy costs and greenhouse gas emissions, and develop an ever-evolving, technically proficient workforce.

- **Clean, Renewable Energy Generation**

The FY 2011 budget request will modernize the Nation’s energy infrastructure by investing in a variety of renewable sources such as solar (\$302 million), wind (\$123 million), water (\$41 million), hydrogen (\$137 million), biomass (\$220 million) and geothermal (\$55 million). These sources of energy reduce the production of greenhouse gas emissions and continue the pursuit of a clean energy economy built on the next generation of domestic production. The Department is also continuing to promote domestic clean energy through the four Power Marketing Administrations, which market and deliver electricity primarily generated by hydroelectric dams.

- **Grid Modernization**

In support of the modernization of the electricity grid, the President’s FY 2011 Budget requests \$144 million for research and development to improve reliability, efficiency, flexibility, and security of electricity transmission and distribution networks. The “Smart Grid” will integrate new and improved technologies into the energy mix, ensuring reliability, integration of renewable energy resources, and improving security.

While investing in energy efficiency, renewable energy generation, and grid modernization are fundamental steps necessary for creating a clean energy economy; investing in the improvement of existing sources of energy will provide a bridge between current and future technologies. These technologies are already a major segment of the energy mix and will play a critical role in providing a solid foundation that will make possible the creation of this new economy.

- **Safe and Secure Nuclear Energy**

Nuclear energy currently supplies approximately 20 percent of the Nation's electricity and 70 percent of the Nation's clean, non-carbon electricity. The request for the Office of Nuclear Energy includes \$495 million for research, development, and demonstration in addition to investments in supportive infrastructure. Work on advanced reactor technologies, fuel cycle technologies, waste management, and cross-cutting technologies and transformative concepts will help ensure that nuclear energy remains a safe, secure, economical source of clean energy. The Department will also promote nuclear energy through the Loan Guarantee Program, which is requesting an additional \$36 billion in loan authority for nuclear power in FY 2011 (for a total of \$54.5 billion).

- **Clean and Abundant Fossil Energy**

The world will continue to rely on coal fired electrical generation to meet energy demand. It is imperative that the United States develop the technology to ensure that base-load electricity generation is as clean and reliable as possible. The Office of Fossil Energy will invest \$438 million in the research and development of advanced coal-fueled power systems and carbon capture and storage technologies. This will allow the continued use of the abundant domestic coal resources in the U.S. while reducing greenhouse gas emissions.

Accurate energy information and analysis play a critical role in promoting efficient energy markets and informing policy-making and strategic planning. This budget requests a total of \$129 million for the Energy Information Administration, the statutory statistical agency within the Department, to improve energy data and analysis programs.

Security: Safeguarding Nuclear and Radiological Materials, Advancing Responsible Legacy Cleanup and Maintaining Nuclear Deterrence

- **Reduces the Risk of Proliferation**

In an April 2009 speech in Prague, the President called the threat of nuclear proliferation "the most immediate and extreme threat to global security" and announced his support for a new international effort to secure all vulnerable nuclear material around the world within four years. The FY 2011 budget for the NNSA Defense Nuclear Nonproliferation program supports this effort, recognizing the urgency of the threat and making the full commitment to global cooperation that is essential to addressing this threat. The budget provides \$2.7 billion in FY 2011, and \$13.7 billion through FY 2015 to detect, secure, and dispose of dangerous nuclear and radiological material worldwide. This request is an increase of 26 percent or \$550 million from FY 2010. The budget supports cooperative nonproliferation initiatives with foreign governments and the effort and expertise to forge them into durable international partnerships, achieving the objective of a world without nuclear weapons. The budget continues the installation of radiation detection equipment at international border crossings and Megaports, significantly expands materials protection and control security upgrades at selected sites in foreign countries to address outsider and insider threats, and accelerates the pace of highly enriched uranium research reactor conversions with an urgent focus to develop the capability to produce the medical isotope molybdenum-99 in the U.S. using low enriched uranium. The FY 2011 budget request provides \$4.4 billion over five years for Fissile Materials Disposition including the construction of U.S.

facilities for the disposition of U.S. weapons-grade plutonium in fulfillment of our commitment with the Russian Federation under the Plutonium Management and Disposition Agreement of September 2000, and provides the first \$100 million of a \$400 million U.S. commitment to advance the construction of plutonium disposition facilities in the Russian Federation. The FY 2011 budget request also supports a funding increase for Nonproliferation and Verification Research and Development for new technologies in support of treaty monitoring and verification.

- **Leverages Science to Maintain Nuclear Deterrence**

The FY 2011 budget request advances the Department's commitment to the national security interests of the United States through stewardship of a safe, secure and effective nuclear weapons stockpile without the use of underground nuclear testing. As the role of nuclear weapons in our Nation's defense evolves and the threats to national security continue to grow, the focus of this enterprise must also change and place its tremendous intellectual capacity and unique facilities in the service of addressing other challenges related to national defense. NNSA is taking steps to move in this direction, including functioning as a national science, technology, and engineering resource to other agencies with national security responsibilities. NNSA must ensure our evolving strategic posture places the stewardship of our nuclear stockpile, nonproliferation programs, counterterrorism, missile defenses, and the international arms control objectives into one comprehensive strategy that protects the American people and our allies. Through the NNSA, the Department requests \$7.0 billion for the Weapons Activities appropriation, a 9.8 percent or \$624 million increase from the FY 2010 appropriation. This increase provides a strong basis for transitioning to a smaller nuclear stockpile, strengthens the science, technology and engineering base, modernizes key nuclear facilities, and streamlines the enterprise's physical and operational footprint.

These investments will enable execution of a comprehensive nuclear defense strategy based on current and projected global threats that relies less on nuclear weapons, yet enhances national security by strengthening the NNSA's nuclear security programs. This improved NNSA capability base will mitigate the concerns regarding ratification of the follow-on Strategic Arms Reduction Treaty and the Comprehensive Test Ban Treaty. The FY 2011 request for Weapons Activities has four major components. The request for Stockpile Support increases, reflecting the President's commitment to maintain the safety, security and effectiveness of the nuclear deterrent without underground nuclear testing, consistent with the principles of the Stockpile Management Program outlined in Section 3113 (a)(2) of the National Defense Authorization Act of Fiscal Year 2010 (50 U.S.C. 2524). The request for Science, Technology and Engineering increases by over 10 percent, and provides the funding necessary to protect and advance the scientific capabilities at the U.S. nuclear security laboratories supporting the stockpile and broader national security and energy issues. The budget request for Infrastructure supports the operation and maintenance of the government-owned, contractor-operated facilities in the nuclear security enterprise, as well as special capabilities for secure transportation and construction. The security and counterterrorism component of the budget provides for physical and cyber security in the NNSA enterprise, as well as emergency response assets and NNSA's focused research and development contribution to the Nation's counterterrorism efforts.

- **Advances Responsible Environmental Cleanup**

The FY 2011 budget includes \$6 billion for the Office of Environmental Management to protect public health and safety by cleaning up hazardous, radioactive legacy waste from the Manhattan Project and the Cold War. This funding will allow the program to continue to accelerate cleaning up and closing sites, focusing on activities with the greatest risk reduction.

As the Department continues to make progress in completing clean-up, the FY 2011 budget request of \$189 million for the Office of Legacy Management supports the Department's long-term stewardship responsibilities and payment of pensions and benefits for former contractor workers after site closure.

The Administration has determined that the Yucca Mountain repository is not a workable option and has decided to terminate the Office of Civilian Radioactive Waste Management. The core functions and staff to support efforts under the Nuclear Waste Policy Act to meet the obligation of the Government will transfer to the Office of Nuclear Energy by the end of FY 2010.

Management: Transforming the Culture of the Department with a Results-Oriented Approach

In order to transform the way Americans use and produce energy, we must transform the Department of Energy. The Department is committed to strengthening its management culture and increasing its focus on results. The implementation of the Recovery Act provided the Department with an opportunity to continue to refine best practices in management, accountability, operations, and transparency. These best practices will be applied in executing the FY 2011 budget.

To achieve our strategic priorities, the Department requests a net of \$169 million for Departmental Administration. These funds, along with resources in individual program offices, will help transform key functional areas such as human, financial, project, and information technology management. The request includes \$2 million for Management Reform within the Office of the Secretary, which will provide the Department with strategic direction, coordination, and oversight of reform initiatives.

DEPARTMENT OF ENERGY FY 2011 PROGRAM OFFICE HIGHLIGHTS

Office of Science: Supporting Cutting-Edge Foundational Scientific Research

The Department of Energy's Office of Science (SC) delivers discoveries and scientific tools that transform our understanding of energy and matter and advance the national, economic, and energy security of the United States. SC is a primary sponsor of basic research in the United States, leading the Nation to support the physical sciences in a broad array of research subjects in order to improve energy security and address issues ancillary to energy, such as climate change, genomics, and life sciences. In FY 2011, the Department requests \$5.1 billion, an increase of 4.4 percent over the enacted FY 2010 appropriation, to invest in science research. The FY 2011 request supports the President's Plan for Science and Innovation, which encompasses the entire SC budget, as part of a strategy to double overall basic research funding at select agencies. As part of this plan, the budget request supports the training of students and researchers in fields

critical to our national competitiveness and innovation economy, and supports investments in areas of research critical to our clean energy future and to making the U.S. a leader on climate change.

SC is addressing critical societal challenges and key missions of the Department of Energy through significant improvements in existing technologies and development of new energy technologies. SC will accomplish this by: (1) sustained investments in exploratory and high-risk research in traditional and emerging disciplines, including the development of new tools and facilities; (2) focused investments in high-priority research areas; and (3) investments that train new generations of scientists and engineers to be leaders in the 21st century. The FY 2011 budget request supports all three of these investment strategies.

Two of the four Energy Innovation Hubs being requested in FY 2011 are through the Office of Science; these Hubs will bring together teams of experts from multiple disciplines to focus on two grand challenges in energy: (1) Fuels from Sunlight, a Hub established in FY 2010 and (2) Batteries and Energy Storage, a new Hub in the FY 2011 request.

The Energy Frontier Research Centers (EFRC) program will be expanded in the FY 2011 request to capture new, emerging opportunities by furthering its scientific reach and potential technological impact. New EFRCs will be competitively solicited in two categories: discovery and development of new materials that are critical to both science frontiers and technology innovations, and basic research for energy needs in a limited number of areas that are underrepresented in the 46 original EFRC awards.

The FY 2011 request for the U.S. ITER Project (\$80 million, a decrease of \$55 million from FY 2010) is a reflection of the pace of ITER construction as of the end of 2009. The Administration is engaged in a range of efforts to implement management reforms at the ITER Organization and accelerate ITER construction while minimizing the overall cost of the Construction Phase for the U.S. and the other ITER members.

The Office of Science supports investigators from more than 300 academic institutions and from all of the DOE laboratories. The FY 2011 budget request will support approximately 27,000 Ph.D.s, graduate students, undergraduates, engineers, and technicians. Nearly 26,000 researchers from universities, national laboratories, industry, and international partners are expected to use SC scientific user facilities in FY 2011.

Advanced Research Projects Agency – Energy: Transformational Research and Development

The FY 2011 budget request includes \$300 million for the Advanced Research Projects Agency – Energy (ARPA-E), a program launched in FY 2009 that sponsors specific high-risk and high-payoff transformational research and development projects that overcome the long-term technological barriers in the development of energy technologies to meet the Nation's energy challenges, but that industry will not support at such an early stage. An essential component of ARPA-E's culture is an overarching focus on accelerating science to market. Beyond simply funding transformational research creating revolutionary technologies, ARPA-E is dedicated to

the market adoption of those new technologies that will fuel the economy, create new jobs, reduce energy imports, improve energy efficiency, reduce energy-related emissions, and ensure that the U.S. maintains a technological lead in developing and deploying advanced energy technologies.

Office of Energy Efficiency and Renewable Energy: Developing and Deploying Clean, Reliable Energy

The Office of Energy Efficiency and Renewable Energy (EERE) strengthens the energy security, environmental quality, and economic vitality of the U.S. through the research, development, demonstration and deployment (RDD&D) of clean energy technologies and generation and advances in energy efficiency. EERE's activities are critical to creating a low carbon economy and sustaining strong economic growth and job creation while dramatically reducing greenhouse gas emissions and energy imports. EERE programs link advances in basic research and the creation of commercially successful products and services to ensure delivery to the marketplace for general use and implementation.

The FY 2011 budget request of \$2.4 billion, an increase of 5 percent over FY 2010, is aimed at accelerating revolutionary change in the Nation's energy economy. The request includes programs associated with meeting the President's goals of investing in the next generation of clean energy technologies, vehicles and fuels, and energy efficiency measures that reduce energy use in Federal agencies and the industrial and building sectors.

Clean, Renewable Energy Generation

The FY 2011 budget request continues to work to transform the Nation's energy infrastructure by investing over \$650 million in a variety of renewable sources of electrical generation such as solar (\$302 million, a 22 percent increase over FY 2010), and wind (\$123 million, a 53 percent increase over FY 2010), as well as deploy clean technologies to reduce our dependence on oil. The request includes expansions on Concentrating Solar Power, biopower and off-shore wind, which will provide new, additional avenues for clean energy development and deployment. These technologies will reduce the production of greenhouse gas emissions and revitalize an economy built on the next generation of domestic production.

Energy Efficiency

The Department implements a number of efforts to increase energy efficiency and conservation in homes, transportation, and industry. The FY 2011 budget requests \$758 million to accelerate deployment of clean, cost-effective, and rapidly deployable energy conservation measures in order to reduce energy consumption in residential and commercial buildings, and the industrial and Federal sectors. The Department will invest \$231 million in the Building Technologies program, a 16 percent increase over FY 2010 for built environment R&D. Federal assistance for state-level programs such as State Energy Program grants (\$75 million) and Weatherization Assistance Program (\$300 million), will continue to help citizens implement energy conservation measures, lower energy costs and greenhouse gas emissions, and build a technical workforce. The FY 2011 request also includes \$545 million to accelerate research, development and deployment of advanced fuels and vehicles to reduce the use of petroleum and greenhouse gas emissions. The FY 2011 budget complements the Recovery Act funding for these programs

(\$3.1 billion for State Energy Programs, \$5 billion for Weatherization Assistance, \$2 billion for Advanced Battery Manufacturing and \$400 million for Transportation Electrification).

Office of Electricity Delivery and Energy Reliability: Moving Toward a More Intelligent Grid to Power the Digital Economy

The FY 2011 budget request for the Office of Electricity Delivery and Energy Reliability (OE) budget is \$186 million, an increase of 8 percent over FY 2010. These funds will build on the “Smart Grid” investments and other activities.

The ability of the United States to meet the growing demand for reliable electricity is challenged by an aging power grid under mounting stress. Despite the increasing demand for reliable power brought on by the modern digital economy, the power grid in the U.S. has suffered from a long period of underinvestment. Much of the power delivery system was built on technology developed over 50 years ago and thus responds to disturbances with speed limited by the technology of that period. This limitation increases the vulnerability of the power system to outages that can spread quickly and impact whole regions. Breakthroughs in digital network controls, transmission, distribution, and energy storage will make the power grid more efficient, alleviating the stress on the system, as well as enable greater use of clean and distributed energy sources. The return on these investments will come from a reduction in economic losses caused by power outages and the delay or avoidance of costly investment in new generation and transmission infrastructure.

The budget request provides \$144 million for research and development, which supports development of technologies that will improve the reliability, efficiency, flexibility, functionality, and security of the Nation’s electricity delivery system. It accelerates investment in energy storage capabilities and funds two new research initiatives: Advanced Modeling Grid Research, to develop grid-modeling capabilities using the large volumes of data generated by advanced sensors deployed on the grid; and Power Electronics, to develop new power control devices in collaboration with universities. The proposal also continues to support the development of “Smart Grid” technologies and cyber security systems for the power grid.

The budget request continues support for Permitting, Siting, and Analysis (\$6.4 million) to assist States, regional entities, and other federal agencies in developing policies and programs aimed at modernizing the power grid; and for Infrastructure Security and Energy Restoration (\$6.2 million) to enhance the reliability and resiliency of U.S. critical infrastructure and facilitate its recovery from energy supply disruptions.

Office of Environmental Management: Reducing Risks and Making Progress

The mission of the Office of Environmental Management (EM) is to complete the safe cleanup of the environmental legacy brought about from over six decades of nuclear weapons development, production, and Government-sponsored nuclear energy research. This cleanup effort is the largest in the world, originally involving two million acres at 107 sites in 35 states, dealing with some of the most dangerous materials known to man.

EM continues to pursue its cleanup objectives within the overall framework of achieving the greatest comparative risk reduction benefit and overlaying regulatory compliance commitments and best business practices to maximize cleanup progress. To support this approach, EM has prioritized its cleanup activities:

- Activities to maintain a safe and secure posture in the EM complex
- Radioactive tank waste stabilization, treatment, and disposal
- Used nuclear fuel storage, receipt, and disposition
- Special nuclear material consolidation, processing, and disposition
- High priority groundwater remediation
- Transuranic and mixed/low-level waste disposition
- Soil and groundwater remediation
- Excess facilities deactivation and decommissioning

The FY 2011 budget request for \$6.0 billion will fund activities to maintain a safe and secure posture in the EM complex and make progress against program goals and compliance commitments, including reduction of highest risks to the environment and public health, use of science and technology to reduce life cycle costs, and reduction of EM's geographic footprint by 40 percent by 2011. EM continues to move forward with the development of the capability for dispositioning tank waste, nuclear materials, and used nuclear fuel. The budget request includes the construction and operation of three unique and complex tank waste processing plants to treat approximately 88 million gallons of radioactive tank waste for ultimate disposal. It will also fund the solid waste disposal infrastructure needed to support disposal of transuranic and low-level wastes generated by high-risk activities and the footprint reduction activities. In addition to the FY 2011 budget request, EM will continue to expend the \$6 billion in Recovery Act funding provided by Congress to complete lower-risk footprint reduction and near-term completion cleanup activities.

EM carries out its cleanup activities with the interests of stakeholders in mind. Most importantly, EM will continue to fulfill its responsibilities by conducting cleanup within a "Safety First" culture that integrates environment, safety, and health requirements and controls into all work activities to ensure protection to the workers, public, and the environment, and adheres to sound project and contract management principles. EM is also strengthening its project and planning analyses to better assess existing priorities and identify opportunities to accelerate cleanup work. Working collaboratively with the sites, EM continues to seek aggressive but achievable strategies for accelerating cleanup of discrete sites or segments of work. In addition, functional and cross-site activities such as elimination of specific groundwater contaminants, waste or material processing campaigns, or achievement of interim or final end-states are being evaluated.

After the EM program completes cleanup and closure of sites that no longer have an ongoing DOE mission, post closure stewardship activities are transferred to the **Office of Legacy Management (LM)**. LM also receives sites remediated by the U.S. Army Corps of Engineers (Formerly Utilized Sites Remedial Action Program) and private licensees (Uranium Mill Tailings Radiation Control Act, Title II sites). Post closure stewardship includes long-term surveillance and maintenance activities such as groundwater monitoring, disposal cell

maintenance, records management, and management of natural resources at sites where active remediation has been completed. At some sites the program includes management and administration of pension and post-retirement benefits for contractor retirees.

The Administration has determined that developing a repository at Yucca Mountain, Nevada, is not a workable option and has decided to terminate the **Office of Civilian Radioactive Waste Management (RW)**. The Nation needs a different solution for nuclear waste disposal. As a result, in 2010, the Department will discontinue its application to the U.S. Nuclear Regulatory Commission for a license to construct a high-level waste geologic repository at Yucca Mountain and establish a Blue Ribbon Commission to inform the Administration as it develops a new strategy for nuclear waste management and disposal. All funding for development of the Yucca Mountain facility and RW will be eliminated by the end of FY 2010. The Administration remains committed to fulfilling its obligations under the Nuclear Waste Policy Act. The Office of Nuclear Energy will develop an integrated approach to improve the waste management options for the Nation and support the Blue Ribbon Commission. Ongoing responsibilities under the Nuclear Waste Policy Act, including administration of the Nuclear Waste Fund and the Standard Contract, will continue under the Office of Nuclear Energy, which will lead future waste management activities.

Innovative Technology Loan Guarantee Program and Advanced Technology Vehicle Manufacturing Program: Supporting Investment in Innovation and Manufacturing

To encourage the early commercial production and use of new or significantly improved technologies in energy projects, the Department is requesting an additional \$36 billion in authority to guarantee loans for nuclear power facilities and \$500 million in appropriated credit subsidy for the cost of loan guarantees for renewable energy systems and efficient end-use energy technology projects under section 1703 of the Energy Policy Act of 2005. The additional loan authority for nuclear power projects will promote near-term deployment of new plants and support an increasing role for private sector financing. The additional credit subsidy will allow for investment in the innovative renewable and efficiency technologies that are critical to meeting the Administration's goals for affordable, clean energy, technical leadership, and global competitiveness.

The FY 2011 budget also requests \$58 million to evaluate applications received under the eight solicitations released to date and to ensure efficient and effective management of the Loan Guarantee Program. This request will be offset by collections authorized under Title XVII of the Energy Policy Act of 2005 (P.L. 109-8).

The **Advanced Technology Vehicle Manufacturing** program requests \$10 million to support ongoing loan and loan monitoring activities associated with the program mission of making loans to automobile and automobile part manufacturers for the cost of re-equipping, expanding, or establishing manufacturing facilities in the United States to produce advanced technology vehicles or qualified components, and for associated engineering integration costs.

Office of Nuclear Energy: Investing in Energy Security and Technical Leadership

The Department is requesting \$912 million for the Office of Nuclear Energy (NE) in FY 2011 – an increase of 5 percent over the FY 2010 enacted level. NE's funding supports the advancement of nuclear power as a resource capable of meeting the Nation's energy, environmental, and national security needs by resolving technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration as appropriate.

Currently, nuclear energy supplies approximately 20 percent of the Nation's electricity and over 70 percent of clean, non-carbon producing electricity. Over 100 nuclear power plants are offering reliable and affordable baseload electricity in the United States, and they are doing so without air pollution and greenhouse gas emissions. NE is working to develop innovative and transformative technologies to improve the competitiveness, safety and proliferation resistance of nuclear energy to support its continued use.

The FY 2011 budget supports a reorganized and refocused set of research, development, and demonstration (RD&D) activities. This program is built around exploring, through RD&D: technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; understanding of options for nuclear energy to contribute to reduced carbon emissions outside the electricity sector; development of sustainable nuclear fuel cycles; and minimization of risks of nuclear proliferation and terrorism.

NE is requesting \$195 million for Reactor Concepts Research, Development and Deployment. This program seeks to develop new and advanced reactor designs and technologies. Work will continue on design, licensing and R&D for the Next Generation Nuclear Plant to demonstrate gas-cooled reactor technology in the United States. The program also supports research on Generation IV and other advanced designs and efforts to extend the life of existing light water reactors. In FY 2011, NE will initiate a new effort focused on small modular reactors, a technology the Department believes has promise to help meet energy security goals.

The FY 2011 request includes \$201 million for Fuel Cycle Research and Development to perform long-term, results-oriented science-based R&D to improve fuel cycle and waste management technologies to enable a safe, secure, and economic fuel cycle. The budget also requests \$99 million to support a new R&D program, Nuclear Energy Enabling Technologies, focused on the development of cross-cutting and transformative technologies relevant to multiple reactor and fuel cycle concepts. The Crosscutting Technology Development activity provides crosscutting R&D support for nuclear energy concepts in areas such as reactor materials and creative approaches to further reduce proliferation risks. The Transformative Nuclear Concepts R&D activity will support, via an open, competitive solicitation process, investigator-initiated projects that relate to any aspect of nuclear energy generation including, but not limited to, reactor and power conversion technologies, enrichment, fuels and fuel management, waste disposal, and nonproliferation, to ensure that good ideas have sufficient outlet for exploration. The Energy Innovation Hub for Modeling and Simulation will apply existing modeling and

simulation capabilities to create a “virtual” reactor user environment to simulate an operating reactor. NE will also continue its commitments to investing in university research, international cooperation, and the Nation’s nuclear infrastructure – important foundations to support continued technical advancement.

Office of Fossil Energy: Abundant and Affordable Energy for the 21st Century

The FY 2011 budget request of \$760 million for the Office of Fossil Energy (FE) will help ensure that the United States can continue to rely on clean, affordable energy from traditional domestic fuel resources. The United States has 25 percent of the world’s coal reserves, and fossil fuels currently supply 86 percent of the Nation’s energy.

The Department is committed to advancing Carbon Capture and Storage (CCS) technologies in order to promote a cleaner and more efficient use of fossil fuels. In addition to significant Recovery Act funds, Advanced CCS with \$438 million requested in FY 2011 is the foundation of the Department’s clean coal research program which seeks to establish the capability of producing electricity from coal with near-zero atmospheric emissions.

In addition, \$150 million of FE’s \$760 million request will be used to promote national energy security through the continued operations of both the Strategic Petroleum Reserve and Northeast Home Heating Oil Reserve programs. These programs protect the Nation and the public against economic damages from potential disruptions in foreign and domestic petroleum supplies.

Energy Information Administration: Providing Independent Statistics and Analysis

The FY 2011 request for the Energy Information Administration (EIA) is \$128.8 million, which is an \$18.2 million increase over the FY 2010 current appropriation. EIA conducts a comprehensive data collection program through more than 60 surveys that cover the full spectrum of energy sources, end uses, and energy flows; generates short- and long-term domestic and international energy projections; and performs informative energy analyses. EIA disseminates its data products, analyses, reports, and other information services to customers and stakeholders primarily through its website.

The increased funding improves EIA’s capability to close energy information gaps, strengthen analysis, and address significant data quality issues. It provides for an expanded survey of energy consumption in commercial buildings that will provide more baseline information critical to understanding energy use. That survey also is a basis for benchmarking and performance measurement for energy efficiency programs. The budget request also provides for: expanded analysis of energy market behavior and data to address the increasingly important interrelationship of energy and financial markets; continued implementation of improvements in data coverage, quality and integration; upgrades to the National Energy Model; and initiation of efforts to track and analyze the adoption of “Smart Grid” technologies and dynamic electricity pricing plans.

The National Nuclear Security Administration: Ensuring America's Nuclear Security and Reducing the Global Threat of Nuclear Proliferation

The National Nuclear Security Administration (NNSA) continues significant efforts to meet Administration priorities, leveraging science to promote U.S. national security objectives. The FY 2011 President's budget request is \$11.2 billion, an increase of 13 percent from the enacted FY 2010 appropriation. The FY 2011-2015 President's Request for the NNSA is a significant funding increase over FY 2010 levels, reflecting the President's priorities on global nuclear nonproliferation and for strengthening the nuclear security posture of the United States to meet defense and homeland security-related objectives:

- Broaden and strengthen the NNSA's science, technology and engineering mission to meet national security needs
- Work with global partners to secure all vulnerable nuclear materials around the world within four years
- Work toward a world with no nuclear weapons. Until that goal is achieved, ensure the U.S. nuclear deterrent remains safe, secure and effective
- Transform the Nation's Cold-War era weapons complex into a 21st century national security enterprise
- Provide safe and effective nuclear propulsion for U.S. navy warships

The FY 2011 budget request of \$7.01 billion for the Weapons Activities appropriation provides funding for a wide range of programs. Some activities provide direct support for maintaining the nuclear weapon stockpile, including stockpile surveillance, annual assessments, life extension programs, and warhead dismantlement. Science, Technology and Engineering programs are focused on long-term vitality in science and engineering, and on performing R&D to sustain current and future stockpile stewardship capabilities without the need for underground nuclear testing. These programs also provide a base capability to support scientific research needed by other elements of the Department, to the federal government national security community, and the academic and industrial communities. Infrastructure programs support facilities and operations at the government-owned, contractor-operated sites, including activities to maintain and steward the health of these sites for the long term. Security and counterterrorism activities leverage the unique nuclear security expertise and resources maintained by NNSA to other Departmental offices and to the Nation.

The Weapons Activities request is an increase of 9.8 percent over the FY 2010 enacted level. This level is sustained and increased in the later outyears. The multi-year increase is necessary to reflect the President's commitment to maintain the safety, security and effectiveness of the nuclear deterrent without underground nuclear testing, consistent with the principles of the Stockpile Management Program outlined in Section 3113 (a)(2) of the National Defense Authorization Act of Fiscal Year 2010 (50 U.S.C. 2524). Increases are provided which directly support of the nuclear weapon stockpile, for scientific, technical and engineering activities related to maintenance assessment and certification capabilities, and for recapitalization of key nuclear facilities. The President's Request provides funding necessary to protect the human capital base at the national laboratories—including the ability to design and certify nuclear weapons—through a stockpile stewardship program that fully exercises these capabilities.

Security and nuclear counterterrorism activities decrease about 3 percent from the FY 2010 appropriated levels, leveraging the continuing efficiencies in the Defense Nuclear Security budget.

The FY 2011 request for Defense Nuclear Nonproliferation is \$2.7 billion, an increase of 25.8 percent over the FY 2010 appropriation. The increase is driven by the imperative for U.S. leadership in nonproliferation initiatives both here and abroad. In addition to the programs funded solely by the NNSA, our programs support the Department of Energy mission to protect our national security by preventing the spread of nuclear weapons and nuclear materials to terrorist organizations and rogue states. These efforts are implemented in part through the Global Partnership against the Spread of Weapons and Materials of Mass Destruction, formed at the G8 Kananaskis Summit in June 2002, and the Global Initiative to Combat Nuclear Terrorism, launched in Rabat, Morocco, in October 2006.

The FY 2011 President's request for International Nuclear Materials Protection and Cooperation reflects selective new security upgrades to buildings and areas that were added to the cooperation after the Bratislava Summit, additional Second Line of Defense sites, and sustainability support for MPC&A upgrades. The Global Threat Reduction Initiative increases by 68 percent in support of the international effort to secure vulnerable nuclear materials around the world within four years. The Fissile Materials Disposition program increases by 47 percent reflecting continuing domestic construction of the MOX Fuel Fabrication Facility and the Waste Solidification Building, as well as design documentation for a related pit disassembly and conversion capability. A portion of the funding increase results from the transfer of funding associated with the latter activity from the Weapons Activities appropriation starting in 2011.

The President's request of \$1.1 billion for Naval Reactors is an increase of 13.3 percent over the FY 2010 appropriated level. The program supports the U.S. Navy's nuclear fleet, comprised of all of the Navy's submarines and aircraft carriers, including 52 attack submarines, 14 ballistic missile submarines, 4 guided missile submarines, and 11 aircraft carriers. These ships are relied on every day, all over the world, to protect our national interests. Starting in FY 2010, there are major new missions for the NNSA Naval Reactors program. A significant funding increase is requested for the OHIO Class submarine replacement and for the related activity which will demonstrate new submarine reactor plant technologies as part of the refueling of the land-based prototype reactor. R&D is underway now, and funding during this Future Years Nuclear Security Program is critical to support the long manufacturing spans for procurement of reactor plant components in 2017, and ship procurement in 2019. Resources are also included in FY 2011 to support commencement of design work for the recapitalization of used nuclear fuel infrastructure.

The Office of the Administrator appropriation provides for federal program direction and support for NNSA's Headquarters and field installations. The FY 2011 request is \$448.3 million, a 6.5 percent increase over the FY 2010 appropriation. This provides for well-managed, inclusive, responsive, and accountable organization through the strategic management of human capital, enhanced cost-effective utilization of information technology, and integration of budget and performance through transparent financial management practices.

Management: Transforming the Culture of the Department with a Results-Oriented Approach

To transform the way Americans use and produce energy, we need to transform the Department of Energy. Because the mission of the Department is vital and urgent, it must be pursued using a results-oriented approach that is safe, fiscally responsible, and legally and ethically sound. The Department has developed strong management and oversight capabilities during implementation of the Recovery Act, and these lessons will be applied to the FY 2011 budget. The budget request of \$337 million for corporate management includes \$75 million for the Office of Management, \$102 million for the Office of the Chief Information Officer, \$43 million for the Inspector General's office, \$62.7 million for the Office of the Chief Financial Officer, \$37 million for the Office of General Counsel, and \$2 million for Management Reform within the Office of the Secretary. The Management Reform effort will provide the Department with strategic direction, coordination, and oversight of management initiatives. The primary mission of this new office is to identify operational efficiencies to free up resources for priority mission activities. The Department is also requesting \$12 million for a new Acquisition Workforce Improvement initiative which will be utilized to increase the size and improve the training of our acquisition professionals.

The Department's human capital management efforts are focused on an integrated approach that ensures human capital programs and policies are linked to the Department's missions, strategies, and strategic goals, while providing for continuous improvement in efficiency and effectiveness. To accomplish this goal, the Department will develop different strategies to attract, motivate and retain a highly skilled and diverse workforce to meet the future needs of the Nation in such vital areas as scientific discovery and innovation.

To improve stewardship of taxpayer dollars, the Department will continue to issue audited financial statements in an accelerated timeframe and provide assurance that the Department's financial management meets the highest standards of integrity. The Department's FY 2009 financial statements were reviewed by independent auditors and received an unqualified opinion. This was made possible by implementing an aggressive plan to mitigate and remediate a number of financial management challenges that were identified by the Department and its independent auditors. In addition, the Department continues to strengthen the execution of program funding dollars by having regular execution reviews that will ensure funding is processed, approved and spent quickly and responsibly. The Department in FY 2011 will continue its effort to build and improve its integrated business management system.

The Department is continuing to make progress in improving project management and is implementing an action plan with scheduled milestones and aggressive performance metrics. The focus of the action plan is to successfully address the root causes of the major challenges to planning and managing Department projects. The action plan identifies eight measures that, when completed, will result in significant, measurable, and sustainable improvements in the Department's contract and project management performance and culture.

To improve financial performance in project management, the Department has increased the use of Earned Value Management (EVM) techniques within program offices. These techniques

objectively track physical accomplishment of work and provide early warning of performance problems. A certification process was instituted for contractors' EVM systems to improve the definition of project scope, communicate objective progress to stakeholders and keep project teams focused on achieving progress. Currently, 70 percent of the Department's capital asset projects have certified EVM systems.

The Department continues to strengthen information technology management by consistent execution of robust IT Capital Planning and Investment Control oversight and reporting processes designed to ensure successful investment performance, including the use of EVM Systems as appropriate, and the remediation of poorly performing investments. Through the establishment and use of an Enterprise Architecture that aligns to the Federal Enterprise Architecture, the Department has ensured that all IT investments follow a comprehensive Modernization Roadmap.

The Department continues to take significant actions to improve its cyber security posture by implementing its Cyber Security Revitalization Plan to address long-standing, systemic weaknesses in the Department's information and information systems. Specifically, the Department seeks to ensure that 100 percent of operational information technology systems are certified and accredited as secure and that the Department's Inspector General has rated the certification and accreditation process as "satisfactory." Additional steps will be taken to ensure that electronic classified and personally identifiable information are secure.

CONCLUSION

I appreciate the opportunity to appear before you to present the FY 2011 budget request for the Department of Energy. I will be happy to take any questions that Members of the Committee may have.

Mr. PASTOR. I have been told that there is a possibility that in the very near future, within 5 to 15 minutes, there may be a call to vote. So we will start with some questions and then we will leave to go vote and come back to continue.

I have a request and, if there is objection obviously I won't. But Congressman Wamp is the Ranking Member on a MILCON that is going to start a hearing. He would like to ask one question before he leaves. Mr. Wamp.

Mr. WAMP. Thank you for your courtesy. And it is timely because Secretary Chu just spent almost 2 full days in Oak Ridge and saw several aspects of what is done there. And I am grateful for your time and enjoyed being there with you. So did our Governor and Congressman Lincoln Davis, and he can follow up on this when I go to the other hearing.

But I wanted to ask you a couple of questions. I know the public knew of most of what you did there. But some of what you did there, the public doesn't know and shouldn't know. But is there anything that you saw or learned in Oak Ridge that in any way opened your incredibly educated eyes to anything? Was there anything that you were struck by after seeing the really excellent multipurpose site? The national security missions are certainly grateful for the budget request on nonproliferation activities to meet this administration's priorities. Yet, clearly, what is done there will assist in a major way the world being a safer place. After we provided the build-up for a long period of time, we are certainly involved in meeting whatever the NPR recommends and we are grateful for that.

Clearly in the science arena, you all have made a big commitment just in the last 15 months in certain areas, that the Oak Ridge National Laboratory is working on. I know you gave a long talk on climate change. While I don't agree with a lot of the objective, it was certainly a talk that the scientists at the Oak Ridge National Laboratory really keyed into and agree with, obviously, a lot of what you said.

I was also fascinated at dinner the other night when we talked about the research programs at ARPA-E and your priorities there. And I want you to go into that today so that the subcommittee and the professional staff can fully understand what your priorities are and why you need what you need from the subcommittee.

Secretary CHU. Thank you, Congressman. Very quickly. I visited two facilities, Y-12, which is part of the NNSA laboratory complex. And I visited Oak Ridge National Laboratory. And I was struck by the fact that in both sites there were an amazing number of Americans working there, a very dedicated workforce on two different aspects. In Y-12, I saw a new place that was being used to consolidate the nuclear materials in a much safer way, so that you can reduce the footprint at Oak Ridge, you can actually reduce the expenditures, because just the guarding this material was becoming exorbitantly expensive.

It is a place where we also do a lot of the refurbishment and dismantlement of our nuclear weapons. This is a very important part of our continuing national security. And, again, amazing workforce.

And Oak Ridge National Laboratory is one of the leading national laboratories in the Office of Science. As you know, we ex-

tended that for another 5 years because of its outstanding management and operation. It is a center for a wide range of activities. It is the leader in the world in advanced computing and the use of advanced computing to do all sorts of things that will play an integral role in the economic prosperity of the United States.

I did give a long talk. I perhaps spent a fifth of my time on climate change, only to say that contrary to some people's beliefs, the evidence of human-caused climate change is mounting, not decreasing. I hope I spent most of my time talking about the economic opportunities the United States has in becoming a leader in this evolution towards sustainable energy. We have a chance and, again, it is because of the great innovation machine in the research universities, in the national laboratory, in the private sector especially. When guided very gently, that great innovation machine can develop leading technologies that can be used at home, but, equally important, that can be exported around the world.

So in my talk there, I was focusing on having the United States seize those opportunities for prosperity tomorrow and the years and decades ahead.

Mr. WAMP. ARPA-E?

Secretary CHU. ARPA-E, is a new way of funding in the very short term, 2 years, 3 years maximum. It is a push where the program directors in ARPA-E are being proactive, just like in DARPA, and they are saying what areas in the technology sector are ripe for a little push to really break open development. We are funding initiatives that we believe can be home runs. So we are not going for signals. If you swing for home runs, you will strike out. But if you hit a home run and a grand slam, then it really gives us a very different result. It creates new industries.

So a lot of the activities we are funding at ARPA are of that ilk. It is very short term, specific. It is sort of prefunding that we hope in 2 or 3 years the private sector will pick up.

Mr. WAMP. Is the stimulus money for ARPA-E actually spent, obligated under Mr. Frelinghuysen's question? Why don't you tell us that?

Secretary CHU. Yes. So in terms of the stimulus money for ARPA-E, the first round of proposals have gone out. The second round, in terms of all of the stimulus money and appropriations, in answer to that question, we were given 36.7 billion. Right now we have obligated 26 billion. We will go to 30 billion by June. By the end of fiscal year 2010 we will have obligated all of it. A large fraction of the selection has already been done. Under contract, about 12 billion. The costing is slower in part because of the costing of any of these areas; in particular some of the weatherization grants, the State energy programs, the ECBG. And some of these programs, you give them to States and we try to help the States set up—and many of these things, they too had to go out for proposals.

And so what we are doing is we are helping the States. There are some excellent States who are costing these at a very good clip. Ohio is a shining example of one such State. And there are other States that are less experienced in this, but we are trying to help them.

I think we are partnering with the States. We are trying to get that money out. But in general, I think we are on our schedule to cost the money as rapidly as we can. We actually had an obligation schedule and a costing schedule with some of the programs. The ramp-up is now going very quickly. It is being well used, and it will be out there and costed in short time.

Mr. PASTOR. Thank you, Mr. Wamp.

Mr. Secretary, as I understand, things have changed again. Now, the vote will probably be at 2:30. We have changed again. The issue is that sometime this afternoon, the supplemental is going to be on the floor, and once that is on the floor, we will have to adjourn.

Secretary CHU. I understand.

Mr. PASTOR. So what I am going to try to do is give the members at least 5 minutes to ask a question. So we are going to try to accommodate as many members as we can, not knowing what time the supplemental comes on and when we have to adjourn. The reason I am going to ask these questions is that I am kind of learning on the job. But I have seen where assistant secretaries and other people from the Department have come forth. Usually we lead off when you had a requirement—I will give you an example from yesterday.

We had Assistant Secretary Miller here. In the legislation that was passed last year, it said that a report on the hubs will be delivered no later than 60 days after enactment. And so I mentioned to the Assistant Secretary, that sometime in January that was due. And based on his expression, he was a little bit surprised to know that that was something that was required.

But he also had another commitment to the committee, the strategic report that was due also around January, and he apologized profusely. He was hoping to have it here, but no plan in hand.

In 2007, I remember on the subcommittee we asked NNSA for the Nuclear Strategy for the 21st Century, and they said it was coming. And then they said, "Well, now, we may have the Nuclear Posture Review that was promised last November," that that is coming. And so it is these series of "it is coming, have faith."

Well, as I told you at the very beginning, my intent and I think a lot of the members of the subcommittee share this, was to look at these reports and see what the future was, where we were going, so that we can make decisions as we planned the 2011 budget. And so it is for us to be able to get the backup, the information, so we can make decisions that are rational. And now I think we have a bigger mandate since our administration has told us to be fiscally responsible, to make sure that the moneys are invested in the right way.

So I would ask you and recommend highly to you that you may want to talk to some of your Assistant Secretaries, Under Secretaries and the various personnel that you have. It is very important that they fulfill their obligation and bring in these reports to us, and the quicker the better. So that we can go on with our work, looking at your 2011 budget, and making decisions that are based on data that they have provided to us.

Secretary CHU. Well, I don't know if it is any small comfort, I will add my apologies. I knew about that obligation and we slipped.

And I will go back and make sure we redouble our efforts and get that back to you. We have slipped on that. There has been a lot of effort. These hubs are new. It is getting a very clear idea that it is very important to start these in the right way. So I've put a lot of direct, personal effort because it is something I take very seriously. So in the startups of the hubs, it wasn't clear, just as it probably was not clear for a little while. I hope to clarify that as best as possible to you and the other members of the committee and the staff of this committee. It was also not clear in the Department of Energy for a little while and we had to go round and round and round. And I had to essentially develop with my team exactly what we mean.

But we will take our responsibilities and our duties to you and this committee very seriously. And also, just along the apology part, certainly I misspoke in the Wall Street Journal article about—

Mr. FRELINGHUYSEN. We do read. They are usually pretty accurate.

Secretary CHU. In the Wall Street Journal article about our budget request, it is a request. But I think the Ranking Member will hopefully support me on that request. But it is a request and we—even I know that. So that I apologize that that slipped. I didn't catch it.

Mr. PASTOR. With a misrepresentation, I guess, on the reporter.

Secretary CHU. No, no. Whatever I wrote.

Mr. PASTOR. I am trying to get you a way out of this one. Rodney, as I understand now, the supplemental will be brought up after this series of votes. So we are going to clarify it, so as we leave we will know where we are at. Rodney.

Mr. FRELINGHUYSEN. Thank you, Mr. Chairman. I don't need to reiterate my unhappiness. I am just wondering, I have a few questions and you may want to bring a few reenforcements up to join you. I would like to clear up some matters relative to the legal authority for some of your actions relative to Yucca.

Mr. Secretary, Section 304 of the Nuclear Waste Policy Act establishes the Office of Civilian Radioactive Waste Management which will be headed by a director. Your budget request materials very clearly state that you are terminating the office. Are you requesting an amendment to the Nuclear Waste Policy Act?

Secretary CHU. No. I felt that this was something I discussed with general counsel in my office as to how to interpret that. And we respectfully believe that it is an authority in the Department of Energy that we can reallocate—

Mr. FRELINGHUYSEN. The office, as you are aware, was established by statute. I don't think you can do it unilaterally.

Secretary CHU. Well, all I can say is I am not a legal expert in this matter. But I did talk with our general counsel on it at some length.

Mr. FRELINGHUYSEN. I raise the issue. This is why some basic communication would help, despite the political dynamic and the determination that the White House is ironclad. You do have to have some statutory authority to do it.

On March 10th, the Department sent a Notice of Expected Separation to more than 150 DOE employees who may lose their jobs

as a result of the administration's Yucca Mountain policy. This puts them on notice that workforce restructuring opportunities may be available to them. It is a kind way to put it, including jobs in another part of the DOE. You are aware of this notice?

Secretary CHU. Yes.

Mr. FRELINGHUYSEN. Yes, of course. And are you aware of section 302 of our fiscal year 2010 act? Or maybe somebody behind you is.

Secretary CHU. Yes. Yes. We are seeking to reprogram the funds so that given the present administration's intent to close down Yucca Mountain, that given the expense of it, we thought it would be prudent to begin and to reprogram those funds.

Mr. FRELINGHUYSEN. Let me just read from that section. And I quote, "None of the funds appropriated by this act may be used to develop or implement a workforce restructuring plan that covers employees of the Department of Energy." All within quotation marks.

Now, I have asked the lawyers at the GAO to give me their preliminary opinion on this provision. But I am sort of looking for yours. And you are using fiscal year 2010 funds to restructure the Office of Civilian Radioactive Waste Management. And what is your authority for doing it?

Secretary CHU. Again, this is—

Mr. FRELINGHUYSEN. I don't want to get into moral authority. I am wondering what your legal authority is.

Secretary CHU. Absolutely. So on matters of legal authority, again, I look to the general counsel on this. And so we would be happy to discuss it, but again this is something where I was under the impression and advised that we, of course, needed to inform this committee and Congress of our intent to do this. But, I was told it was within our capability.

Mr. FRELINGHUYSEN. Some think that this provision only applies to the Defense nuclear facilities because of its original links to section 3161 of the fiscal year 1993 Defense authorization bill.

But a defense nuclear facility is defined in the act and I quote, "includes," in quotation mark, "a nuclear waste storage or disposal facility that is under the control or jurisdiction of the Secretary," end of quotation. That sounds pretty much like Yucca Mountain. I assume you would agree.

I think we need some clarity here. I know that determination has been made but quite honestly, I don't think you have the statutory authority to do it.

Secretary CHU. Well, I think this would require a longer discussion, you and I and our staffs on that.

Mr. FRELINGHUYSEN. We will have that. I welcome that.

Secretary CHU. Okay.

Mr. FRELINGHUYSEN. And I think, quite honestly, public opinion is behind having it, certainly in relation to the Blue Ribbon Commission that the Chairman and I have talked about. That always ought to be on the table. I know the word is out it has been eliminated. But in reality that is not our read there, nor is it in the statute which I cited there.

Secretary CHU. Okay. I am misunderstanding what you were saying because I was on an earlier comment. If the discussion is what the Blue Ribbon Commission—

Mr. FRELINGHUYSEN. That is one discussion. But I think to some extent if you move unilaterally, you are actually violating section 3161 of that 1993 Defense Authorization Act. Obviously we are going to see what we can do to get a little more clarity. And I welcome the discussion with you.

Thank you, Mr. Chairman.

Mr. ISRAEL. Thank you, Mr. Chairman. Mr. Secretary, I want to thank you for the work you are doing. Your Department has had a legacy of several decades I believe of unfilled potential, and I believe you are changing that. You are changing it in your management style, you are changing it your expertise, and you are changing it with new investments. So thank you for that.

I know we are going to go to votes fairly soon, so I will ask a very quick question. I am going to dispense with the wind-up and get right to the pitch. You and I have had conversations in the past about PACE bonds, Property Assessed Clean Energy bonds. You recognize that energy efficiency is low-hanging fruit to displace oil almost immediately. You also recognize that the best way of achieving that energy efficiency is to allow people to get a faster return on investment. And one good way of doing that is to incentivize local governments to help people finance those energy-efficiency retrofits in deployment of renewable energy, whether it is an individual homeowner or a major commercial property developer.

My question is—I have asked this to Secretary Johnson and Secretary Souza as well. I am going to pose it to you and then ask if you and I could follow up. I believe that the big game-changer in this would simply be for the Department of Energy to apply its existing loan guarantee authorities to guarantee local financing, to guarantee that when a municipality goes into the bond market to finance those retrofits, that the full faith and credit of the United States Government is behind those financings.

We passed that language in the climate change bill in the House. I am not sure you need an act of Congress to do that. You have the authority to simply say that some of your loan guarantee authority will apply to PACE bonds and other local financing.

So I am asking you today to give that deeper consideration. I know that there are some theories in the Department, but when can we have a conversation so that we can get to a decision by you on applying some of that loan guarantee authority to PACE bonds and other local financing mechanisms?

Secretary CHU. Congressman, first, yes, I am a big fan of the PACE mechanism of funding, upfront cash so homeowners and even businesses can do retrofits that will prevent out-of-pocket expenses and actually save them money on a month-to-month basis. We are looking at this—I am being assaulted now with a lot of legal questions.

In some sense I should have my younger brother, the lawyer, here. In any case, I have asked whether we, within our authority, can do this or not. But I do agree that it is something that we are very enthusiastic about and we would invite you over to the Department of Energy, so we can talk about that.

Mr. ISRAEL. I would like to have that conversation and also some certainty as to when the lawyers are going to give you an answer. I know it has been churning, but if we can do a little less churning

and a little more producing it would be good. If you can prioritize that, I would appreciate it and look forward to following up with you personally.

Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Simpson.

Mr. SIMPSON. Thank you, Mr. Chairman. Thank you for being here, Secretary. I appreciate it very much.

Let me say first of all, I appreciate the administration's response to the nuclear energy budget in this budget that you proposed. I see many administrations come through that say they support nuclear energy. Then when the budget comes in, it doesn't seem to do that. This is the first one that I have seen that actually looks like they are serious about nuclear energy. So I thank you for that. It is very important.

I told you I wasn't going to ask you anything about Yucca Mountain, and I am not; but I will make a statement and you can respond if you want to. You don't have to. The white elephant sitting in the room back there is—we all know why it is closing. Nobody wants to say it, but we all know why it is closing. It has nothing to do with science or anything else. It is just the reality. And I get it. It is going to close. But I do have one complaint. You are seeking to withdraw the license application. I understand why you are doing that. What I don't understand is why you are seeking to withdraw it with prejudice. Which means that some future administration, some future Congress, when we are all gone, can't decide those guys back in 2000 knew what they were doing and this maybe is a good place to put it.

Now, the Blue Ribbon Commission is not a siting commission. It is a process commission to look at how we are going to deal with this stuff. But we all agree that at some point in time we are going to need a geological repository. You said that last year. At some point in time, we are going to have to have some siting commission, some future administration, some future Congress, whoever, is going to have to have a siting commission.

Why not leave everything on the table instead of trying to tie the hands—and, in fact, this doesn't really tie the hands. What it does is just make it more expensive, because it just means you cannot reapply for the same license application. They could say we are going to expand Yucca Mountain. It is a different license application, and we can apply for it. All that withdrawing with prejudice says is you are going to have to go through some additional steps, maybe reducing the size of it, maybe expanding the size of it, change it somehow so it is a different license. That just means it adds cost to it. So I just don't understand why you would withdraw it with prejudice.

Having said that, I think what Ranking Member Frelinghuysen was saying was the ability of the Department of Energy to discontinue the OCRWM division, a division that was created by Congress, by statute, is questionable. And so we probably need some legal clarification or at least some discussions with you on that.

Having said all that, will you guarantee me that it is the intent of the Department of Energy to meet the milestones in the Governor's agreement to the State of Idaho, and does that include having all the SNF removed from the State of Idaho by the year 2035?

Secretary CHU. So in answer to your last question, the answer is a very simple "yes." We intend to fulfill our obligation. The reason we are withdrawing with prejudice is so that we give a very clear signal this administration does not intend to proceed, so we move on with it.

Mr. SIMPSON. Are you going to blow it up? It is a big hole in the ground. We have abandoned mines that we try to take care of. Are they going to put cement over it?

Secretary CHU. None of the above.

Mr. SIMPSON. I think it is a pretty clear indication that you have made. I don't think you have to withdraw with prejudice. I mean, you said we ain't going to pursue it.

Anyway, one other question. Loan guarantees. I appreciate the fact that you put out the \$8 billion in the conditional loan guarantees for the new reactors. It is a huge step forward. As you know, for front-end enrichment facilities, there are proposed loan guarantees that are currently before the Department of Energy. I talked with the Under Secretary of the loan guarantee program, the director of the loan guarantee program. There have been applications that have been going on for about 18 months. His goal is to try to reduce that to 4 to 6 months.

Any idea when we are going to see any type of results from the loan guarantee on the front-end enrichment? And I also applauded your decision yesterday with the 45 million that you have committed to USEC, at Oak Ridge and so on. I think that is the right step. I don't think these companies have to be in competition with one another. The fact is we need all technologies.

Secretary CHU. Yes, I agree with that. And what we are doing is we are proceeding on the two front-end loan guarantee applications. They are on different timetables. One is not holding up the other. We are trying to work and finalize arrangements so that we can finance both of them. I think that is proceeding forward. So, in fact, if what we hope is to restart the nuclear industry, we will need both.

Mr. SIMPSON. Could you tell me how the credit subsidies are determined in the loan guarantee program?

Secretary CHU. Very, very complicated issue. It depends on the financial stability of the assets of the company; in case of default, what the Federal Government could put liens on. These are complex determinations on the bond rating, if you will, that accompany many other things, the assets. And then we determine a range. And then through discussions with OMB, a credit subsidy is finally determined.

Mr. PASTOR. Thank you. Mr. Davis.

Mr. DAVIS. Mr. Chairman, thank you very much. And, Mr. Secretary, thank you for being here today. My father always told me if you want to hear a sermon, be sure you have a preacher that is preaching it. And if you want someone to operate your farm, be sure you get a farmer. Now, I use those two analogies for a reason. If you want someone to be the head of the Agency for Energy Research and Development, get a scientist and someone who has been there and done that and knows what they are doing.

I am pleased for one of the few very first times, we have a Noble Laureate and someone who gets it. Someone who is willing to ques-

tion even what may be going on in the laboratories, if necessary, and to be sure that those individuals we have tasked with certain responsibilities are fulfilling those responsibilities.

I have been impressed with your leadership of this Department and I am sure that in the future we will even be more impressed as you continue to work to be sure that America's energy needs and our national security needs will be met.

I hear a lot about climate change being discussed. In my district, it is a very rural district, and there will be folks who challenge me on all cases, generally: Climate change is not occurring; there are just changes in certain cycles. And I say, "So you believe that it is a cyclical process?" "Yep." "So you think we go through cycles on the Earth and therefore the temperatures change." They say, "yeah." And I say, "So you believe in climate change." "Oh, yeah, but I don't believe man has anything to do with it." And then you say, "Well, if we are talking about an energy policy, climate change, you are pretty happy that we are talking about removing the hold from our throat that foreign countries have on us that are supplying us with energy."

So, should we call this an energy policy? Should we shift the title of what we are doing? Because everyone wants cheaper energy.

My wife and I built a house many years ago when we put a split-unit electric system in it. The air handler was in the basement and the outside condenser was outside. And then natural gas came, and we put a natural gas system in. And then that ran out because they were using the wells in the area—I am getting to energy efficiency. And then when the natural gas ran out, we put in another propane. And eventually, about 2 years ago, we put in a high-efficiency electric unit that has saved us 65 percent or better of the energy we consumed the last 30 years in that house, on an average annual basis, if you look at the kilowatts that we use per month by using the highly efficient unit.

So for me, I think there are many, many parts of the puzzle when we talk about becoming closer to energy independent, and becoming more and more economically secure, and having more national security as we look in the energy policy that brings us there.

So from where I am sitting, I am looking at someone like you that has the experience, has the knowledge. Where do you see our country being a decade from today as it relates to all of the proposals we are seeing in the area of energy? And what do you expect our labs to be able to do to make us more energy independent and less dependent on nations who may not be our friend?

Secretary CHU. Well, I agree with you. I think the lowest-hanging fruit is to promote energy efficiencies. Show homeowners, show individuals, show companies, how to decrease their energy usage so they save money and create incentives and really show this can be done.

I do this personally in every home I've lived in. Well, there is one that was built very recently that I didn't have to do much. In every other home that was older I personally, with my own hands, weatherized these homes, putting insulation in, and I got huge energy savings immediately—and a more comfortable home.

And so I think that is one of the things. In 10 years' time we hope we will have then piloted successfully and deployed at scale

energy-efficiency programs that homeowners can immediately start saving money using finance mechanisms so there is no out-of-pocket cost, but on a monthly basis they are saving money. I think we want to do the same in industries, factories, and commercial buildings.

So these are some of the things that we want to push as hard as possible. We also want to develop and push the continuation of cleaner forms of energy, to develop cleaner ways of using fossil fuel as we develop renewable energy.

So I see within 10 years a growth of wind, I see solar photovoltaics dropping at least by a factor of 2, hopefully a factor of 3 in price. Factor 4, magic will occur. But then, without subsidy, everyone will put it on their roof. I see batteries that will have twice the energy density of today's batteries, so we can have plug-in hybrids at a massive scale. In 10 years, we begin to massively deploy—it is simply, again, saving more money because you can plug your car in, and if we have batteries that are compact and could last 15 years, that were at the target price we want, you are driving your car in the first 40–50 miles with maybe three times less cost and decreasing our oil dependency. In 10 years' time, what I see in the battery technology, I think this will happen.

Mr. DAVIS. I think also, as I see the increasing of potential loan guarantees for those reactors in nuclear energy, is that also an area where you see expansion?

Secretary CHU. Yes, very much so. I think it is the intent of the administration to—and this is why we are requesting 36 billion in additional loan guarantee authority. So that we can show that the new generation 3-plus reactors can be built on time, on budget, that it makes good economic sense. And then the private sector, the financial companies will say, this makes good economic sense, it is a good way to baseload clean energy, and they will take over. That is the strategy.

Mr. PASTOR. Mr. Rehberg. Calvert.

Mr. CALVERT. Thank you, Mr. Chairman. And thank you, Mr. Secretary. It is always great to see a fellow Californian out here today.

As you know, not all solutions for energy are high-tech. Some solutions are relatively low-tech, and one of those was a number of companies that are coming out with new roofing granules, so-called cool roofs. You talked about them. President Obama has talked about them. And as a matter of fact, 3M Corporation that make these roofing granules just happens to be in my congressional district. It's a low-tech solution that works, brings down your energy costs substantially.

And since you both have talked about it, you continue to be a strong proponent of those technologies, could you encourage homeowners to install cool roofs when possible?

Secretary CHU. Yes. The answer is yes.

Mr. CALVERT. Okay. Then you know in this Home Star legislation that is now being considered here in Congress, the so-called Silver Star rebate to consumers who make energy-efficient upgrades such as insulation and other things that you have talked about. Which I think is great. But I think other products also need to be considered. I know you cannot have an open-ended process on

this, but certainly these ideas that have substantial energy savings I think you should look at. Would you agree that it makes sense to add cool roofing to the list of products eligible for Silver Star rebates?

Secretary CHU. Yes.

Mr. CALVERT. Well, good. That is good to have that on the record. That was easy.

I understand that you sent notification on February 17th that the Department intends to reprogram \$115 million of the remaining fiscal year 2010 funds to close Yucca Mountain, which was not at all what those funds, as you know, were intended for. And I should note at this point the committee has not approved or denied that reprogramming. So I would expect that no action has yet been taken; is that correct?

Secretary CHU. That is correct. We are waiting on the ruling from the NRC.

Mr. CALVERT. Well, do you intend to reprogram those funds without congressional approval?

Secretary CHU. Well, that again goes back to this legal question that we need to—

Mr. FRELINGHUYSEN. We would like the answer “no.”

Secretary CHU. We will work on clarifying the legal question.

Mr. CALVERT. You do not know. You may?

Secretary CHU. I hear a difference of opinion between Ranking Member Frelinghuysen and our lawyers. So we need to work that out.

Mr. CALVERT. So the answer is you may make a determination to reprogram those funds without congressional approval?

Secretary CHU. Let’s say before we do anything, we are going to have a discussion with this committee.

Mr. CALVERT. Okay, that is fair enough. I will just leave it at that. Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Berry.

Mr. BERRY. Thank you, Mr. Chairman. Thank you, Mr. Secretary, for being here.

My question relates to Yucca Mountain also. It is my understanding that you intend to continue to collect the nuclear waste fees, but there is no Yucca Mountain anymore and we do not know what we are going to do. And we still have to spend the money to take care of this stuff while it is on site.

What are we going to do? Why are we even collecting those fees? Why don’t we think about returning them, if we do not know what we are going to do with them?

Secretary CHU. Well, this is one of the charges of the Blue Ribbon Commission, to first determine the appropriate fee collection as they make recommendations to me, the President, and Congress on how to move forward with better solutions. So one of the charges of that committee is to look at the fees.

But I would have to say that we need that money for the the long-term disposal of the permanent waste. We will need that money for the current storage. But the rate, the fee, all those things, that is part of the charge of the Blue Ribbon Commission.

Mr. BERRY. I guess my first reaction to that was that if we collected fees or taxes for everybody that needs it, there would not be

anything left. It would take all the resources of the entire world. I do not consider that to be an acceptable situation.

How long is it going to take this Blue Ribbon Commission to do their work? Are we going to be bound by that, or are we still going to have to pass legislation? Or is the Department of Energy going to be able to decide after they receive that information from the commission?

Secretary CHU. Well, the Blue Ribbon Commission is actually beginning to meet tonight and tomorrow on this. The chairs, General Scowcroft and Congressman Hamilton, are very eager to get on with this and to deliver a report before the announced deadline. They want to do this as soon as possible. So we do not want to delay.

But again, we also want it to be a thoughtful process, where this very distinguished committee and any subcommittees they choose to form can really look at this and give us advice. And what we know today is really different than where we were in 1982 and the mid-1980s.

The quote in the Wall Street Journal interview is correct. We are in a different place. We know more. I think we would like the Blue Ribbon Commission to take that new knowledge—and, quite frankly, we do want to restart the nuclear industry in the United States. That is part and parcel of a lot of things.

Let me also say with regard to everybody's favorite topic, Yucca Mountain, that things evolved from the first time a decision was made. The Supreme Court ruling changed things. As we went more into it, things changed. Over a period of years, the determination was made that in order to make this repository work and the requirements that were not anticipated at the beginning of this, a titanium shield had to be constructed which was not budgeted, which, you know, rough estimate, this is an additional \$5-plus billion.

And so as things progressed along it looked like, you know, what was happening? Now we want to take stock and get this very distinguished committee to say, give us advice, nonpartisan advice.

Mr. BERRY. The people that made the original decision, were they not distinguished? Or very distinguished?

Secretary CHU. Everybody was very distinguished. No, seriously, what has happened is that the requirements changed. There were a few things. The most notable requirement was 10,000 years to a million years, a very different requirement. And so there were all sorts of things that were changing from the mid-1980s to today.

Mr. BERRY. Thank you, Mr. Chairman. Thank you, Mr. Secretary.

Mr. PASTOR. Quick question. You know the language for the charter. And as written it says, we think including a deep geologic disposal—that Yucca Mountain should be considered.

And the charter also says that—it references that the Secretary—such other matters the Secretary deems appropriate.

And I guess the question is, as directly as I can put it: Have you told the Blue Ribbon Commission that Yucca Mountain is not an alternative to be considered?

Secretary CHU. Yes.

Mr. PASTOR. So therefore it is not.

Secretary CHU. Correct.

Mr. PASTOR. Well, I have to tell you that it was our intent—and the legislative history was that Yucca Mountain, should also be considered. But that is, a political battle we will have to fight somewhere else. So thank you.

Mr. Frelinghuysen.

Mr. FRELINGHUYSEN. Just following up on Congressman Calvert's question on the notification to the committee on the intent to reprogram. If you have not made a decision—that means you are responsible for executing the plan as Congress directed.

Secretary CHU. No.

Mr. FRELINGHUYSEN. Tell me why that is wrong.

Secretary CHU. Let me clarify.

Mr. FRELINGHUYSEN. We understand that if you do not do anything, that you ought to proceed with continuing on the license application.

Secretary CHU. Let me try and state it a little clearer. A decision was made in the administration to discontinue advancing Yucca Mountain. But I thought the question was: Are we going forward with this? We cannot go forward with it until the NRC rules on it. Okay. So given that, we are waiting for an NRC ruling, so we have applied to the NRC to say we want to discontinue. They make a ruling. So we would like to discontinue it, but you have to go through these procedures.

Mr. FRELINGHUYSEN. So until we go through those procedures—

Secretary CHU. Right. Until the NRC says we accept your application to withdraw, we cannot do that.

Mr. FRELINGHUYSEN. In the time remaining, can you put a little meat on the bones relative to what you have done to create jobs under the stimulus bill? I know you have talked about numbers.

We see from time to time, and I will not pull them out of a hat here, we do some good things—invest in smart grids—and then some suggest we lose 36,000 meter reader jobs.

I wonder, can you paint a picture for us of the money that has been spent—so we understand the difference. You say you have obligated \$26 billion? Tie some job numbers to that. And if you can, distinguish between private sector jobs and adding on people to State payrolls and stuff like that.

Secretary CHU. Sure. We believe that most of the Recovery Act money is stimulating private sector jobs. Our experience is, once we obligate money, that all of a sudden starts a stream of activity. People go out and hire. The so-called costs that are spent is a bill. After you have done the work, then you apply for the bill. So that is followed by a month, maybe later.

So once you have said, okay, we have selected an organization, a company, whatever, and then you finally obligate the money, they go out and they start hiring. So we have many, many examples of that—

Mr. FRELINGHUYSEN. I do not mean to be crass, but I did visit your Web site. And I assumed, under your tutelage, that Web site would be of the highest quality. I saw nothing on the DOE's Web site where we have these types of figures. And I cannot see any-

thing on there as to how jobs are being created by program. Have you taken a look at your Web site?

Secretary CHU. Yes, I have. But let me just—

Mr. FRELINGHUYSEN. You are telling me it is all there?

Secretary CHU. Did you look at the DOE Web site or recovery.gov Web site?

Mr. FRELINGHUYSEN. I assume you have command over the DOE Web site. You have got more money, obviously, close to \$40 billion, that you might as well take some credit for creating jobs on your own Web site. So you are telling me that the Recovery Act has its own Web site?

Secretary CHU. That is correct.

Mr. FRELINGHUYSEN. And has sucked away—has the totals, but you do not have them on your Web site?

Secretary CHU. Well, we have the totals. And so what you are asking—I do not know. I have to ask my people, whether when you click on the DOE Web site, whether there are links that guide people. But there was, a very good reason for trying to consolidate all the Recovery Act money on a single Web site so you can click around, independent of the Agency.

Mr. FRELINGHUYSEN. Yeah, but nobody proportionately got, quite honestly, as much money as you did. And I am sure you are putting it to good use. If we need any more clarity, we will look at the other Web site.

Secretary CHU. And I will make sure that on the home page of the DOE Web site, there is an easy click to the recovery Web site if you want to do that, if it is not there already. But I will certainly do that.

Mr. FRELINGHUYSEN. Thank you, Mr. Secretary. Mr. Chairman, thank you.

Mr. SIMPSON. Mr. Secretary, as I understand it, the NRC can let you withdraw it with prejudice, they could let you withdraw it without prejudice, or they could deny you from withdrawing the license application. In any case, if they let you withdraw it, waste confidence is an issue as we move forward.

Are you going to propose legislation to effectively legislate waste confidence?

Secretary CHU. Well, again, we are going to take it one step at a time. The Blue Ribbon Commission is there to look at what we know now; also they will anticipate things being developed for the coming decades. The NRC believes that the current dry-cask storage of waste, does not impose an immediate environmental threat. We can do this. Also we can store it safely, securely for many decades. And so we have time to develop a strategy.

So the Blue Ribbon Commission is being asked to make recommendations, including legislative recommendations that would then go to Congress. Rather than jumping at this, given that the NRC has said that it could be a half-century or century before it becomes an environmental challenge—

Mr. SIMPSON. Let me just make one other comment that you can comment on. One of the things that has concerned me is we talked a lot about the science and technology, all important work. But at some point in time, this stuff has got to get out in the real world.

I think ARPA-E is a great start for particularly small new technologies. Those things that might not be able to compete in the real world until they have a chance at this kind of thing.

What about NGNP? You know, I understand you awarded \$40 million for the design work to two companies for two different designs on, what, the Prismatic reactor and the Pebble bed reactor? You are now negotiating final cost-share.

When are we going to start working with industry so that I, as an appropriator, and we, as an Appropriations Committee, know what is going to be expected of us? What is going to be the government's responsibility and share? And when does industry step in and when are they going to take over?

We need some, formal type organization, that works this out ahead of time. I am surprised that after awarding these two things that we are now discussing with them cost-share. You would think that would almost have been a done deal before the bids were awarded.

I am just saying, are we doing it right? Do we need a better organizational structure to work with industry? Because ultimately we can do all the science in the world; if industry doesn't want it, it doesn't mean anything. It has got to be deployable.

Secretary CHU. I agree. But you know, I think the Department of Energy has been a good partner with industry and with Congress. Legislation had a program to help companies go through the licensing, for example, for the new AP-1000 nuclear reactor that is still in this process. But that program after 2010 is ending, and it is well on its way.

So in these issues, any new design reactor, if industry is not going to pick it up, we don't really want to see it. These are big, expensive things.

And so we will continue doing this in the small modular reactors. There has been a lot of new industry interest in this. So we are facilitating that; facilitating the licensing, so we can actually help initiate getting it going. But eventually you want to step back and say, look, is this going to stand on its own?

For example, this generation of nuclear reactors like the AP-1000. You know, after you have built a couple of them, two or three. That should be enough proof that you can build these things on time, on budget. Then let industry decide.

Mr. SIMPSON. Okay. Let me ask just one follow-up, and then I can be done, Mr. Chairman, and I don't have to come back.

Mr. PASTOR. We are not coming back.

Mr. SIMPSON. So I will be done. If the NRC denied your withdrawal of the application, what would that do to your fiscal year 2011 budget?

Secretary CHU. Good question. I think we are going to have to regroup there, wouldn't we?

Mr. PASTOR. Be another reprogramming.

Secretary CHU. I don't know. We will see.

Mr. SIMPSON. So there is no ancillary plan?

Secretary CHU. I think if they deny our request, then we will have to—

Mr. SIMPSON. Reassess.

Secretary CHU. We will have to reassess where we are.

Mr. FRELINGHUYSEN. Let me just push for better communications between all of us. So if there are some issues you are moving on, I think it is important to let the committee leadership, the committee members, know.

Secretary CHU. Okay.

Mr. FRELINGHUYSEN. If you can give us that assurance.

Secretary CHU. Yes, I will.

Mr. FRELINGHUYSEN. We are educable.

Mr. SIMPSON. Some of us.

Mr. FRELINGHUYSEN. Some of us more educable than Mr. Simpson. But he is very knowledgeable, as you know, certainly when it comes to Idaho and nuclear issues. But I am headed out to Berkeley and to Livermore to see what is going on out there.

We would like better communication, generally speaking, between you and our membership.

Secretary CHU. You have my pledge. With regard to, for example, that letter. I have been frustrated with the time delay of some of the letters, not only from Congress but in general. And as I sign some of these things, I am actually looking back at the tortuous route and why did it take 4 months. So we have a new person in the Department, executive secretary, that will hopefully accelerate this. There is no reason in the world it should be taking 4 months to answer letters.

Mr. FRELINGHUYSEN. Thank you. Thank you, Mr. Chairman.

Mr. PASTOR. Mr. Secretary, thank you very much for being with us.

This will conclude the hearing, because after this series of votes we will get on with the supplemental on the floor. And the committee rule is that if there is appropriations business on the floor that the subcommittee cannot have hearings.

So we thank you for being here with us this afternoon. You have heard some of the comments from some of the members and some of their concerns. Just to remind you from the beginning of my statement, there will be questions for the record.

Secretary CHU. Right.

Mr. PASTOR. And if you could answer them within the time period requested, we would greatly appreciate it. And as Assistant Secretary Miller said yesterday, next time we see each other the plan will be in hand. So I hope that all the other plans that are due through the hubs and the other ones, we will have soon.

So I need to look at some of these plans to dictate what happens in the future. So I would appreciate it very much. And I wish you a great day, and congratulations on your tenure at the Department of Energy.

Secretary CHU. All right. Thank you.

Mr. PASTOR. That concludes the hearing.

QUESTIONS FOR THE RECORD
ENERGY AND WATER DEVELOPMENT SUBCOMMITTEE
HOUSE COMMITTEE ON APPROPRIATIONS

DEPARTMENT OF ENERGY FISCAL YEAR 2011 BUDGET HEARING
MARCH 24, 2010

I. MANAGEMENT LEADERSHIP

Question: Mr. Secretary, you have repeatedly stated that management is one of your top priorities at the Department. The Committee has, for years, been emphasizing reducing waste, fraud, and abuse as a priority through its oversight efforts on project management, cost estimating and elimination of redundancies. After one-year on the job, what would you consider your major accomplishments with regard to improving management?

Answer: Management reform is one of my top priorities. Three accomplishments in the last year are indicative of my long-term vision for management throughout the Department: 1) Applying the speed and transparency of Recovery Act; 2) Launching innovative programs such as the Advanced Research Project Agency – Energy (ARPA-E); and 3) Streamlining processes such as loan guarantee approvals.

First, we changed the way we do business, selecting (by March, 2010) over \$32 billion in Recovery Act (ARRA) projects with unprecedented speed, accountability, and transparency. We are on track to award \$32.7 billion in ARRA contract and grant appropriations by the end of the fiscal year. We have established data hubs to synthesize information on finances, performance, risks, implementation schedules, benefits, and costs to facilitate more informed decision-making. This enables us to provide exceptional customer service to our stakeholders and local governments.

Second, I stood up the Advanced Research Project Agency – Energy in 2009, with \$400 million in Recovery Act seed funding. ARPA-E uses an entrepreneurial funding model to invest in high-risk, high-payoff concepts that could transform the ways we generate, store, and utilize energy. The program responded to intense demand for its initial Funding Opportunity Announcement by convening experts to process more than 3,600 concept papers (with each paper receiving at least two reviews), and consider 338 full applications for the selection of 37 promising projects.

Third, in 2009, we successfully streamlined review processes to offer the first conditional loan guarantee commitments. The previous administration was unable to complete a loan guarantee award since the program was authorized through the 2005 Energy Policy Act. We have now offered 13 conditional commitments for eight projects, and closed one. These projects will help meet our goals to double renewable energy and restart the nuclear industry in the United States.

In addition to these accomplishments, we have also instituted several departmental management reform initiatives. We released our Departmental Management Principles on December 2, 2009, and our Project Management Principles (March 4, 2010). The former set of principles highlights our management approach (such as rigorous peer review, managing risk, fiscal responsibility) and the latter guide how DOE will strengthen front-end planning, and improve our oversight, cost-estimating capability, and staffing levels. We are also reviewing our safety and security directives to improve results while assuring that these support functions are thoroughly integrated into our line management.

We also created venues for open exchange for DOE's HQ, labs, and field sites:

- Operations Management Council, which addresses mission-support functions. Topics covered have included cyber security, managing space at headquarters, peer review processes, DOE's sustainability plan, improving contract and project management, and re-engineering of the funds distribution process. We stood up this body on recommendation by the National Academy of Public Administration (NAPA).
- Program Reviews, which focus on goals and challenges in achieving DOE's mission, and enhance coordination between program and support offices.
- Field Management Council, which enables field leaders to discuss site issues and present priorities and challenges to DOE leadership.
- National Lab Directors Council, which enables lab directors to discuss issues of joint concern with HQ.
- Project Reviews, which focus on projects over \$750 million, as well as those that are experiencing difficulties in meeting their cost and schedule objectives.

Question: What have been your disappointments?

Answer: Given the urgency of our mission, I would have liked to see more and faster results from our management reform efforts in the first year. However, we are still striving to promote the management excellence I envision for DOE. One source of optimism is the genuine reform achieved in establishing Recovery Act projects and programs, and the possibility of applying those reforms across the DOE enterprise. For example, the robust web-based analytics adopted for Recovery Act projects will be instrumental to our future management reform successes. Second, although we have made strides to improve our contract and project management culture, we inherited some projects that already were not meeting the original scope, cost, and schedule commitments, and we have not yet achieved the performance I would hope for in all cases. That said, since the Root Cause Analysis and Corrective Action Plan were completed in 2008, all of our new projects are on track to be successful. I am disappointed that we have not made greater strides yet, but we are committed to keep working hard at it.

Question: What are your top management agenda items in the fiscal year 2011 budget request?

Answer: In FY 2011 we will use the momentum from the Recovery Act and our early successes to embark on broader management agenda. Our management reform initiatives, stemming from the aforementioned principles and venues, include:

- Safety/Security Reform: Reforming DOE's framework of **requirements and oversight** to enhance productivity and achieve our vital and urgent mission goals, while maintaining the highest standards of safe and secure operations.
- IT/Cyber Security: Keeping sensitive information secure and facilitating open collaboration for non-sensitive work.
- Project and Contract Management: Improving DOE's project and contract management culture through strengthened front-end planning, improved staff levels, comprehensive change control, better cost estimating, and enhanced oversight and contract administration in order to get off and stay off the GAO High-Risk List.

- Transparency. Deploying an upgraded version of our Project Assessment and Reporting System, to provide accurate, timely, complete, and verifiable project performance data, enabling greater transparency and data analysis.
- Greening DOE: Reducing DOE's GHG 28% by 2020 and meeting other energy and sustainability goals within the Department as required by Executive Order 13514, including an integrated strategy for sustainability.
- Competitive Financial Assistance Awards: Developing consistent methods for performing high quality peer-review and competitive project selection.
- Hiring Process: Reforming workload distribution, workflow, enhanced use of technology, and timely executive-level hiring.
- Strategic Sourcing: Improving Departmental coordination to increase cost savings and process efficiencies and incorporate sustainability at the federal and contractor levels through the Energy-wide Strategic Sourcing Program (e.g., Supply Chain Management Center, Contractor Purchasing Council, Integrated Contractor Purchasing Team).
- Presidential Contracting Initiatives: Achieving OMB goals and objectives relating to the implementation of Presidential initiatives for reducing contract spending, reducing the use of high-risk contracting instruments, increasing competition, and improving management of the multi-sector workforce.

2. WASTE, FRAUD AND ABUSE

Question: Last month *The Hill* reported on Speaker Pelosi's efforts to crackdown on wasteful spending. In her April, 2009, letter to each of her chairmen, she required them to not only produce a schedule of hearings that would highlight areas of waste, fraud and abuse within the Federal budget, but each were further requested to provide a list of programs that are deemed wasteful and to target them for elimination. That is not something you would have much insight on, and frankly, I have little more visibility into how this request has panned out than you would have. But, it is a practical exercise and one that should be applied across government agencies, as well. As you produced this budget request, were the program offices directed to carry out a similar request to eliminate inefficient or underperforming programs?

Answer: The Department of Energy followed the Administration's guidance, issued June 11, 2009, by OMB, to pursue terminations and reductions and to achieve administrative savings. The Department's efforts are reflected in the "Terminations, Reductions and Savings" volume that accompanied the President's Budget request in February. Among these terminations and reductions, the Administration proposed to eliminate the Ultra-Deepwater Unconventional Natural Gas program (\$50M), discretionary research and development on unconventional fossil fuel production (\$20M) and termination of the refurbishment of the Los Alamos Neutron Science Center (LANSCE) (\$20M).

Question: The Speaker requested a list of initiatives "aimed at reducing costs, ending duplication and promoting efficiency", again a prudent exercise. Can you share with the Committee any similar initiatives that you may have already implemented or have under consideration?

Answer: Another set of initiatives the Administration put forward to improve efficiency and reduce costs was captured in the Securing Americans' Value and Efficiency (SAVES) program. The Department is exploring ways to cut our travel costs by making greater use of video teleconferencing technology where and when appropriate. Our goal is to reduce the FY 2011 travel expenditures by 5% versus those recorded by the Department in FY 2009.

3. GOVERNMENT ACCOUNTABILITY OFFICE (GAO) HIGH-RISK LIST

Question: The Department of Energy has been on the GAO high-risk list since its inception in 1990. The Department's cost-overruns, schedule delays and other management shortcomings on its major operating and construction projects are well-chronicled. What specific steps have you taken over this past year to see that the Department gets removed from the GAO high-risk list with respect to management of its projects and contracts?

Answer: The Department is firmly committed to the continuous improvement of contract and project management and removal of all departmental organizations from the GAO High-Risk List. The Department has undertaken fundamental systemic reforms that are being implemented under the Root Cause Analysis / Corrective Action Plan (RCA/CAP) to improve contract and project management such that the Department is removed from the GAO High-Risk List. Specific actions undertaken (starting Fall 2007 and continuing into the future) as part of the RCA/CAP include:

Improved project front-end planning by increasing focus on requirements definition and technology readiness and segmenting large projects into smaller, more manageable, complete and useable projects.

Enhanced federal contract and project management workforce by developing a Departmental staffing model to influence staffing levels by functional area (e.g., construction oversight and management) for specific projects.

Improved project risk assessment, communication and management by centrally making available risk management tools and providing protocol on application of contingency and management reserve to project teams.

Aligned and integrated budget profiles and project cost baselines by issuing full funding, incremental funding and project affordability policies.

Improved independent government cost estimates through establishing the Office of Cost Analysis and conducting independent cost estimates on major projects.

Improved acquisition strategies and plans by better defining requirements up-front, which enabled a shift to awarding more firm fixed-price contracts (a contract type in which the contractor, not the government, bears the cost and performance risk).

Improved project oversight and management by procuring, expanding, and piloting a project assessment and reporting system (PARS-II) in which the contractor's project data is directly uploaded into the government system. This will provide timely, accurate, consistently reported, and auditable project information.

Additionally, the Department has exported an Office of Science best business practice to conduct "Project Peer Reviews" across the Programs.

Improved adherence to project management requirements by reviewing contract and project management policies and directives for consistency, clearly defining roles, responsibilities, and authorities, and incorporating best practices.

4. CONGRESSIONAL REPORTING REQUIREMENTS

Question: Provide for the record a list of all reporting requirements contained in the fiscal year 2010 Appropriations Act, or the corresponding House and Senate reports, the response, or if the information is not yet available, the schedule for completion.

Answer: Attached is a listing of all Department of Energy reporting requirements contained in the fiscal year 2010 Appropriations Act.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports

Completed Items for Energy Efficiency and Renewable Energy

from 10/30/2009 to 04/21/2010

Completed

REPORT	RESPONSIBLE OFFICE Contact	DATE DUE * Category	REPORT REQUIREMENT	STATUS
2. (ESCS-4955 / EXEC-2010-001818) Report on the selected Hub's progress, including site selection, staffing, & progress towards research goals. Also a plan for incorporating input from industry & the scientific community when it selects research topics for Hubs in budget requests.	Energy Efficiency and Renewable Energy	04/01/2010	Administrative Limited Duration (1) FY 2010 Energy and Water Appropriations, HR-111-209, Page 81	Completed on: 04/09/2010
3. (ESCS-4959 / EXEC-2010-006370) Quantify and track the progress and impact of the substantial invests the Committee has made in EERE. The Department shall report on an annual basis on the return on investment for each of the accounts.	Energy Efficiency and Renewable Energy	12/31/2010	Administrative Annual FY 2010 Energy and Water Development Appropriations, HR-111-209, Page 89	Completed on: 04/21/2010
4. (ESCS-4961 / EXEC-2010-003320) Report on strategic plan for prioritizing investments in EERE technologies & activities to increase the supply of clean, affordable energy; reduce energy demand; decrease Nation's dependence on foreign oil; & reduce greenhouse gas emissions.	Energy Efficiency and Renewable Energy	04/01/2010	Administrative Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR 111-209, Page 95	Completed on: 04/21/2010

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports

Completed Items for Office of Nuclear Energy

from 10/30/2009 to 04/21/2010

Completed

REPORT	RESPONSIBLE OFFICE Contact	DATE DUE * Category	REPORT REQUIREMENT	STATUS
1. (ESCS-4951 / EXEC-2009-017205) Report detailing the Department's site selection process, progress measurement plan, and the Hub's specific research goals and milestones.	Office of Nuclear Energy	12/01/2009	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 101	Completed on: 04/09/2010
2. (ESCS-4956 / EXEC-2010-001817) Report on the selected Hub's progress, including site selection, staffing, & progress towards research goals. Also a plan for incorporating input from industry & the scientific community when it selects research topics for Hubs in budget requests.	Office of Nuclear Energy	04/01/2010	Administrative Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR 111-209, Page 81	Completed on: 04/09/2010
3. (ESCS-4964 / EXEC-2009-017314) Submit a detailed nuclear energy R&D strategy and program plan (Roadmap Report)	Office of Nuclear Energy	01/04/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR 111-203, Pages 103-104	Completed on: 04/15/2010
4. (ESCS-4965 / EXEC-2009-017313) Report on NGNP regarding research conducted and a detailed accounting of the funds appropriated to date.	Office of Nuclear Energy	01/04/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 115	Completed on: 04/05/2010

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports

Completed Items for National Nuclear Security Administration

from 10/30/2009 to 04/21/2010

Completed

REPORT	RESPONSIBLE OFFICE <small>Contact</small>	DATE DUE * <small>Category</small>	REPORT REQUIREMENT	STATUS
1. (ESCS-4972 / EXEC-2009-017310) Submit a detailed description of current work done at LANSCH, specific explanation of alternative sites, an analysis of budget resources, including security costs for upgrade of site.	National Nuclear Security Administration Robert Hannaman 202-386-4600, NA-10	01/04/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 128	Completed on: 03/19/2010
2. (ESCS-4978 / EXEC-2009-017439) To better inform budget formulation, develop a risk-based prioritization scheme for all nuclear nonproliferation programs, include R&D.	National Nuclear Security Administration Michael Czornofez, 202-586-9686, NA-20	01/28/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Pages 85-86	Completed on: 04/08/2010

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports

Completed Items for Office of Science
from 10/30/2009 to 04/21/2010

Completed

REPORT	RESPONSIBLE OFFICE Contact	DATE *	REPORT REQUIREMENT	STATUS
		DUE Category		
1. (ECS-4952 / EXEC-2009-017204) Report detailing the Department's site selection process, progress measurement plan, and the ESO's specific research goals and milestones.	Office of Science	12/01/2009	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriation, CR 111-278, Page 101	Completed on: 04/09/2010

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)
Items Due for Office of the Chief Financial Officer
Through 12/31/2010
Overdue

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ESCS-4954 / EXEC-2009-020871) Not later than March 1, 2010, develop and implement a PPBE process, including five-year budget planning, for all programs and all projects exceeding \$100M.	Office of the Chief Financial Officer	03/01/2010	03/01/2010	Statutory Limited Duration (I) FY 2010 Energy and Water Development Appropriation, CR 111-278, Page 78	Report is still being generated and is expected to be completed by the end of April.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Office of the Chief Financial Officer

Through 12/31/2010

Due within 30 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
2. (BSCS-4953 / EXEC-2009-017203) Report on specific activities undertaken & underway to improve its cost estimating practices, how activities are being coordinated, who has responsibility for coordinating, & what performance metrics the Department will use.	Office of the Chief Financial Officer	05/01/2010	05/01/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriation, CR 111-278, Page 78	Report is still being drafted, however it has to be coordinated with other offices. Expect to be completed by mid May.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Office of the Chief Financial Officer

Through 12/31/2010

Due within 60 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
3. (ESCS-4938 / EXEC-2010-003318) Submit an Annual Financial Balance Report (instead of the semi-annual report included in the House report)	Office of the Chief Financial Officer	05/31/2010	05/31/2010	Statutory Annual FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 101	On schedule. This report replaces the uncosted balances report.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Office of the Chief Financial Officer

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
4. (ESCS-4949 / EXEC-2009-017121) Annual Report on the Status of Work for Other Activities in Each of the National Labs and DOE programs	Office of the Chief Financial Officer	12/31/2010	12/31/2010	Statutory Annual FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 101	CF expects to meet the due date. The report will need to go through Departmental clearance before transmitting to the Hill.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Energy Efficiency and Renewable Energy

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ESCS-4960 / EXEC-2010-006571) The Committee directs DOE to use the available funding to validate economic & technical viability of a variety of technologies, & report on the prospect of each of the technologies.	Energy Efficiency and Renewable Energy	09/30/2010	09/30/2010	Statutory Annual FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 103	EE expects to meet the due date.
2. (ESCS-4962 / EXEC-2010-006572) Report on the variety & density of recharging infrastructure options necessary to support significant penetration of plug-in, electric drive, light-duty vehicles; progress of secondary applications & disposal of electric drive vehicle batteries program.	Energy Efficiency and Renewable Energy	12/31/2010		Administrative Limited Duration (L) FY 2010 Energy and Water Development Appropriations, SR 111-45, Page 92	EE expects to meet the due date.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Environmental Management

Through 12/31/2010

Overdue

REPORT	RESPONSIBLE OFFICE	ES * STATUTORY DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ESCS-4947 / EXEC-2009-017058) Status Report on Accelerate the Reduction of Environmental Risks (ARRA) Funding and EM Progress	Environmental Management Merle Sykes, 202-586-6754	04/01/2010	04/01/2010	Statutory Limited Duration (1) Signature on letters to Chairmen Visclosky and Dorgan transmitting the attached updated appendices of the National Defense Authorization act. FY 2010 Energy and Water Appropriations, CR 111-278, Page 136	Action sent to OMB for concurrence.
2. (ESCS-4948 / EXEC-2009-017057) Provide a Program Plan to Include Priority Areas of Technology Development	Environmental Management John Weagle, 202-586-0396	03/01/2010	03/01/2010	Statutory Limited Duration (1) Sign letters to Congress transmitting the Technology Development Program plan for the Office of Environmental Management. FY 2010 Energy and Water Development Appropriations, CR 111-203, Pages 139-140	Draft report completed; in Departmental clearance process.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a legislative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Fossil Energy

Through 12/31/2010

Due within 30 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ESCS-4963 / EXEC-2009-020870) Provide an updated integrated strategy & program plan, including activities supported by the Recovery Act, for its research, development, & demonstration efforts relevant to management of greenhouse gas emissions.	Fossil Energy	04/20/2010	04/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR 3183, Page 110	The report is being drafted, however it has to be coordinated with other departmental offices.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Fossil Energy

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
2. (ESCS 4981 / EXEC-2010-005539) Establish a comprehensive RD&D strategy for the development of unconventional oil, gas & coal resources. Report on the domestic resource opportunities, as well as technology applications.	Fossil Energy	09/30/2010	09/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 118	FE expects to meet the due date.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)
 Items Due for Office of Nuclear Energy
 Through 12/31/2010
 Overdue

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ECS-4967 / EXEC-2009-017311) Submit with the budget a start-up plan for Pu-238, including the role & contribution of major users (interagency coordination with NASA).	Office of Nuclear Energy	02/08/2010	02/08/2010	Statutory Limited Duration (I) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 116	NE is addressing OMB's comments.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for National Nuclear Security Administration

Through 12/31/2010

Overdue

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ECS-4973 / EXEC-2010-001945) Report on savings to be expected by direct contracting for construction and the greatest savings found on individual job, individual site, or complex-wide contracting.	National Nuclear Security Administration David Boyd, 202-586-7554, NA-60	03/31/2010	03/31/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 128	The report is being drafted, and will have to be coordinated with other departmental offices.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

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Congressional Reports (EWD-)

Items Due for National Nuclear Security Administration

Through 12/31/2010

Due within 30 days

REPORT	RESPONSIBLE OFFICE	ES * STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
2. (ESCS-4969 / EXEC-2010-001815) Within six months of enactment, prepare a report delineating NNSA's activities and achievements in countering non-detectable threats.	National Nuclear Security Administration	04/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 127	NNSA expects to meet the due date.
3. (ESCS-4970 / EXEC-2010-003319) No later than six months after enactment, report on the utility of a National Threat Reduction Center.	National Nuclear Security Administration Zaring, Michele	04/30/2010	Administrative Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR 111-209, Page 125	NNSA expects to meet the due date.
4. (ESCS-4971 / EXEC-2010-001946) Report on NNSA's progress on complex-wide contracting.	National Nuclear Security Administration David Boyd, 202-586-7554, NA-60	04/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 128	NNSA expects to meet the due date.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for National Nuclear Security Administration

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
5. (ESCS-4968 / EXEC-2010-006573) Report on number of nuclear weapons of each type in active & reserve stockpiles; strategic rationale; past & projected future total direct lifecycle cost of each type. Projected for 5, 10, 15, & 20 years.	National Nuclear Security Administration Joe Oder, 202-586-0257, NA-10	12/01/2010	12/01/2010	Statutory Annual FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 124	NNSA expects to meet the due date.
6. (ESCS-4974 / EXEC-2010-000007) Annual report on each project with the baseline cost, scope and schedule, deliverables, and public or private entity performing the R&D, and proposed user. Submit with budget request.	National Nuclear Security Administration Pete Duklis, 202-586-1480, NA-20	09/30/2010	09/30/2010	Statutory Limited Duration (I) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 131	Draft report completed; in Departmental clearance process.
7. (ESCS-4975 / EXEC-2010-001748) Report on the status of the Department's plans for transformation of the Nuclear Weapons Complex, not later than 90 days after release of the Nuclear Posture Review.	National Nuclear Security Administration George Allen, 202-586-7183, NA-10	09/30/2010	09/30/2010	Statutory As Required FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 84	NNSA expects to meet the due date.
8. (ESCS-4976 / EXEC-2010-001747) Directs Nuclear Weapons Council, in cooperation with the Secretary, to enter into agreement with the National Academy of Sciences to execute a study addressing the national security & deterrence value of B61.	National Nuclear Security Administration Joe Oder, 202-586-0257, NA-10	09/30/2010	09/30/2010	Statutory As Required FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 127	NNSA expects to meet the due date.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for National Nuclear Security Administration

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
9. (ESCS-4977 / EXEC-2010-001746) Commission a further study by the JASON Defense Advisory Group examining whether the B61 can be expected, without nuclear testing to offer sufficient margin & other advantages.	National Nuclear Security Administration Dimitri Kusnezov, 202-386-8266, NA-10	09/30/2010	09/30/2010	Statutory As Required FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 127	NNSA expects to meet the due date.
10. (ESCS-4979 / EXEC-2010-006574) Identify the location, status & proposed disposal for all known radioactive source materials; & implement the recommendations made by IG's February 09 report & update Nuclear Materials Management & Safeguard Systems.	National Nuclear Security Administration	09/30/2010	09/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 131	NNSA expects to meet the due date.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Office of the Secretary

Through 12/31/2010

Due within 30 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ECS-4966 / EXEC-2009-017312) NE, working in cooperation with SC, should lead an evaluation of the Naval Research Lab's use of Krypton-fluoride lasers and high-performance directly drive target to generate inertial fusion energy.	Office of the Secretary	04/30/2010	04/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 123	The report is being drafted and will require Departmental clearance prior to transmitting to the Hill.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

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Congressional Reports (EWD-)

Items Due for Policy / International Affairs

Through 12/31/2010

Due within 90 days

REPORT	RESPONSIBLE OFFICE	ES # DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ECS-4980 / EXEC-2010-00317) Reassess the Small Refineries Exemption Study. Undertake an economic review to estimate the actual economic impact of the RFS on small refineries on a regional basis.	Policy / International Affairs Al Cobb, 202-586-8635	06/30/2010	06/30/2010	Statutory Limited Duration (1) FY 2010 Energy and Water Development Appropriations, CR 111-278, Page 126	PI is drafting the report and the study has been initiated. Expect to meet the due date.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.

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EXECUTIVE SECRETARIAT EXECUTIVE COMMITMENTS SYSTEM (ESECS)

Congressional Reports (EWD-)

Items Due for Office of Science

Through 12/31/2010

Due in over 90 days

REPORT	RESPONSIBLE OFFICE	ES * DUE DATE	STATUTORY DUE DATE	REPORT REQUIREMENT	STATUS
1. (ESCS-4957 / EXEC-2010-001816) Report on the selected Hub's progress, including site selection, staffing, & progress towards research goals. Also a plan for incorporating input from industry & the scientific community when it selects research topics for Hubs in budget requests.	Office of Science	12/31/2010		Administrative Limited Duration (1) FY 2010 Energy and Water Development Appropriations, HR-111-209, Page 81	This is a followup report to the "Energy Innovation Hubs Report to Congress" which was completed on 04/09/10.

* Due Dates are determined by the statute, if the statute specifies a deadline. When a due date is not specified in the statute, a tentative Due Date has been set by the Office of the Executive Secretariat.



Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Barbara Boxer
Chairman, Committee on Environment and Public Works
United States Senate
Washington, D.C. 20510

Dear Madame. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

Conference Report 111-278 for Public Law 111-85 requested the Department of Energy to report to the House and Senate Committees on Appropriations on the research conducted in support of the NGNP and to provide a detailed accounting of the funds appropriated to date for this project.

If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable James M. Inhofe
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Edward J. Markey
Chairman, Subcommittee on Energy and Environment
Committee on Energy and Commerce
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Fred Upton
Ranking Minority Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Thomas R. Carper
Chairman, Subcommittee on Clean Air and Nuclear Safety
Committee on Environment and Public Works
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Senator George V. Voinovich
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Byron Dorgan
Chairman, Subcommittee on Energy and
Water Development
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,

A handwritten signature in black ink, appearing to read "Warren F. Miller, Jr.", written over a horizontal line.

Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Robert F. Bennett
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Peter J. Visclosky
Chairman, Subcommittee on Energy and Water Development
Committee on Appropriations
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Rodney P. Frelinghuysen
Ranking Member





Department of Energy

Washington, DC 20585

APR 5 - 2010

The Honorable Daniel K. Inouye
Chairman, Committee on Appropriations
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,


Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Thad Cochran
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Henry A. Waxman
Chairman, Committee on Energy
and Commerce
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Joe Barton
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Jeff Bingaman
Chairman, Committee on Energy
and Natural Resources
United States Senate
Washington, D.C. 20510

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,

A handwritten signature in black ink, appearing to read "Warren F. Miller, Jr.", with a long horizontal line extending to the right.

Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Lisa Murkowski
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable David Obey
Chairman, Committee on Appropriations
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

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If you have any questions, please contact me or Stephen Lerner, Office of Congressional and Intergovernmental Affairs, at 202-586-5450.

Sincerely,



Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Jerry Lewis
Ranking Member





Department of Energy
Washington, DC 20585

APR 5 - 2010

The Honorable Bart Gordon
Chairman, Committee on Science and Technology
U.S. House of Representatives
Washington, DC 20515

Dear Mr. Chairman:

This letter transmits the Next Generation Nuclear Plant (NGNP) Report to Congress.

Conference Report 111-278 for Public Law 111-85 requested the Department of Energy to report to the House and Senate Committees on Appropriations on the research conducted in support of the NGNP and to provide a detailed accounting of the funds appropriated to date for this project.

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Sincerely,

A handwritten signature in black ink, appearing to read "Warren F. Miller, Jr.", written over a faint, illegible background.

Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Ralph M. Hall
Ranking Member



**NEXT GENERATION NUCLEAR PLANT
REPORT TO CONGRESS**

March 2010

Prepared by
the U.S. Department of Energy's
Office of Nuclear Energy

EXECUTIVE SUMMARY

The Department of Energy's (DOE) Next Generation Nuclear Plant (NGNP) Project helps address the President's goals for reducing greenhouse gas emissions and enhancing energy security. The NGNP Project was formally established by the Energy Policy Act of 2005 (EPAct 2005) (Public Law 109-58, 42 USC 16021) to demonstrate the generation of electricity, and/or hydrogen with a high temperature nuclear energy source. The Project is executed in collaboration with industry, DOE National Laboratories, and U.S. universities. The U.S. Nuclear Regulatory Commission (NRC) is responsible for licensing and regulatory oversight of the demonstration nuclear reactor.

The NGNP Project includes design, licensing, construction, and research and development conducted in two phases as defined in EPAct 2005. Phase 1 is pre-conceptual and conceptual design and demonstration activities leading to the selection of a single technology for NGNP. Phase 2 is preliminary and final design leading to licensing and construction of a demonstration plant. Licensing scope supports the development of a licensing framework for high temperature gas reactors and includes the preparation and submission of a Combined Operating License Application (COLA) for the NGNP. Research and development scope falls into the following major technical categories: (a) Fuel Development and Qualification, (b) Graphite Qualification, (c) High Temperature Materials Qualification, and (d) Design and Safety Methods Validation. Licensing and research and development activities are included in both Phase 1 and Phase 2 of the project with appropriate risk mitigation strategies incorporated to minimize the impacts on design from parallel R&D.

From 2006 through 2010, a total of \$528.4M has been appropriated for the NGNP Project. Of this amount, \$192.8M will have been spent on NGNP research and development, \$177.6M on NGNP design, engineering, licensing and project management, and \$158M on university R&D programs and other NGNP related activities.

On September 18, 2009, DOE published a Funding Opportunity Announcement (FOA) for the conceptual design and demonstration activities of the NGNP. Proposals were received by the Department on November 16, 2009, winning proposals were announced in March.. Conceptual design reports are expected to be completed by September 30, 2010. These conceptual design reports are the last major deliverables of Phase 1 of the NGNP Project.

DOE plans to have the Nuclear Energy Advisory Committee (NEAC) launch a programmatic review of the NGNP Project in September 2010. This review will inform the Secretary of Energy on the readiness of the NGNP Project to proceed to Phase 2. It is expected that a Secretarial decision on whether or not to proceed into Phase 2 will be made in January 2011. All planned milestones and activities referenced in this report that occur after that timeframe are dependent on the outcome of the Secretarial decision. Phase 2 includes the competitive selection of a single reactor design for demonstration as the NGNP. The conceptual design reports completed in Phase 1 would inform the competitive selection of a final design for the prototype reactor and plant.

Phase 2 also includes finalizing the design of all safety systems in order to facilitate the preparation and submittal of a COLA to the NRC in accordance with the licensing strategy recommended in the *NGNP Licensing Strategy Report to Congress (2008)*. The COLA is presently scheduled for submittal in FY 2013.

The COLA schedule will be re-evaluated in conjunction with the conceptual design activities in preparation for the Secretarial decision and revised as necessary. Whether or not the overall schedule for completing the construction of the NGNP in FY 2021 can still be met depends on many factors, including funding availability from both federal and private sectors.

Assuming completion by 2021, the current preliminary project cost estimate, based on FY2007 pre-conceptual design information, is \$4 billion. Improved cost estimates will be part of the conceptual design reports due in September 2010. More detailed cost estimates that would meet commercial financing requirements are dependent on the completion of preliminary design activities. The relative share of costs allocated to Government and Industry will conform to EPAAct 2005 requirements. To date, cost share requirements have not been imposed on the national laboratories and universities who have been conducting R&D on enabling gas reactor technologies. After a public-private partnership is formed for Phase 2 activities, any R&D required to support a specific reactor design may be cost shared in accordance with EPAAct 2005.

Currently there are two major types of high temperature gas reactor designs under consideration: the pebble bed and the prismatic designs. Early versions of these reactor designs were demonstrated in the 1970s and 1980s. Test reactors for the pebble bed and prismatic designs are presently operating in China and Japan respectively. Both of these reactor designs are graphite-moderated, helium cooled, and use coated particle fuel kernels embedded in a graphitic matrix material. The primary differences between these designs are the shape of the fuel-bearing graphitic matrix and how the fuel is located in the reactor core.

The pebble bed design uses hundreds of thousands of tennis-ball sized spherical fuel elements called *pebbles*. The pebbles are stacked together in contact with each other like gumballs in a vending machine. The pebbles are added from the top, circulate through the reactor core, and are removed from the bottom. Fuel replacement in a pebble bed design is continuous and allows for online refueling.

The prismatic design uses cylindrical fuel elements that are pressed into channels drilled into graphite blocks. These fuel bearing blocks are stacked in columns in fixed locations in the reactor core. Refueling is accomplished by shutting down the reactor, removing the fuel bearing blocks, and replacing the oldest ones with new blocks.

Most of the challenges for these two reactor types are held in common. These are: licensing and regulatory issues associated with containment and emergency planning, business issues associated with breaking into new markets for nuclear energy in the transportation and industrial sectors, and infrastructure issues associated with first-of-a-kind technology demonstrations. Some challenges are unique. For the pebble-bed, the stochastic nature of the fuel presents a unique design and licensing challenge. For the prismatic design, controlling coolant flow through the narrow channels of the graphite blocks is a challenging design and manufacturing issue.

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List of Acronyms

AGR	Advanced Gas Reactor
ASME	American Society of Mechanical Engineers
CTC	Component Testing Capability
BTU	British Thermal Units
CD	Critical Decision
COL	Combined Operating License
COLA	Combined Operating License Application
CSNI	Committee on the Safety of Nuclear Installations
DDN	Design Data Needs
DoD	Department of Defense
DOE	Department of Energy
EPAct	Energy Policy Act
ESP	Early Site Permit
FOA	Funding Opportunity Announcement
FSV	Fort Saint Vrain
FY	Fiscal Year
GAO	Government Accountability Office
Gen IV	Generation IV Nuclear Energy Systems
GFR	Gas Fast Reactor
GIF	Generation IV International Forum
GT-MHR	Gas Turbine - Modular Helium Reactor
HTGR	High Temperature Gas Reactor
HTTF	High Temperature Test Facility
HTTR	High Temperature Test Reactor
IHX	Intermediate Heat Exchanger
INL	Idaho National Laboratory
LFR	Lead cooled Fast Reactor
LWR	Light Water Reactor
MIT	Massachusetts Institute of Technology
MSR	Molten Salt Reactor
MWe	Mega Watt electric
MWt	Mega Watt thermal
NASA	National Aeronautics and Space Administration
NE	Office of Nuclear Energy
NEAC	Nuclear Energy Advisory Committee
NEA	Nuclear Energy Agency
NERI	Nuclear Energy Research Initiative
NGNP	Next Generation Nuclear Plant
NRC	Nuclear Regulatory Commission
NQA-1	Nuclear Quality Assurance
OECD	Organization for Economic Co-operation and Development
OMB	Office of Management and Budget
PBMR	Pebble Bed Modular Reactor

PIRT	Phenomena Identification and Ranking Tables
PICS	Project Information Collection System
R&D	Research and Development
RD&D	Research, Demonstration and Development
SBIR/STTR	Small Business Innovation Research and Technology Transfer Research
SCWR	Super Critical Water Reactor
SFR	Sodium Fast Reactor
SSC	Structures, Systems and Components
TRISO	Tri Isotropic
TRL	Technology Readiness Level

1. INTRODUCTION

This report has been prepared by the Office of Nuclear Energy to give the status of the Next Generation Nuclear Plant (NGNP) Project in accordance with Conference Report 111-278 for Public Law 111-85 which states that a program execution plan, detailing the scope and scheduling of activities, milestones, or critical decision points, total cost estimates including anticipated cost share requirements, and any necessary updates to the licensing strategy, should be included in the report as well as a detailed accounting of the funds appropriated to date. The report presents the historical background of the project, details the project's spending, and discusses the principal investments in design, licensing, and research. Finally, the report highlights the technology options for NGNP and presents the principal challenges.

The primary mission of the Office of Nuclear Energy is to advance nuclear power as a resource capable of making major contributions in meeting the nation's energy supply, environmental, and energy security needs by resolving technical, cost, safety, security and proliferation resistance barriers, through research, development, and demonstration as appropriate.

In addition to its primary mission, the Office of Nuclear Energy performs several mission-related functions including providing:

- International engagement in support of the safe, secure, and peaceful use of nuclear energy as well as support to other Department offices and other federal agencies on issues related to the international use of civilian nuclear energy
- The capability to develop and furnish nuclear power systems for use in national security and space exploration missions
- Stewardship of the DOE Idaho National Laboratory Site

NE is working to develop innovative and transformative technologies to improve the competitiveness, safety and proliferation resistance of nuclear energy to support its continued use in the United States and abroad. NE has established programmatic goals that reflect nuclear power's continuing role in satisfying the demand for clean energy. Those goals include exploring, through RD&D: technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; understanding of options for nuclear energy to contribute to reduced carbon emissions outside the electricity sector; development of sustainable nuclear fuel cycles; and minimization of risks of nuclear proliferation and terrorism.

The activities represented in this report are designed to support the development of advanced reactor designs and technologies that could be capable of meeting electricity generation, co-generation of process heat, and performance demands beyond current base load nuclear power plants.

2. BACKGROUND

2.1 Gas Cooled Reactor History

As shown in Figure 1, gas-cooled reactors have a rich history and a promising future. The earliest commercial gas-cooled reactors were primarily developed and used in the United Kingdom (UK) and France and used CO₂ as a coolant. Eighteen of these CO₂ gas-cooled reactors are still in operation in the UK. Because of its capacity to produce higher outlet temperatures, helium is the coolant of choice for future gas reactors. Peach Bottom Unit 1 and Fort Saint Vrain (FSV) were two helium-cooled demonstration plants built and operated in the U.S using a graphite block fuel configuration. Peach Bottom Unit 1 was a 110 MWt reactor with an outlet temperature of 794°C and was operational from 1967 – 1974. FSV was a 842 MWt reactor with an outlet temperature of 778°C and was operational from 1976 – 1989. There were numerous successes and problems with FSV and Peach Bottom Unit 1 which provided valuable insight into the design, construction and operation of gas-cooled reactors. The Germans developed pebble-bed gas reactors and demonstrated them with the Arbeitsgemeinschaft Versuch Reaktor and the Thorium High Temperature Reactor. The People's Republic of China HTGR program is based on the German pebble bed design. The centerpiece of the Chinese program is the 10 MWt test reactor called HTR-10. The Chinese are also pursuing a modular design called HTR-PM which builds upon their operational test reactor experience. In Japan, the High Temperature Test Reactor (HTTR) is the centerpiece of their HTGR program. The 30 MWt HTTR is a prismatic block design with outlet temperatures as high as 950°C. The Republic of South Africa has a gas reactor program that is structured to support the deployment of the Pebble Bed Modular Reactor (PBMR). South Africa is presently evaluating the configuration and size of a PBMR best suited to their national needs with a potential co-generation cycle for electricity production that will also support near term process heat applications in the 200MWt size for use in their coal-to-liquids industry that supplies over 40 percent of their liquid petroleum needs.

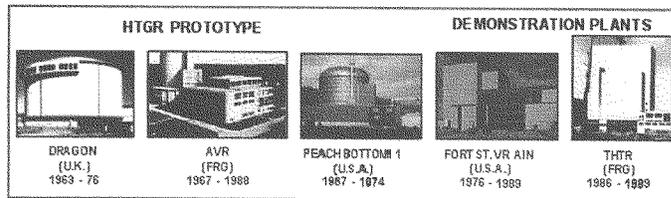


Figure 1. Historical High Temperature Gas Reactor Demonstration Plants

While not all of the gas reactor demonstrations and deployments satisfied every expectation, the operation of the early reactors and the current test reactors have demonstrated the practicality of the pebble bed and prismatic gas-cooled reactor designs. The Next Generation Nuclear Plant (NGNP) Project is aimed at demonstrating improvements to the gas-cooled reactor technology and supporting its commercial viability in the United States.

2.2 NGNP Project History

The Next Generation Nuclear Plant Project found its origins in *A Technology Roadmap for Generation IV Nuclear Energy Systems*, published in December 2002, by the Department's Nuclear Energy Research Advisory Committee in cooperation with the Generation IV International Forum (GIF). The *Technology Roadmap* identified the Very-High Temperature Reactor (VHTR) as a system with potential for economical near-term development that is compatible with advanced electricity and hydrogen production, and high-temperature process-heat applications. VHTRs extend the operating temperature range of HTGRs upwards to 950°C. It should be noted that although the operating temperatures envisioned under the NGNP are less than those of the GIF VHTR concept, many research and development activities are mutually supportive and therefore the NGNP Project benefits from this international collaboration.

In FY 2003 and 2004, the Department invested in early program planning and limited research and development activities for VHTR concepts. These investments included an independent assessment of the near-term commercialization potential for VHTR technology options that included prismatic and pebble bed designs and a design using salt as a coolant. These development efforts were the beginnings of the Next Generation Nuclear Plant Project.

In 2005, the Energy Policy Act of 2005 (EPAc 2005) (Public Law 109-58) formally authorized the Next Generation Nuclear Plant. The provisions of the EPAc 2005 establish two distinct phases for the project. Phase 1 is the phase that covers selecting and validating the appropriate technology, carrying out enabling research, development and demonstration activities, including conceptual design work and development of design methods and safety analytical methods and studies. Phase 2 is the phase that covers development of a final design for the prototype through a competitive process, application of licenses to construct and operate the nuclear reactor from the NRC, and construction and start up operations. Both phases include research and development and licensing activities with full consideration to risk mitigation from parallel R&D and design in order to avoid technical complications, cost overruns, and schedule disruptions.

2.3 Benefits of the NGNP

To meet our national goals for greenhouse gas emission reductions while maintaining a reliable and secure domestic energy supply, the United States must develop and deploy safe, clean, and affordable energy sources as quickly as possible. Nuclear energy has been and will continue to be a key component of our domestic energy portfolio. Nuclear power plants presently provide 20 percent of our nation's electricity and constitute 70 percent of our low-emissions energy supply.

DOE's NGNP Project supports the application of nuclear energy to help address the President's goals for reducing greenhouse gas emissions and enhancing energy security. The NGNP's HTGR technology is uniquely able to provide economical electricity and high-temperature process heat with low life cycle greenhouse gas emissions

The NGNP Project has supported the evaluation of this technology in a wide range of industrial applications. For example, the HTGR technology could be a technically viable low-carbon substitute for the burning of natural gas and other fossil fuels to supply steam, electricity and high temperature heat to industrial applications. Every 750 MWt of installed HTGR capacity could avoid 1 million metric tons of CO₂ emissions per year when compared to a similarly sized natural gas plant. The NGNP Project has performed technical and economic analyses of specific co-generation applications that show the HTGR

technology can be competitive with natural gas as an energy source in certain non-utility electricity and co-generation applications. The price of energy from the HTGR will be stable and secure, insulating the industries from the volatility in natural gas pricing. The use of HTGR technology in place of natural gas also may also free up more of this domestic resource for more productive uses in home heating and as feedstock for plastics and chemical manufacturing.

The NGNP Project has also performed studies integrating the HTGR technology with petro-chemical processes, (e.g., production of ammonium and ammonium products, extraction of non-conventional crude, production of hydrogen). These studies show that the HTGR technology could help reduce GHG emissions when compared with conventional processing.

The NGNP is being developed for economical production of electricity and other desirable products derived from high quality heat. The capabilities of the HTGR may help meet both greenhouse gas reduction goals and our need for energy security.

2.4 Key Accomplishments

Pre-conceptual design activities conducted thus far have been carried out to determine research and development needs, inform licensing process development, and establish the basic parameters for the reactor system. The pre-conceptual design work has included an assessment of the maturity and availability of equipment to operate at the design conditions for the HTGR, and R&D needed to support the design and licensing processes. Project cost and schedule estimates based on pre-conceptual design were also developed as a part of these pre-conceptual design activities.

In developing the strategy for partnering with industry, the Department issued a Request for Information/Expression of Interest in April 2008 to obtain input on the scope, cost, schedule, licensing development strategy, financing, and cost-share provisions needed to support the complete scope of the NGNP Project. Responses were received in June 2008 from several companies including General Atomics, AREVA, Westinghouse/Pebble Bed Modular Reactor Pty Ltd, and a group of companies referred to as the *Consortium*. Meetings and correspondence with these potential partners indicated that industry would like to deviate from the EAct 2005 framework for the Project by accelerating the development schedule, minimizing industry up-front cost share while maintaining an overall equal cost share, and building the demonstration at a commercial/industrial site rather than at the Idaho National Laboratory.

On September 18, 2009, the Department of Energy issued a Funding Opportunity Announcement (FOA) for the conceptual design of the Next Generation Nuclear Plant. In accordance with the EAct 2005 section 988, the FOA established a 50/50 cost share requirement for conceptual design and demonstration activities and allows the Secretary of Energy to grant a reduction to the cost share requirement if he determines it to be necessary and appropriate. On November 16, 2009, the department received several applications that were evaluated by an independent review team of nuclear reactor professionals and by a federally staffed review panel that advised the selection official. The resulting selections were announced in March 2010. DOE announced the award of approximately \$40 million in total to two teams led by Pittsburgh-based Westinghouse Electric Company and San Diego-based General Atomics. DOE anticipates completed conceptual designs will be available by September 30, 2010. Approximately \$38 million of the \$40 million obligation for these awards is from FY 2009 funds held for this specific purpose.

Key accomplishments since the beginning of the project are:

- Established a comprehensive R&D program that is integrated by the Idaho National Laboratory.
 - Demonstrated U.S. capability to manufacture gas reactor fuel with very few defects (2007)
 - Began irradiation of over 400 graphite specimens to test mechanical properties under irradiation (2009)
 - Completed record breaking irradiation of NGNP test fuel with no fuel failures (2009)
- Collaborated with the U.S. NRC to develop a joint NGNP Licensing Strategy (2008).
- Established a Licensing Implementation Plan for near-term interactions with the NRC to address NGNP licensing issues (2009).
- Completed engineering studies and pre-conceptual design to establish industrial end-user requirements and focus R&D activities (2007- 2009.)
- Established a systematic approach to managing technology related-risk and uncertainty, based on models used by the National Aeronautics and Space Administration (NASA) and the Department of Defense (DoD) (2008 - 2009).
- Announced selection of design teams for conducting conceptual design studies (2010).
- Supported the continuing development of industry codes to qualify high temperature materials and analytical methods (2006 – 2010)
- Supported the continuing development of models related to specific HTGR systems and structure behaviors of interest for analyses and design method validation (2008 – 2010)
- Supported the continuing development of models and scaling analyses to support ongoing testing at multiple U.S. and international facilities related to HTGR development (2008 – 2010).
- Conducted cost-shared research and benchmark activities in collaboration with the GIF VHTR System Arrangement (2007 – 2010).
- Established collaborations with international entities on NGNP-related R&D, design, and licensing activities (2006 – 2010).

An expanded description of the supporting RD&D for these accomplishments is given in Section 4.5 of this report.

2.5 Next Steps

The Department is presently working toward the completion of Phase I activities. In September 2010, DOE plans to provide information derived from Phase I R&D licensing activities and conceptual design(s), including the associated cost and schedule estimates and program execution plans to the Nuclear Energy Advisory Committee (NEAC) for review. It is expected that in December 2010, NEAC will make a recommendation to the Secretary of Energy on the project's readiness to move into Phase 2. This recommendation will be an input in the Secretary's decision on whether or not to take the project into Phase 2. A Secretarial decision on Phase 2 readiness is planned for January 2011.

3. BUDGET HISTORY AND DATA FOR FY 2006 – FY 2010

This section of the report provides figures that illustrate the cumulative distribution of funding for all years following the EAct 2005 authorization of the NGNP Project. Also provided are figures that give year by-year as-spent distributions of appropriated funds. In total, approximately \$528 million will have been spent on the NGNP Project by the end of FY 2010. In broad terms, \$192.8 million will have been spent on NGNP R&D in the areas of reactor fuel development, high temperature metals and graphite development, and

analytical codes and methods development. \$177.6 million will have been spent on NGNP design, engineering, licensing and project management to inform the R&D process, the development of public-private partnerships, and advance the design and licensing of NGNP. \$158 million will have been spent on university supportive and competitive R&D grants and contracts and other NGNP-related activities to include domestic and international partners in accelerating the development of gas reactor technology. Key accomplishments from the application of this funding were listed in section 2.5 of this report.

Definitions of the terms and categories found in the budget figures follow:

Table 1. Definition of budget terms

Term	Definition
NGNP Regulatory Affairs	INL staffed activity to work with NRC on the Licensing Implementation Plan
NGNP Component Test Capability (CTC) Investigation	INL staffed activity to investigate the need for large-scale component testing capability
Other NGNP Activities	Compilation of a number of small contracted activities in support of NGNP
VHTR Activities	R&D aimed at extended temperature operation of gas-cooled reactors and multi-physics modeling
GIF Support / International Collaboration	Support to attend meetings and develop materials for GIF collaborations including the Generation IV Materials Handbook
Technical Integration	Multi-laboratory coordination and management of NGNP R&D
University NERI Awards	R&D awards that highlight collaborations between U.S. universities and laboratories
University Research & Education	Competitive grants provided to U.S. universities for work related to Gen IV and NGNP
SBIR/STTR	Legally mandated set asides for small business
Rescission/Reductions	Programmatic reductions mandated by law
NGNP Project Management	INL Project Office funding to manage the NGNP project, includes quality assurance, safety, project management, procurement, etc.
NGNP Fuel Development:	R&D to develop the advanced coated particle fuel for NGNP
NGNP Materials Development	R&D to qualify high temperature metals, ceramics and graphite for NGNP
NGNP Design Methods Development	R&D to benchmark improved methods for calculating reactor system phenomena
NRC Support for NGNP	Funding provided directly to the NRC for regulatory work on NGNP
NGNP Pre-conceptual Designs	Vendor pre-conceptual design studies for NGNP
NGNP Engineering / Conceptual Design	NGNP engineering activities and vendor conceptual designs for NGNP
Earmark: Russian GT-MHR	Congressional earmark to continue Russian GT-MHR work
Earmark: VHTR Deep-Burn	Congressional earmark to look at extended fuel utilization and actinide burning in NGNP
Modeling and Simulation Hub	Secretarial Initiative to advance modeling and simulation capability of American designers

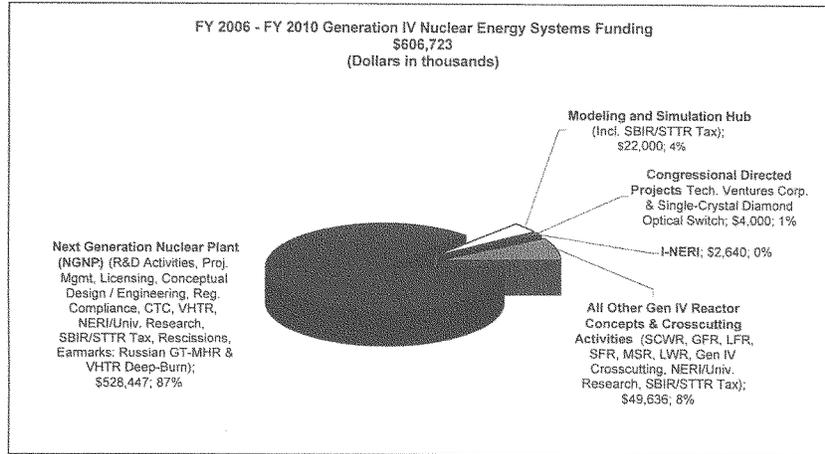


Figure 2. FY 2006 – FY 2010 Gen IV Funding

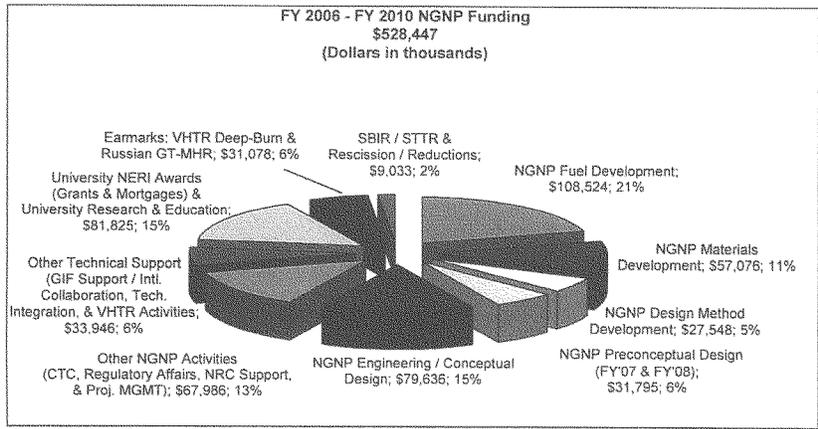


Figure 3. FY 2006 – FY 2010 NGNP Funding

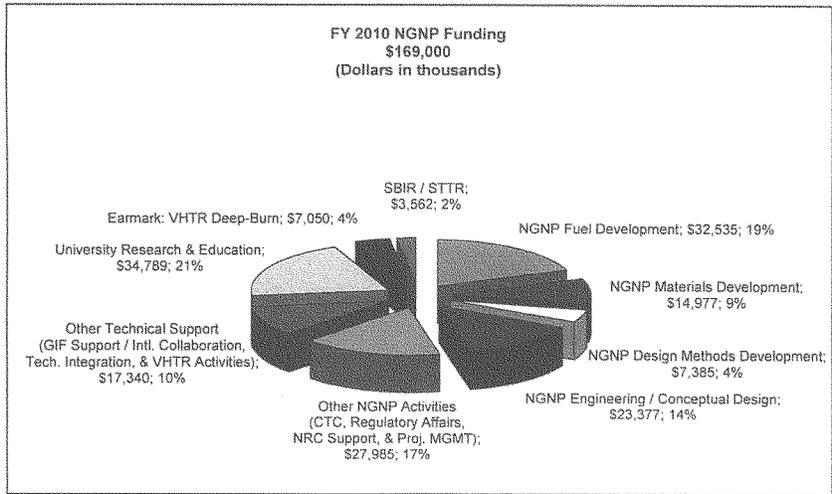


Figure 4. FY 2010 NGNP Funding

4. PROJECT EXECUTION PLAN

The NGNP Project includes R&D, design, licensing, construction, and initial operations of a first-of-a-kind demonstration facility to be conducted in two phases as defined in EAct 2005. The Project is managed by DOE/NE using the Idaho National Laboratory as a project integrator. Private industry may take on the role of systems integration of the project in Phase 2 after a suitable public-private partnership is formed.

High-level NGNP project objectives are:

- Develop prototype NGNP design and licensing basis through a public/private partnership resulting from a competitive selection process.
- Establish regulatory licensing basis and design certification process for HTGRs by the Nuclear Regulatory Commission (NRC).
- Demonstrate basis for commercialization through construction and reliable operations of NGNP and associated technologies.

The following sections describe the scope and execution of the various programmatic elements of the NGNP Project. In addition to the principal elements of design, licensing, R&D and construction, project execution also involves risk management, quality assurance, and program controls to track budget and schedule performance. An updated Project Execution Plan following a process comparable to that required by DOE Order 413.3A will be developed by the Department to support the Secretarial Decision in January 2011 on whether or not to proceed into Phase 2.

4.1. Project Management

Fundamental Project Management principles provide a framework for successful project execution. This section describes the project management systems that have been put in place to successfully manage the NGNP Project comparable to processes identified in DOE O 413.3A.

4.1.1 Project Organizational Framework and Relationships

The NGNP Project is sponsored by NE and is managed under the Office of Gas Reactor Deployment (NE-33). The NGNP Program Manager (sometimes referred to as the DOE Federal Project Director) is a senior staff position in NE-33 responsible for the project's mission, goals, objectives and budget, and provides those elements to the INL NGNP Project Director, who executes the project via implementation of the INL Project Management System Document (PLN-7305, Rev. 1).

The INL's Technology Development Office (TDO) is responsible for planning and executing the R&D work scope required to design and ultimately license the NGNP, identify and meet R&D milestones and deliverables, report on monthly status, develop schedules, and provide Earned Value Management on the budget assigned to the TDO for NGNP.

4.1.2 Project Risk Management Process

The project risk management process ensures that project risk and uncertainties are identified, analyzed, managed, or determined to have been mitigated or eliminated. The process also provides a structured, formal, and disciplined approach to determine and control risk events and general uncertainties at an acceptable level through the lifecycle of the project. Under this approach, risks are first identified and used to populate the project Risk Register. These are analyzed and categorized as Very Low, Moderate, High, and Very High based on probability of occurrence and consequence. A Risk Mitigation Strategy is then developed for each risk and becomes part of the Risk Response Plan for those High and Very High risks.

NGNP risks are technical and programmatic, and both types have the ability to manifest themselves in cost and schedule impacts. NGNP pre-conceptual design work has highlighted several known technical risks that must be resolved to ensure successful completion of the NGNP Project. Additionally, DOE expects that throughout the design process other risks will be identified. To ensure that decisions are made and risks (both known and unknown) are addressed on a consistent and objective basis, the NGNP Project has tailored a systematic approach to managing technology-related risk and uncertainty. This approach combines similar technology maturity measurement methodologies as those used by NASA and DoD in their programs, with unique approaches and tools developed at the INL for using uncertainty measurement to both make decisions and manage project execution. This systematic approach correlates technical risk areas identified through Design Data Needs (DDNs) to the maturity of any one technology using Technology Readiness Levels (TRLs) as depicted in Figure 5 below. Given the historical experience with the HTGR concept, most of the components are at a modest level of maturity indicating that the technology may require some enhancement in performance or some greater level of engineering demonstration to meet the mission and goals of NGNP Project but are not at the lowest level of maturity where the fundamental scientific or proof of principle experiments would have been needed to establish the concept feasibility. These readiness measures, when coupled with other technical information, not only allow management of the complex set of R&D activities but also provide simple metrics to monitor progress, mitigate risks, and prioritize activities relative to funding to ensure that the higher risk activities with little schedule contingency receive the greatest attention.

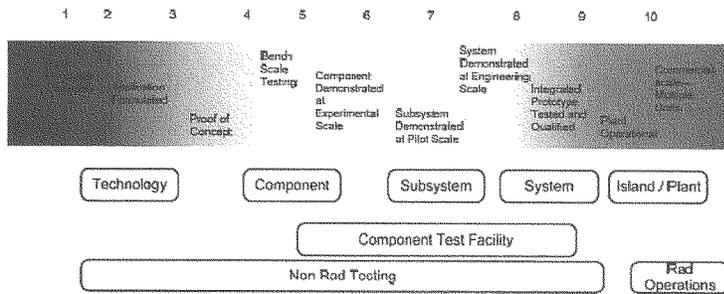


Figure 5. Technology Readiness Levels

4.1.3 Long-Lead Procurement Items and their Procurement Strategy

DOE is conducting R&D to reduce technical risk associated with key components and systems in order to facilitate long-lead procurements by the future Phase 2 private industry partners. The plan is to select the most promising technologies and mature them through R&D and testing. Long-lead procurement items will be identified as early as possible, and procurement will be scheduled consistent with the overall project schedule. Some items anticipated to be long-lead procurement include fuel, graphite, high-temperature material, the Intermediate Heat Exchanger, the Reactor Pressure Vessel, and the Power Conversion System.

4.1.4 Quality Assurance

The American Society of Mechanical Engineers (ASME) Nuclear Quality Assurance (NQA)-1 is the baseline standard for the NGNP QA program (QAP). Currently, the NGNP Project is relying on the INL's QAP, which implements the requirements of NQA-1-2000. The INL QAP meets the requirements of 10 CFR 830 Subpart A and DOE Order 414.1C. An NGNP Project-specific Quality Assurance Program Plan (QAPP) was developed to identify deviations from the INL QAP and to address NGNP Project-specific implementation approaches. Personnel performing quality-affecting activities are required to abide by the NGNP QAPP.

The NGNP Project is sponsored by NE and will be subject to the licensing and related regulatory authority of the NRC as stated in EPart 2005. NRC requirements in 10 CFR 50, Appendix B, will be applicable to the fabrication, construction, and testing of the Structures, Systems and Components (SSCs) of the reactor. The NGNP QA program will be updated to meet these NRC requirements on a schedule consistent with the NGNP regulatory strategy and agreements reached during pre-application discussions with the NRC. It is anticipated that the NRC will soon adopt NQA-1-2008 and the NGNP Project will complete the transition to NQA-1-2008 in FY 2010.

4.1.5 Project Controls

Project Controls describe the project work authorization, project controls processes, and performance measurement commensurate with the framework of the current level of maturity of the project. The non resource-loaded project schedule is aligned with the work breakdown structure (WBS) to integrate individual schedules from each functional area.

The project will continue to use the current INL financial control reporting processes until such time as the framework of the public-private Partnership and a project performance baseline are more fully established. The project is using the INL's earned value management system (EVMS) as the mechanism for reporting project earned value status. At the federal level, the project is monitored and tracked using proprietary custom software known as the Project Information Collection System (PICS). This software suite allows for online posting of project cost and schedule performance, project deliverables, and variance analysis by the many project participants.

4.1.6 Acquisition Strategy

DOE is managing this project consistent with the project management and development philosophy described in DOE Order 413.3A, Program and Project Management for the Acquisition of Capital Assets. The mission need statement developed for NGNP was approved by DOE Deputy Secretary on October 18, 2004, officially completing Critical Decision-0. Responses to Request for Information and Expressions of Interest (RFI/EOI) issued in the summer of 2008 constitute a collection of alternatives that will provide input into the project's acquisition strategy and cost and schedule projections equivalent to DOE O 413.3A, Critical Decision-1 (CD-1), Approve Alternative Selection and Cost Range.

The Department anticipates that industry standards and practices under NRC licensing will drive many of the activities necessary in executing the remainder of the project scope. The formal NGNP public-private partnership would have provisions equivalent to hold points corresponding to DOE Critical Decisions for launching final design and construction activities. This structured decision process will assure high visibility and appropriate project management controls on critical decisions for the Department.

4.2 Design

Phase 1 design scope includes pre-conceptual and conceptual design. Design through the conceptual phase is sufficient to make technology selections, develop a project cost and schedule estimate, and initiate pre-application licensing review with the NRC. Phase 2 design scope, expected to commence in FY 2011, includes preliminary and final design. Preliminary design is sufficient to inform long-lead procurements, prepare a Construction and Operating License Application to the NRC, and develop high confidence cost and schedule estimates. Final design is required to complete NGNP construction.

Pre-conceptual design was completed in September 2007 with the issuing of the pre-conceptual design reports by Westinghouse/PBMR, AREVA NP, and General Atomics. The NGNP is currently in the conceptual design and demonstration phase. Conceptual design tasks include support for technology down-selections; the development of key SSCs; and addressing generic concerns such as issues identified in the NRC's Phenomena Identification and Ranking Tables (PIRT).

During the conceptual design and demonstration phase, the INL will work with industry to develop and validate documentation of design technology maturation levels and will subsequently develop and implement the process to perform and track risk reduction strategies and activities for key SSCs. The design of the NGNP will be developed so as to provide technical and functional requirements, including safety requirements; hazards analysis; project risk evaluation; information needed for a focused R&D effort; and a defined basis for a cost range, schedule, and performance requirements for the project. At the end of conceptual design, key piping and instrumentation diagrams, general arrangements, and process flow diagrams for critical systems will be provided. The project baseline (i.e., cost estimates, schedule, design documents, long lead procurements, etc.) will be developed at a conceptual design level.

Conceptual design is expected to conclude by September 30, 2010, with the submissions of the conceptual design reports. DOE plans to request that NEAC commence a programmatic review of the NGNP program as stipulated by EPAct 2005 in September 2010. This review will include an examination of the conceptual designs completed by the awardees of the FOA, along with the associated cost and schedule estimates and program execution plans. The review will also cover the results of pre-conceptual design studies, completed R&D and the status of R&D still in progress, and any NEPA studies and licensing reports that have been developed. At the completion of the programmatic review, NEAC will make a recommendation to the Secretary of Energy or his designate on the readiness of the program to proceed to Phase II

activities. The NEAC review is expected to be completed in November 2010. Secretarial approval is required to move into Phase II.

4.3 NGNP Licensing Scope and Strategy

Although gas-cooled reactor technology dates back to the 1960s, the gas reactors built in the United States were licensed through exceptions to regulations established for light water reactors. In accordance with section 644 of the EAct 2005, the NRC will need to establish licensing requirements and processes to support the commercialization of gas reactor technology.

4.3.1 Summary of Recommended Licensing Approach Reflected in the *NGNP Licensing Strategy Report to Congress*

The *NGNP Licensing Strategy Report to Congress* included the conclusion that the best alternative for licensing the Next Generation Nuclear Plant (NGNP) demonstration facility will be for the applicant to submit a COLA under Subpart C, *Combined Licenses, of Title 10, Part 52 Licenses, Certifications, and Approvals for Nuclear Power Plants*. This recommended licensing approach is expected to take advantage of the new *one step* plant licensing process, which is expected to reduce both licensing risk and attendant financial risk compared to other available licensing options. Risks would be reduced because the NRC will approve the final design, site, verification criteria, and operational and procedural aspects of the application before any significant construction begins. Therefore, this licensing approach is expected to ensure the most effective and efficient use of NRC and applicant resources while minimizing licensing risk and taking no longer than other alternatives to complete. This licensing approach is also expected to reduce financial risk to the industry stakeholders who may decide to fund the project.

The following sections describe NGNP actions and progress to date, as well as next steps, as both the DOE and the NRC begin executing the licensing strategy described in the *NGNP Licensing Strategy Report to Congress*.

4.3.2 NGNP Project Licensing Activities and Accomplishments to Date

The NGNP Project has adopted the 10 CFR 52 Combined Operating License (COL) application process as the foundation for the NGNP licensing strategy. As a first step in executing this licensing strategy, NGNP Project team members have conducted a review of gas reactor licensing history and precedents, and performed an initial screening review of applicable light water reactor regulations and associated regulatory guidance that will need to be addressed by the Project. The plan is to establish a regulatory framework and project licensing structure that will enable the successful licensing, construction, and operation of the NGNP demonstration facility. For the near term, DOE and NRC will focus on the most significant policy issues and outline a licensing path for the NGNP that will lead to the approval and issuance of a COL by the NRC. Issuance of the COL will allow the construction and operation of the HTGR plant. Near term critical licensing activities will proceed in parallel with the DOE's planned establishment of a public-private partnership, which is expected to ultimately be responsible for the facility's COL. Establishment and implementation of this licensing structure provides a framework for future commercial HTGR applications.

4.3.3 NGNP Project Interactions with the NRC

As described in the *NGNP Licensing Strategy Report to Congress*, the NRC is participating in the early NGNP Project licensing process by gathering information; identifying and developing proposals for resolution of key design, safety, and licensing issues; and preparing papers identifying programmatic, regulatory, and key technical issues with recommendations for consideration and approval by the Commission. Frequent, focused, and coordinated interactions between the NRC Staff and the NGNP Project team are being conducted and are critical to the success of the project. In order to support these interactions, the following steps have occurred:

- The NRC has established and staffed an Advanced Reactor Program, with a specific project branch assigned to the NGNP Project.
- The NGNP Project team has engaged the NRC Staff in initial public meetings regarding the resolution of priority licensing issues.

A Memorandum of Understanding was established between the NRC and DOE to collaborate on NGNP-related licensing issues, including R&D, as appropriate. Regulatory-related R&D includes:

- Developing models and scaling analyses to support ongoing testing at multiple facilities related to HTGR development (Note: These models will be at the heart of the licensing process to predict performance under normal and off-normal conditions).
 - Perform reference modeling and analyses in support of Oregon State University High Temperature Test Facility (HTTF)
 - Provide technical support for Japanese Atomic Energy Agency High Temperature Test Reactor (HTTR)
- Develop models related to specific HTGR systems and structure behaviors of interest for analyses and design method validation
 - Develop pre-conceptual model for reactor cavity-cooling system in NGNP geometry
 - Develop air ingress experiments and analyses
 - Develop bypass flow experiments and analyses

4.3.4. International Collaborations

The DOE and the NRC have also established collaborations with international regulators, vendors and academia to further the establishment of an HTGR licensing framework. International collaborations include:

- Collaborations through the Organization for Economic Co-operation and Development/Nuclear Energy Agency/Committee on the Safety of Nuclear Installations to conduct integrated large scale tests in Japan's HTTR to examine HTGR safety characteristics in support of regulatory research and licensing activities.
- Collaborative efforts among DOE, NRC, international regulators, international vendors and international universities to discuss the graphite dust safety issues in the context of the NGNP. A comprehensive workshop on this topic is being planned for a future date.
- Collaborations with international researchers on HTGR-related research topics through the International – Nuclear Energy Research Initiative. One such collaboration is with the Republic of Korea on experimental and analytical studies of the core bypass flow in HTGRs.

4.3.5 NGNP Licensing Integration Strategy and Priorities – Next Steps

The priority licensing topics currently being addressed were developed based on an initial review of existing requirements, references, and project material that were expected to identify many of the most critical regulatory issues for commencement of the licensing process. In order to arrive at a more comprehensive listing of issues to be addressed as a part of the COL application development process, a more detailed regulatory gap analysis will be required. The NGNP Project is currently establishing an approach for implementing this process, and expects to commence this work in the near term, in order to supplement the high priority licensing work already underway.

4.3.6 Updates to NGNP Licensing Strategy Report to Congress

The following table describes updates to the *NGNP Licensing Strategy Report to Congress* that have occurred since it was first published in August of 2008. The licensing approach recommended in the report has not changed, but some schedule adjustments have been made. DOE and NRC continue to be engaged in review activities that should mitigate any overall schedule delay. Change will be evaluated in conjunction with the conceptual design and demonstration activities and a revised schedule will be developed as needed. Whether or not the overall schedule for completing the construction of the NGNP in FY 2021 can still be met depends on many factors, including funding availability from both federal and private sectors.

Table 2. Updates to Licensing Strategy Report to Congress

Report Section	Report to Congress Text	Update or Revision to Report to Congress
2.1.3	<i>...DOE chooses a single design no later than March 2009 to support the pre-application review.</i>	DOE has decided to fund up to 2 designs through the Phase 1 conceptual design and demonstration phase.
2.1.3	<i>...DOE identifies the applicant for the NGNP prototype by the start of the pre-application review in FY 2010.</i>	Choosing an applicant is a phase 2 activity that occurs after a down-select decision is made. The NGNP Project team will be engaged with the NRC on high priority licensing activities until the applicant is identified.
2.1.3	<i>The applicant submits a regulatory gap analysis in FY 2010...</i>	Choosing an applicant is a phase 2 activity that occurs after a down-select decision is made. The NGNP Project team will begin regulatory analysis work in FY 2010.

2.1.3	<i>Programmatic, regulatory, and key technical issues identified during the pre-application review are resolved at least 1 year before the licensing application is submitted to ensure the incorporation of any design modifications. To achieve this, preliminary design descriptions of all safety-significant systems must be available at the beginning of the pre-application review (FY 2010), and the applicant must propose reasonable solutions to potential programmatic, regulatory, and key technical issues at that time.</i>	Pre-application is a Phase 2 activity. Conceptual design reports completed by FOA awardees will include preliminary design descriptions of all Safety-Significant Systems and anticipated solutions to potential programmatic, regulatory, and key technical issues. Conceptual design reports are expected to be completed in September 2010. The NGNP Project efforts to address and resolve priority licensing issues will proceed in parallel with the completion of safety-significant design descriptions. Those descriptions will be available on or after the completion of Phase 1 (January 2011).
Basis Doc	<i>DOE has stated that it will submit the license application, which would include the preliminary design (final design of all safety-significant systems), no later than September 2013 (NGNP Project Phase 2)</i>	The COLA submittal schedule will be re-evaluated in conjunction with the conceptual design activities and will be revised as needed and will reflect the 2011 Secretarial decision.

4.4 Construction

The project is not at the level of design and planning maturity necessary to formulate specific plant construction information. However, an initial estimate would have construction beginning in late 2017, depending on the 2011 Secretarial decision. Development of detailed construction schedules is a Phase 2 activity.

4.5 NGNP Research and Development

At the inception of the Next Generation Nuclear Plant (NGNP) Project, experts from DOE national laboratories, gas reactor vendors, and universities collaborated to establish technology R&D roadmaps to help guide NGNP R&D. These internal roadmaps outlined the testing and computational development activities needed to qualify the materials and validate the modeling and simulation tools to be used in the design and operation of the NGNP. The technology development roadmaps drew on world-wide experience gained from the six demonstrations and/or prototype HTGRs that were built and operated over the past 60 years. The roadmaps included detailed descriptions of the required technical activities with associated schedules and budgets for completion of the project and still form the baseline for execution of the R&D needed for the NGNP Project. The R&D activities are organized into four major technical areas: (a) Fuel Development and Qualification, (b) Graphite Qualification, (c) High Temperature Materials Qualification, and (d) Design and Safety Methods Validation. The objectives of each area, current status,

accomplishments to date, and future plans are discussed in this section. To accomplish these objectives, the R&D program draws upon expertise at DOE national laboratories and a broad array of universities along with international facilities and expertise accessible to the DOE via the Generation IV International Forum. All R&D activities are being conducted in compliance with the Quality Assurance requirements established by the ASME NQA-1 code. This will ensure that experimental data is useful to designers and regulators of the NGNP.

4.5.1 Fuel Development and Qualification

The NGNP concept is based on coated particle fuels as shown in the upper left of Figure 6. Such fuels have been extensively studied over the past four decades. Layers of carbon and silicon carbide surround a uranium kernel to form a tri-isotropic (TRISO) coated fuel particle of approximately 1 millimeter in diameter. The NGNP will contain billions of TRISO coated-particles that are pressed into compacts. The compacts are shaped as either small cylinders or tennis-ball-sized spheres. Rigorous control is applied at every step during the fabrication process to produce high-quality, very low-defect, fuel. Defect levels are typically on the order of one defect per 100,000 particles.

The TRISO layers provide robust protection for the uranium kernels and superb retention of the radioactive material produced during fission. Extensive testing in Germany in the 1970s and 1980s demonstrated the outstanding performance of TRISO-coated particle fuels under both normal operation and accident conditions. It is this fuel performance, combined with passive plant safety features that could allow an NGNP class reactor to be located in an industrial complex to provide heat and electricity to that complex. Prior to the NGNP Project, the German experience was considered the "gold standard" around the world. Today, the NGNP Project is also achieving and in some cases exceeding the high levels of fuel performance established by the Germans.

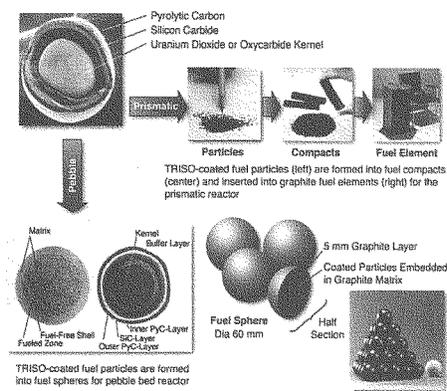


Figure 6. TRISO coated particle fuel
 TRISO fuel particles are formed into spheres for a pebble bed HTGR and compacts for a prismatic HTGR.

Qualification of fuel for use in a licensed reactor involves experiments and examinations that will allow an understanding of the behavior of TRISO-coated fuel under the radiation and temperature environment expected in an HTGR. It also involves experiments to allow for an understanding of how well the fission products, the elements produced when uranium fissions, stay inside or move outside of the coated fuel particles and through the graphite reactor core. Development of modeling and simulation tools to analyze and predict this behavior is also important to the design and safety analysis for the NGNP.

The NGNP Project had to re-establish the capability to fabricate and characterize TRISO-coated particle fuel in the United States. This was a significant effort that required the development of the fabrication processes and characterization approaches used in historical TRISO-coated fuel made in the 1970s and 1980s. Many of

the procedures and recipes used in the past were still available, but needed to be modernized to take advantage of improvements in measurement science over the past 25-years. The result has been much more accurate and precise characterization of this fuel form. The Project is now fabricating TRISO-coated fuel particles at industrial scale with very low defects (about 1 defect in every 100,000 particles).

The first fuel experiment, called AGR-1, has recently completed approximately three years of radiation exposure at the high temperatures expected under normal operation in a HTGR. About 300,000 TRISO fuel particles have been tested to a real level of energy utilization, called peak burnup, of 19 percent *without a measurable indication of a single particle failure*. These results are critical in demonstrating the superior performance capability of TRISO fuel and ultimately the HTGR concept. This level of burnup is about three times that of current light water reactors and double that achieved by the German gas reactor program in the 1980s. Work has also been underway to establish the capability to perform high temperature testing of this fuel at accident conditions (higher temperatures) to confirm robust safety performance of the fuel under highly unlikely but possible conditions. This testing will begin in late 2010 and provide critical qualified data on the safety basis of the fuel for licensing by the NRC.

The NGNP fuel development program has also spent significant effort developing a state-of-the-art computer modeling and simulation capability to predict the behavior of TRISO fuel under the wide range of conditions anticipated in an HTGR. The model has been extensively compared against similar tools developed by international colleagues as part of an effort under the auspices of the International Atomic Energy Agency.

4.5.2 Graphite Qualification

Graphite has been effectively used in the past as structural material for high temperature reactor cores. Historical grades of graphite and the supply of raw feed stocks used in gas reactors no longer exist. The objective of the NGNP Graphite Qualification RD&D is to demonstrate that modern grades of nuclear graphite made with current feedstock materials will perform at least as well as historical grades did. The Project is seeking a science-based understanding of the fundamental mechanisms of irradiation behavior of graphite in order to predict how new types and grades will behave in the future. In the longer term, the Project plans to evaluate the influence of fabrication processes and different feedstock materials on graphite behavior so that extensive qualification efforts are not needed when feed stocks or improved fabrication methods are used to make graphite for future HTGRs after NGNP.

At the start of the graphite qualification research, significant effort went into establishing the analytical measurement laboratories required to perform the extensive characterization of nuclear graphite under consideration for HTGRs being evaluated by the NGNP Project. This task consisted of procuring, setting-up, and calibrating state-of-the-art analytical testing equipment and developing protocols and testing methods to make accurate, repeatable measurements on graphite, abilities well established for metals. An extensive characterization effort is currently underway to establish the material properties before irradiation on a series of large graphite chunks or blocks, called billets, have been

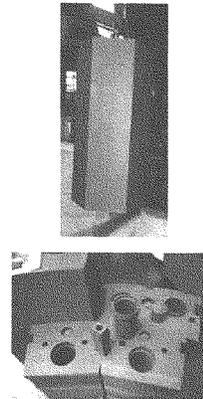


Figure 7. Graphite core components.

procured from two major graphite vendors (one in the U.S. and one in Europe). The first of six planned tests to evaluate the irradiation behavior of graphite under radiation exposure and high temperatures expected in an HTGR is underway. This test, the largest of its kind ever performed on nuclear graphite, will produce a large number of well-characterized irradiated samples. Tests are planned at specified temperatures and level of radiation dosage that envelope the anticipated irradiation conditions for the HTGRs being developed by the NGNP Project. Extensive post-test examinations are also planned to understand the key material property changes caused by the irradiation exposure. Our current understanding in this area is incomplete. Of particular interest is the need to understand the ability of graphite to relax the stresses induced by neutron bombardment (termed "creep"). If significant relaxation occurs then the neutron-induced stresses will not cause failure of the graphite components (e.g. cracking) and graphite will have a longer lifetime than currently anticipated in HTGRs. Extending the life of graphite in the reactor would reduce the quantity of graphite used in each HTGR, which would yield important economic and waste disposal benefits. These irradiation data and the as-fabricated material properties will be used to improve the detailed modeling and simulation tools currently being used to predict the structural response of graphite both inside a large block as well as throughout the whole core. The data from all characterization and modeling activities will be needed by the ASME to certify the structural adequacy of graphite during the HTGR licensing process.

4.5.3 High Temperature Materials Qualification

The high outlet temperature of an HTGR (750°C or higher depending on the application need) requires the development of high performance metallic alloys to transfer heat from the reactor to the process application. Because these alloys will contain the high-pressure helium used to cool the reactor, stringent requirements are imposed to ensure that this piping and the equipment through which the helium flows, called the pressure boundary, will maintain its integrity. Thus, the goal of high temperature materials qualification for NGNP is to obtain the performance data required to support the development of these high temperature components over the range of envisioned outlet temperatures.

Production grade quantities of candidate high temperature alloys have been procured. State-of-the-art mechanical and environmental testing of the candidate high temperature metallic alloys is underway to understand its mechanical behavior at high temperatures and ensure that it does not degrade after long term exposure to low levels of moisture and other impurities in the helium coolant environment at the high temperatures expected in an HTGR. Extensive development of the testing equipment and its associated experimental procedures was required to modify traditional material test systems to accommodate the high temperatures necessary to obtain the accuracy and repeatability needed to qualify the alloys for use in a nuclear system like those found in HTGRs.

The testing will cover a broad range of anticipated physical dimensions and structures to be used for the high temperature components including both thick and thin sections of the alloy, flat plate and tubes, as well as welded sections and other joints to ensure adequate structural performance and safety margins for

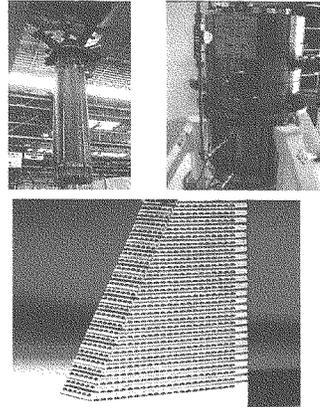


Figure 8. Example of high temperature heat exchangers and circulators.

use in the HTGRs. A detailed characterization of each alloy is performed after each test to understand the underlying behavior at the microscopic scale that contributes to the measured mechanical behavior of the metal. All of the high temperature performance data generated in the testing will be needed to certify the structural adequacy of the high temperature metals by the ASME via an established process, a part of the NGNP licensing process. As the design of the high temperature components in NGNP matures, R&D is envisioned to establish techniques to inspect the metals that form the pressure boundary during operation of the reactor. Integrated testing of key high temperature components, or testing them with the connections and in the environment experienced as part of HTGR, will be needed to characterize the integrated behavior and validate the inspection techniques for use in NGNP. It should be noted that the establishment of ASME codes and standards for both graphites and high temperature metals provides a strong foundation to support licensing by the NRC and broad commercialization of gas reactor technology.

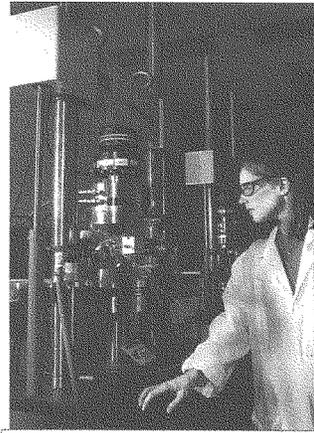


Figure 9. High temperature material testing.

4.5.4 Design and Safety Methods Validation

The goal of the NGNP design and safety methods validation is to develop the experiments and data needed to validate modeling and simulation tools used to establish the design and safety of the NGNP. DOE researchers have participated with colleagues at the NRC using a well-established expert input process to establish a ranking of important events that might occur during an accident. A best allocation of resources for safety-related R&D activities was developed based on the importance of the specific accident-related event to the overall safety of the HTGRs and the associated level of technical knowledge. Areas where the importance is high and the knowledge is low receive the greatest attention.

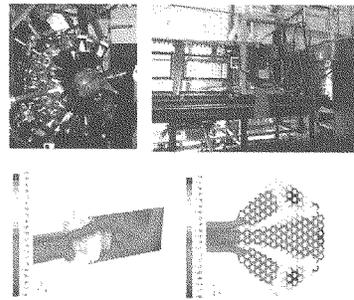


Figure 10. Experiments and computer simulations used in HTGR design and safety.

Based on this exercise, the NGNP Project is interacting with the NRC to jointly develop a set of large-scale experiments to provide safety-related data needed to validate modeling and simulation tools used to design and assess the safety of the HTGR design. This joint development effort avoids duplicative costly experiments by the licensing applicant and the regulator. The DOE and NRC have also initiated a joint collaboration with the Japanese gas reactor team to obtain unique operational data from their operating high temperature gas test reactor to validate modeling and simulation tools that predict the behavior of the integrated reactor system. Assessments are currently underway by DOE, NRC, and Laboratory personnel to technically evaluate other international capabilities that can be used to provide relevant safety data.

In addition, experiments and computer models are being developed to reduce uncertainties and improve design and safety margins.

4.5.5 Future Plans

Given the need for specialized facilities (nuclear test reactors, hot cells for examining radioactive fuels, specialized high temperature/high pressure testing facilities), acquiring the R&D data needed to qualify NGNP fuels, materials, modeling, and simulation tools for licensing will take a long time. Near-term R&D is therefore focused on continuing qualification activities in Fuel Development, Graphite Qualification, High Temperature Materials Qualification and Design and Safety Methods Validation areas to reduce risks and develop the data needed for plant design and licensing. Management of the NGNP R&D program will remain at the INL subsequent to the formation of a public-private partnership.

4.6 Schedule of activities, milestones and critical decision points

Whether or not the overall schedule for completing the construction of the NGNP in FY 2021 can still be met depends on many factors, including funding availability from both federal and private sectors. Milestones for Phase 1 of the NGNP schedule are listed in the following table. Detailed timelines for Phase 2 activities will be available after the 2011 Secretarial decision, but for the sake of completion, current rough estimates are included here.

Table 3. NGNP Schedule

Date	Activity	Type
2005 – 01/10/2011	Phase 1	Activity
08/2009	Select and validate appropriate hydrogen production Technology (High Temperature Electrolysis was selected)	Critical decision Point
2005 - 2021	Carry out enabling R&D, and demonstration activities	Activity
2005 - 2009	Carry out initial design activities for a prototype reactor and plant	Activity
9/18/2009	Issue FOA for competition to complete conceptual designs	Milestone
11/16/2009	Receive responses to FOA	Milestone
04/30/2010	Issue awards under the FOA	Milestone
04/30/2010 – 9/30/2010	Complete Conceptual Designs	Activity
09/30/2010	Detailed conceptual design reports due to DOE	Milestone
09/30/2010 – 12/15/2010	Conduct NEAC review	Activity
12/15/2010	NEAC recommendation to the Secretary on proceeding to Phase 2	Milestone
12/30/2010	Submit NEAC report to Congress	Milestone
01/11/2011	Secretary of Energy's Announcement on path forward to Phase 2	Critical Decision Point
01/11/2011 – 2021	Phase 2*	Activity
01/15/2011 – 09/30/2011	Competition process for Phase 2 Award*	Activity
09/30/2011	Award cost shared, cooperative agreement for final design and licensing*	Milestone
09/30/2011 – 09/30/2013	Prepare COLA*	Activity
09/30/2013	Submit COLA*	Milestone
10/01/2013 – 10/01/2017	NRC Review COLA*	Activity
10/01/2017	NRC Issue COL*	Milestone
2017	Start of Construction*	Milestone
2020-2021	NRC Inspections, Tests, Analysis, Acceptance criteria*	Activity
2021	NGNP Operational*	Milestone

* The schedule for these milestones and activities are dependent on the outcome of the Secretarial decision currently scheduled for January 2011

4.7 Cost Estimate and Anticipated Cost Share Requirements

Based on FY 2007 pre-conceptual design data, the Idaho National Laboratory has worked with the reactor vendors to arrive at a total project cost estimate of just under \$4 billion for a 350 – 600 MWt plant through 2021. The uncertainty of this estimate is very high and does not include escalation. A better estimate will be available as a product from the conceptual design; however, a completed preliminary design is needed to obtain high quality estimate with low uncertainty. This \$4 billion estimate assumes that two designs are funded through conceptual design with one design subsequently selected as the NGNP. This is the entire cost of the project and will include industry cost share. In accordance with the EAct 2005 section 988, the FOA established a 50/50 cost share requirement for conceptual design and demonstration activities and allows the Secretary of Energy to grant a reduction to the cost share requirement if he determines it to be necessary and appropriate. Negotiations are now in progress with the selected industry teams which, if successful, will result in cost shared awards of approximately \$40 million of Department funds. DOE anticipates use of a 50/50 cost share for Phase 2 of the NGNP Project with the exception of applied R&D, which will be cost shared at 80/20 as required in EAct. R&D that is fundamental in nature will be funded without a cost share requirement.

The major areas of cost uncertainty are related to project risk in the following areas: 1) the timely completion of necessary R&D activities in order to support design development; 2) the timely development of licensing requirements for HTGRs upon which NGNP can be designed; 3) the timely submittal of the NRC license application with appropriate final design details; and 4) the timely completion of NRC's regulatory review and hearing process and approval of the license application to permit the start of construction and operations. Delays in any of these areas will increase total project costs.

Table 4. Current Preliminary Estimated Total Project Scope Costs (federal and non-federal costs)

Cost Category	Cost (in \$millions)
Project Management	279
Research and Development	517
Design*	687
Licensing	276
Procurement	1099
Construction/Startup/Initial Operation	842
Process Heat Application	210
Total	3911**

* This estimate was prepared in FY 2007 and reflects the support of 2 designs through the conceptual design phase followed by competitive selection of a single final design.

**The uncertainty of this estimate is very high and does not include escalation. A better estimate will be available as a product from the conceptual design

5. EXAMINATION OF TECHNOLOGY OPTIONS

The NGNP will be a graphite-moderated nuclear reactor cooled by helium. This reactor design will be capable of heating its helium coolant to temperatures ranging between 750°C and 950°C, which can enable such potential applications as highly efficient electricity generation or co-generation of process heat for use in the chemical industry. Key characteristics of this reactor concept are the use of helium as a coolant, graphite as the moderator of neutrons and ceramic-coated particles as the fuel. Helium is chemically inert and will not react under all conditions. The graphite core slows down the neutrons and provides high temperature strength and structural stability for the core. The ceramic-coated particle fuel is extremely robust and retains the radioactive byproducts of the fission reaction under both normal and off-normal conditions.

There are two major design concepts for the NGNP under consideration today: a prismatic and pebble bed reactor. In the prismatic configuration, hexagonal graphite blocks are stacked to fit in a cylindrical pressure vessel. Within each block are cooling passages for helium and positions to place right circular graphite cylinders about the size of a piece of chalk that contain the coated particle fuel. Graphite reflectors surround the core to shape the neutron flux. The reactor is refueled with blocks containing new fuel enriched to 15% uranium-235 content every 12 to 18 months. In pebble bed designs, the fuel particles are formed into pebbles, the size of a tennis ball. Graphite reflectors surround the pebbles to provide structural support of the core and reflect neutrons back into the core. Pebbles enriched to about 10% uranium-235 continuously circulate through the core. On average, the pebbles are re-circulated six to ten times during their three-year life before they are permanently discharged from the reactor.

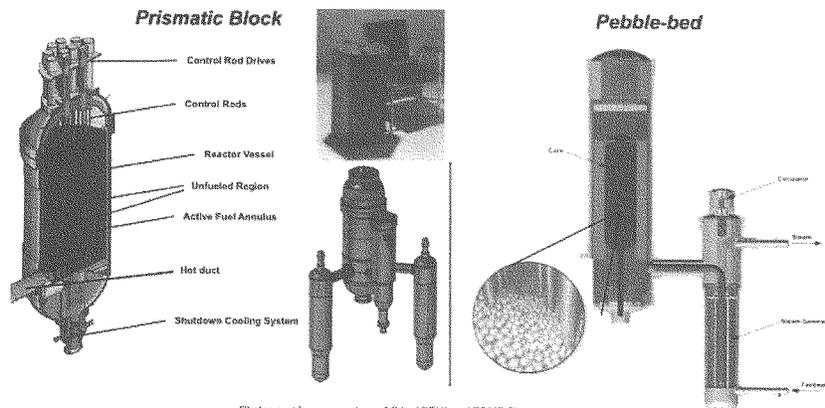
Both reactor concepts are based on coated particle fuels. Such fuels have been extensively studied around the world over the past four decades. Layers of carbon and silicon carbide surround the uranium core or kernel (the active part of the particle) thus forming tri-isotropic (TRISO)-coated particle fuel. HTGRs would contain billions of these multilayered (TRISO)-coated particles in the form of either small right circular cylinders called compacts or tennis-ball-sized spheres called pebbles.

The TRISO layers provide this fuel with extremely robust protection for the nuclear material and outstanding retention of the radioactive byproducts produced during fission. Extensive testing in Germany in the 1970s and 1980s demonstrated that outstanding performance of high-quality low-defect TRISO-coated particle fuels under both normal operation and potential but highly improbable accident conditions can be achieved. Recently completed experiments at the INL set the world record for particle fuel performance by consuming a maximum of 19 percent burn-up of the initial low-enriched uranium content, with an average burn-up of 16 percent for all of the fuel tested. The maximum 19 percent burn-up achieved is more than double the previous record set by similar particle fuel experiments run by German scientists, and more than three times that achieved by current light water reactor fuel. None of the fuel particles experienced failure during the entire three year irradiation.

It is this performance combined with the large graphite reflectors that act as a large heat sink that contributes to the passive safety of the concept, potentially allowing these reactors to be located in close proximity to industrial complexes where they can provide heat for the high temperature chemical processes

and hydrogen for chemical and petrochemical industries, the major objective of the NGNP Project. Schematics of the two design options are shown below.

Most of the challenges for these two reactor types are held in common. These are: licensing and regulatory issues associated with containment and emergency planning, business issues associated with breaking into new markets for nuclear energy in the industrial sector, and infrastructure issues associated with first-of-a-kind technology demonstrations. Some challenges are unique. For the pebble-bed, the stochastic nature of the fuel presents a unique design and licensing challenge. For the prismatic design, controlling cooling flow through the narrow channels of the graphite blocks is a challenging design and manufacturing issue.



Photos and figures courtesy of GA, AREVA and PBMR-Pty
 Figure 11. Schematics of the pebble bed and prismatic designs

6. CONCLUSIONS

This report presents a detailed accounting of the funds appropriated to the NGNP Project from FY 2006 through FY 2010. Of the \$528.4M, \$192.8M will be spent on NGNP research and development, \$177.6M on NGNP design, engineering, licensing and project management, and \$158M on university programs conducting R&D and other NGNP related activities. This report also includes a program execution plan which details the scope and schedule of activities, milestones and critical decision points, and total project cost estimates including anticipated cost share requirements. The scope of the NGNP Project includes research and development, design, licensing and construction activities leading to the operation of the NGNP in 2021. Major near term milestones include the completion of conceptual design in September 2010, and the Secretarial decision to move into Phase 2 planned for January 2011. The NGNP Project, as defined in EAct 2005, is anticipated to cost \$4 billion to execute. This project scope will be conducted on a cost share basis with the private sector. The exact details of the cost share arrangement will not be known until a final public-private partnership is formed. This report also presents the licensing

implementation strategy which details how DOE plans to execute the *NGNP Licensing Strategy Report to Congress*. The licensing approach advocated in the report has not changed, but some schedule adjustments have been made. Finally, the report describes the two major technology options under consideration which are the Pebble Bed Modular Reactor and the Prismatic designs, and the technical and commercial challenges facing each option.

NGNP Report to Congress Distribution List:

The Honorable Jeff Bingaman
Chairman, Committee on Energy
and Natural Resources
United States Senate
Washington, D.C. 20510

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Ranking Member

The Honorable Henry A. Waxman
Chairman, Committee on Energy
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Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

ESCS-4978
EYE-2009-017439
OFFICE OF THE ADMINISTRATOR

The Honorable Byron L. Dorgan
Chairman
Subcommittee on Energy
and Water Development
Committee on Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

The House report on the FY 2010 Energy and Water Development Appropriations bill (House Rep. 111-203) requests the Department of Energy to provide a status report on the National Nuclear Security Administration's development of a risk-based prioritization scheme for all nuclear nonproliferation programs, including R&D. The requested report is enclosed.

We appreciate your continued support for DOE's important nonproliferation programs. If you have any questions, please contact me or Mr. Clarence T. Bishop, Director, Office of Congressional, Intergovernmental and Public Affairs, at (202) 586-7332.

Sincerely,

Thomas P. D'Agostino
Administrator

Enclosure

cc: The Honorable Robert F. Bennett
Ranking Member





Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

OFFICE OF THE ADMINISTRATOR

The Honorable Carl Levin
Chairman
Committee on Armed Services
United States Senate
Washington, DC 20510

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Sincerely,

A handwritten signature in black ink, appearing to read "T. P. D'Agostino".

Thomas P. D'Agostino
Administrator

Enclosure

cc: The Honorable John S. McCain
Ranking Member





Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

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Enclosure

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Ranking Member



Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

OFFICE OF THE ADMINISTRATOR

The Honorable Ike Skelton
Chairman
Committee on Armed Services
U.S. House of Representatives
Washington, DC 20515

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Thomas P. D'Agostino
Administrator

Enclosure

cc: The Honorable Howard P. McKeon
Ranking Member



Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

OFFICE OF THE ADMINISTRATOR

The Honorable Peter J. Visclosky
Chairman
Subcommittee on Energy
and Water Development
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

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Enclosure

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Ranking Member





Department of Energy
National Nuclear Security Administration
Washington DC 20585

April 8, 2010

OFFICE OF THE ADMINISTRATOR

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Committee on Appropriations
United States Senate
Washington, DC 20510

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Sincerely,

A handwritten signature in black ink that reads "T. P. D'Agostino".

Thomas P. D'Agostino
Administrator

Enclosure

cc: The Honorable Thad Cochran
Ranking Member



**Report on Status of Risk-Based Prioritization Scheme
Defense Nuclear Nonproliferation
National Nuclear Security Administration (NNSA)**

Background

The House report on the FY 2010 Energy and Water Development Appropriations bill (H.Rep. 111-203) requests the Department to provide a status report to the Appropriations Committee within 90 days of enactment of the bill on the NNSA's development of a risk-based prioritization scheme for all nuclear nonproliferation programs, including R&D (pg 89).

“To better inform budget formulation, the Committee directs the NNSA to develop a risk-based prioritization scheme for all nuclear nonproliferation programs, including R&D and provide a status report within 90 days of enactment.”

Individual Program Risk Assessment

Each program within the Office of Defense Nuclear Nonproliferation (DNN) applies a particular formula to assess risk, determine whether security at a given site is adequate, and prioritize activities. Detailed below is an explanation of how risk is assessed for the following DNN programs:

- International Nuclear Materials Protection and Cooperation (INMP&C)
- Global Threat Reduction Initiative (GTRI)
- Nonproliferation and Verification Research & Development

Additionally, the Office of Defense Nuclear Nonproliferation has developed an overarching risk assessment methodology that is used by all DNN programs. These established criteria help evaluate risk, prioritize among nonproliferation program activities, and inform budget allocations.

The **International Nuclear Materials Protection and Cooperation (INMP&C)** program uses a formula to quantitatively assess risk for Material Protection Control and Accounting (MPC&A): Risk = Frequency of Attack x Consequence of Loss x (1 - Probability of System Effectiveness). Each of these variables is represented by a value within a range from 0.0 (no probability) to 1.0 (certainty). The Frequency of Attack always equals 1.0 (for analysis purposes, we assume an attack will occur). Consequence of Loss (C) is a value placed on the relative lethality, portability, and/or nature of the nuclear target. For nuclear warheads, that value equals 1.0, the highest possible consequence value. “System Effectiveness” is a critical value that represents the relative capability of the physical protective system (PPS) to detect, assess, interrupt, and neutralize specified threats. As no systems are perfectly effective under all conditions, the actual System Effectiveness (Probability of Effectiveness or PE) is assumed to be some value less than 1.0. (1- PE) describes the probability of system ineffectiveness. The conditional Risk formula is: $R = F \times C \times (1-PE)$, where:

R = Conditional Risk
F = Frequency of Attack (1.0)
C = Consequence of Loss
PE = Probability of (Physical Protective) System Effectiveness

The INMP&C program determines appropriate upgrade strategies based on risk determinations and detailed security upgrade methodologies contained in the MPC&A Programmatic Criteria Document and the Sustainability Guidelines Document.

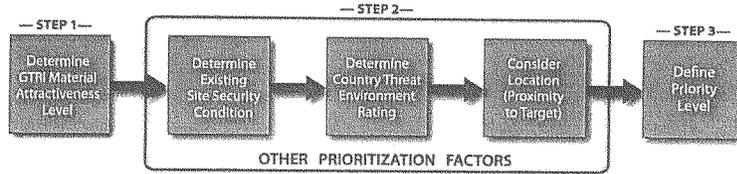
The Second Line of Defense program uses two complementary prioritization approaches, one for its Core Program and one for its Megaports Initiative. Under the Core Program, DOE/NNSA deploys equipment at land borders, airports and feeder seaports.

The SLD Core Program uses a variety of tools to prioritize countries and sites. It has funded risk modeling at Los Alamos National Laboratory and Sandia National Laboratories. These models utilize factors such as past smuggling events, proximity to nuclear material, corruption, etc. The Core Program targets sites in three types of countries: source, transit and destination countries. Source countries are those with recognized stockpiles of weapons useable nuclear materials. Transit countries include the Caucasus, Eastern Europe, and Central and South Asian countries. Destination countries include countries in the Middle East, North Korea, and others. In addition, the Core Program has funded regional studies and risk assessments through other subject matter expert contractors. Sites are prioritized using model results and other information such as input gained from discussions with host country governments, who share smuggling and traffic volume information. One overriding goal of the program is to stop illicit trafficking as close to the source as possible, before material has been fabricated or assembled into a device. The further through the fabrication process, the greater the investment by a terrorist and the more likely that the material/device will be well protected from detection.

The Megaports Initiative follows a strategy that considers the volume, origin, and destination of container cargo movement through a port, the likelihood that nuclear material might be smuggled through a port and the country's willingness to participate in the program. DOE/NNSA considers both ports of high volume and ports in areas of high strategic interest or threat. Working closely with the national laboratories, DOE/NNSA developed a Maritime Prioritization Model (MPM) to assist in the evaluation of candidate ports considering both the volume of containers handled and the potential threat. The model considers factors such as terrorist groups operating in the country, the human development index for the country, the presence of special nuclear material in the country, governance data, ship movements into and out of the ports, and estimated scannable volume. Using this model, we have identified approximately 100 ports of interest (of the approximately 700 ports that ship to the U.S.). Implementation of the Megaports Initiative at these 100 ports will result in the scanning of approximately 50 percent of global shipping traffic.

The **Global Threat Reduction Initiative (GTRI)** program follows a three-step prioritization process, reflected in its "Protection and Sustainability Criteria" (updated January, 2010), which provides a systematic method to prioritize projects and assign resources, and a graded, risk-based approach to integrated protection of nuclear and other radioactive materials domestically and internationally. The three-step process involves: 1) determining the attractiveness of the nuclear/radiological material, 2) assessing other risk factors, and 3) assigning a prioritization score. This process is illustrated in the figures below.

Figure 1. GTRI Prioritization Process



In step 1, GTRI assigns a Material Attractiveness Level based on amount and type of nuclear/radiological material.

Figure 2. GTRI Material Attractiveness Levels

Step 1 Attractiveness Level	Nuclear Concern (kg)		Radiological Concern	
	²³⁵ U (HEU > 20% Enriched)	Pu ²³⁹ Pu	Radioactive Sources (Ci)*	Research Reactors
1A	≥25Kgs	≥8Kgs	---	---
1B	≥5Kgs	≥2Kgs	≥100,000 Ci	---
2	≥1Kg	≥0.5Kgs	≥1,000 Ci	≥1 MW
3	≥15g	≥15g	≥10 Ci	≥0.1 MW
4	<15g	<15g	<10 Ci	<0.1 MW

* The 16 materials of concern are ²³⁵Am, ²⁴¹Am/Ba, ²⁴²Cl, ²⁴⁴Cm, ²⁴²Co, ²⁴³Ca, ²⁴³Gd, ²⁴³Hf, ²⁴³Pm, ²⁴³Pu, ²⁴³Pu/Ba, ²⁴³Ra, ²⁴³Se, ²⁴³Sr, ²⁴³Tm, ²⁴³Yb, and spent fuel. Seven additional isotopes of concern in very large amounts (e.g., isotope production facilities) are ¹³C, ¹⁵Fa, ¹⁵³I, ²¹⁰Po, ²⁵²Sr, ²⁴³W.

Step 2 involves assigning Other Prioritization Factors based on the location and security situation of the material.

Figure 3. Other Prioritization Factors

Step 2 Factor	Existing Site Security Conditions (Choose one)		Country Threat Environment (Choose one)		Location/Proximity to Target (Choose one)	
	Factor	Points	Factor	Points	Factor	Points
BASIC SECURITY – Site has a few of the approved security upgrades listed in the Site Security Upgrades Toolbox or has difficulty responding to security events.		+2	Very High	+2	In the United States UASI Tier 1 or 2	+2
MODERATE SECURITY – Site has most, but not all, of the approved security upgrades listed in the Site Security Upgrades Toolbox and has demonstrated a limited ability to respond to security events.		+1	High	+1	In United State, but not UASI Tier 1 or 2; Near "Strategic Asset" outside the U.S.	+1
ADVANCED SECURITY – Site has nearly all the approved security upgrades listed in the Site Security Upgrades Toolbox and has demonstrated ability to maintain and respond to security events.		+0	Moderate	+0	Outside U.S., not near "Strategic Asset"	+0

* In 2003, DHS created the UASI (Urban Areas Security Initiative) program to support the planning, operations, equipment, training and exercise needs of high-threat, high-density urban areas across the U.S.

Finally, step 3 involves combining the Material Attractiveness Level and Other Prioritization Factors together to determine the final GTRI Prioritization Level.

Figure 4. GTRI Prioritization Levels

Material Attractiveness	Cumulative Score from Other Threat Factors	GTRI Priority
Level 1A		
Level 1B	0-3	Priority 1B
Level 2	0-3	Priority 2
Level 3	4-6	Priority 2
	0-3	Priority 3
Level 4	4-6	Priority 3
	0-3	Priority 4

The GTRI Prioritization Level is used to develop GTRI’s lifecycle plan, and aids in determining which projects should be undertaken each fiscal year, given budget constraints.

The **Office of Nonproliferation and Verification Research & Development** assesses and manages risk through a two-tiered approach. The first tier is designed to manage risk across the R&D programs as a component of a long-term strategic prioritization of research activities. The second tier is determined through a process of selection of individual projects utilizing a standardized merit review process practiced across federal R&D funding agencies.

Further, the R&D program utilizes internal and external expert opinion to develop program prioritization and drive down risk. Among the external groups consulted are a number of intergovernmental executive and working level groups to inform decision making. These groups represent the user community to ensure that R&D efforts address future nonproliferation needs and to identify areas of greatest risk to U.S. security and rank the investment requirements in those areas.

Some examples include:

- Counterproliferation Review Committee (CPRC) – Senior leaders from DOE, DoD, State and other agencies provide a bi-annual report to Congress on R&D trends applicable to national-level counterproliferation efforts;
- White House, Office of Science and Technology Policy (OSTP) Committees – Multiple OSTP-led working groups under the National Science and Technology Council (NSTC) set technology roadmaps for future federal investments;

- Space Technology Alliance – A forum for the R&D leaders from agencies engaged in space systems development and operations that coordinates technical programs and develops plans to address national needs/gaps in space technology and industrial capacity; and
- Nuclear Test Intelligence Committee – A forum of agencies with roles in monitoring, analyzing, and reporting nuclear activity that coordinates and reviews developments and plans future capability.

The internal community routinely consulted consists of technical experts from across the U.S. national laboratories, academia and industry to provide strategic advice and opinion on individual programs and on the risks associated with each research area. These assessments minimize risk through identification of areas of potential technological surprise that require long-term, high-risk/high-payoff technological investment.

This sequential, tiered process of risk reduction results in specific technology development roadmaps, which provide programmatic guidance over multiple years and ensure the highest quality technical product for the least investment. An example of one programmatic roadmap, in this case for the development of new technologies to detect the illicit movement of highly enriched uranium or plutonium – which could be used in a nuclear weapon – is shown below.

Figure 5. Risk assessment for technology areas in Special Nuclear Material Movement Detection.

Red – high risk; Yellow – medium risk; Green – low risk

R&D Technical Area	R&D Technology Class	Shielded HEU Detection			Standoff Detection of SNM			Shielded Pu Detection		
		Characterize	Identify/Screen	Search	Characterize	Identify/Screen	Search	Characterize	Identify/Screen	Search
Gamma correlation	High-rate, high-multiplicity gamma detector	2	2	2	2	2	2	2	2	2
Gamma Imaging	Distributed sensor systems									
	Electronically collimated systems	1	1	1						
	Mechanically collimated systems	2	2	2	2	2	2	2	2	2
Gamma spectroscopy	Algorithms for ID in active systems	1	1							
	High-resolution gamma-ray detectors	1	1							
Neutron correlation	Alternate neutron detectors	2	2	2	2	2	2	2	2	2
	Large-area detectors—high energy			1					2	2
	Large-area detectors—thermal	2	2	2	2	2		3	3	3
	Solid-state neutron detectors	1	1	1		1		1	1	1
Neutron Imaging	Timing and multiplicity	2	2	2	2	2	2	2	2	2
	3D neutron tracking detector	2	2	2						
Neutron spectroscopy	Neutron imaging detectors	2	2	2	2	2	2	2	2	2
	Ultra high-resolution neutron spectrometry	3			3					
Photon source	Neutron spectroscopy systems	2	2	2	2	2	2	2	2	2
	Broad spectrum	3	3	3	3	3	3	3	3	3
Neutron source	Monenergetic	3	1	1					1	1
	Accelerator based	2	2	2				2	2	2
Other Source	Radioactive source based	3	3	2	2	2	2	3	3	2
	Muon sources, proton sources, ...									

Roadmaps such as the one presented above have been developed for all major programs in the Office of Nonproliferation and Verification R&D. These roadmaps are continually updated and reassessed through the aforementioned processes to ensure that the programs are on the technical cutting edge while providing the best value for the resources expended.

DNN Risk Assessment

While the various nonproliferation programs at NNSA have developed a variety of methodologies over the years for prioritizing the threat reduction efforts within their programs' purview, DNN also makes use of a risk assessment methodology to prioritize and evaluate trade-offs across the full range of nonproliferation programs that would otherwise defy easy comparisons. These risk trade-offs are used to inform decision making, and the full scope of national security demands is evaluated within available resources throughout the **Planning, Programming, Budgeting, and Evaluation (PPBE)** process.

Some fundamental principles underlie the DNN risk assessment methodology. First, even with the hypothetical situation of unlimited resources, it is not possible to completely eliminate all proliferation risk. Second, not all threats are equally probable or consequential. Therefore, the DNN program management methodology reflects the view that it is possible to manage and minimize the many variable risks by addressing the most credible and most serious threats before attempting to mitigate lesser threats.

To implement this approach, NNSA prioritizes activities considered part of the first line of defense against nuclear terrorism and proliferation: funding for efforts to secure special nuclear materials at their site of origin, as it becomes progressively more difficult to detect and secure such material once it has been moved; and material disposition to reduce the total amount of material that requires security. NNSA then focuses down the risk continuum on second line of defense activities to detect materials in transit, especially across international borders and other transit sites, to reduce the availability of the technologies and technical expertise to create these materials, and securing radiological source materials.

PPBE Process

The PPBE process is the fundamental business process in the NNSA. It provides the mechanism to conduct horizontal integration of NNSA priorities, and perform cost-performance trade-offs. The Strategic Planning phase at the start of the PPBE process is essentially "fiscally unconstrained" and assures that all requirements, new ideas, and novel approaches are raised for discussion and considered. The Administrator's strategic planning guidance (sometimes issued annually but not always) illuminates his long-term vision, priorities, and issues faced by NNSA as a whole, and it establishes the fiscal framework for the Programming phase of the process. It sometimes identifies "emerging issues" that might challenge the NNSA Baseline Program and may also direct some "excursions" to be studied further during the Programming phase.

The Programming phase is fiscally-constrained, and uses the previous year's Future Years Nuclear Security Plan (FYNSP) estimates as its starting point. The programming process uses a number of documents to: 1) develop proposals to update and rebalance baseline programs; 2) identify for discussion changes needed to policy and program implementation, and; 3) clarify and memorialize NNSA programming process decisions. These include internal multi-year program plans, NNSA Program and Fiscal Guidance, individual program guidance documents and priorities to field elements, and major construction data sheets, to name a few.

PPBE Risk Assessment Criteria

Within the PPBE process DNN considers eight criteria to help evaluate risk, prioritize among nonproliferation program activities, and inform budget allocations. The criteria are as follows:

- Budgetary Risk
- Urgency
- Policy priority
- Likelihood of crisis
- Legal obligation or other commitment
- Opportunity to save money and/or time
- Unique opportunity (political/technological)
- Other parties involved

Other departments and agencies use different criteria to evaluate risk. The Department of Defense, Federal Bureau of Investigation, Central Intelligence Agency, Department of Homeland Security, Department of Health and Human Services, etc., are each focused on a different set of problems and view certain phenomena as more or less threatening or benign – more or less meaningful in their judgment in terms of evaluating how they should allocate their marginal funds. The GAO has correctly noted that program managers are in the best position to assess the risks associated with their own programs and to develop and implement appropriate policies and controls to mitigate the risks they encounter.

Budget Risk

“Budget risk” refers to the threat posed to the program by the current or projected level of funding. It is not useful in every single programmatic decision, because it refers to a problem that only results when funding for a particular effort is judged insufficient to achieve a desired objective. Using this criterion, underfunded capital construction projects would likely be characterized as “at funding risk” because construction projects require funding in discreet chunks, rather than as periodic and possibly variable revenue streams. A program at funding risk would be a candidate for increased budgetary attention if, without additional funds, the program would fail to achieve critical milestones. Among the questions a manager would have to answer regarding this criterion are:

What is the budgetary risk to this program if it doesn’t receive the requested funding? Is the program likely to fail without new funding? Can the program satisfy its goals with the funding originally projected for it over the FYNSP or over the projected life cycle of the project or program?

Urgency

“Urgency” refers to the time dimension of the consequences associated with not funding a particular request. A program advocate would present an urgent need for funding if within the time horizon envisioned for the budget request (18-24 months) there was a foreseeable need for funds that could not be accommodated by a slower process (e.g., until a reprogramming request could be completed), and if the nature of the need increased as a

function of time. There are many examples of programs with budgetary needs, but if the requirement does not increase as a function of time, then it would not be considered “urgent.” Urgency, as a criterion for budgetary attention, requires that an element of exigency or impending crisis be present. A program manager seeking to claim an urgent requirement would have to be prepared to answer questions such as the following:

Is there something time-critical about this problem that should affect the decision about funding? Does a particular action or decision have to be taken within the time horizon of the current budget cycle?

Policy Priority

“Policy priority” refers to the degree of convergence between the policy impetus behind a funding request and U.S. foreign policy, as expressed by a variety of documents, including but not limited to: the National Security Strategy, the National Strategy to Combat Weapons of Mass Destruction, relevant National Security Policy Decisions (NSPDs), Secretarial commitments, the Department of Energy and NNSA strategic plans, statutory or treaty requirements, and legislative guidance. Funding requests that can be shown to advance policy preferences spelled out in documents such as those cited above are more likely to enjoy support than proposals that advance ideas not already endorsed by policy deliberations. Advocates can be expected to answer questions such as:

What is the policy priority of this program and its funding need? Does the policy priority accord with those expressed in relevant NSPDs, the National Security Strategy, the National Strategy to Combat Weapons of Mass Destruction, Secretarial policy positions, the NNSA Strategic Planning Guidance, and the individual program office strategic plan?

Crisis Likely

A program advocate is more likely to get increased funding upon demonstration that a crisis of some sort is likely in the absence of that funding. However, alarming claims are sometimes suspect, and a merely challenging situation has to assume significant proportions of demonstrable authenticity to get previously-unanticipated funding. Furthermore, this criterion is not the same as “urgency.” The difference is that this criterion asks “how dangerous is the event that might transpire” if a decision were made to not fund, rather than asking about the time-criticality of the funding. An advocate deploying this argument would need to be able to credibly answer the following:

Is there any likelihood of an international crisis as a result of not funding this request? For example, could a war break out or could a serious terrorist incident occur as a result of not funding this request? Could failure to fund the request trigger a major political crisis, such as a coup in another country, or present a major political embarrassment to the United States?

Legal obligation or other commitment

Another important criterion we consider in evaluating how to allocate relatively scarce resources is what the U.S. legal obligation or other commitment may be in carrying out proposed activities. Legal requirements can be found in treaties and other agreements to which the United States is a signatory. Given the binding, legal nature of these mandates, associated funding requests are treated earnestly and with gravity. Other undertakings, such as Secretarial commitments or the continuation of highly-visible, long-standing practice, also present a pressing sense of importance. An advocate who deploys this argument would have to be able to answer the following question:

Does the United States or the Department of Energy bear some legal or other obligation to fund this effort, such as by treaty, court ruling, legislation, regulation or longstanding and expected practice?

Opportunities to save time or money

It is sometimes the case that we may be able to accelerate ongoing work or take advantage of economies of scale if we can commit funds to some projects earlier in their life cycle than later or originally anticipated. We are always attentive to fleeting opportunities to perform work that would be relatively less expensive to accomplish in the present than might be in the long run. For example, we may evaluate two proposed projects of roughly equal nonproliferation value, but one of them may pave the way to a new technology that could accelerate progress in another program. Such a benefit would be one of the criteria we consider in allocating marginal nonproliferation funds. An advocate using this argument would have to be able to answer the following questions:

Does this proposed expenditure carry with it any opportunity to save time or money in the long run if funded now, rather than later? Could the proposal accelerate work by a measurable and meaningful amount of time? Might the incremental expenditure sooner than planned actually result in a decreased lifecycle cost?

Unique opportunity (political or technological)

Even more frequent than opportunities to accelerate work or reduce overall expense, we often encounter political changes or technological opportunities that partially direct our allocation decisions. Examples abound in current news events, intelligence traffic and diplomatic reporting, but the 2003 decision by Libya to renounce its WMD program is a particularly good example of a unique political environment that required us to respond quickly and meaningfully to the unexpected opportunity. Similarly, technological opportunities also present themselves, and make it more desirable to undertake some activities than might have been the case without the technology. A manager proposing additional funding with this line of argument would have to answer the following:

Does this proposed expenditure carry with it any unique opportunity to 1) take advantage of favorable political developments in a foreign country; 2) make use of a recent technological

advance that wasn't available earlier or that will be lost later, or; 3) take advantage of a particular market condition (e.g., low uranium prices on the world market)?

Other parties involved

The final criterion among those we typically consider as we evaluate risk in disparate NNSA nonproliferation programs is whether or not other parties are involved. For example, two proposals may enjoy roughly equal nonproliferation value, but one may carry with it an industry partner or a foreign government willing to commit matching funds to the venture. A second example exists in the support the USG provides to organizations such as the Nuclear Suppliers Group (NSG) or the International Atomic Energy Agency (IAEA). For example, we might consider the benefit of funding a specific capability for the NSG or a new technology to the IAEA, and would evaluate the impact of the expense against the clear benefit of multilateral action against a particular threat. An advocate using this argument would have to be able to answer the following question:

Does this proposed expenditure carry with it any opportunity or obligation because other parties or equities are involved, such as a private company, bilateral or multilateral partners, or a non-governmental organization that is prepared to contribute to this work?

Conclusion

These evaluations are not produced as formal documents, but they serve as a valuable tool in helping senior nonproliferation managers think clearly and systematically about the costs and benefits of various funding alternatives, particularly with respect to how well those proposals align with the numerous planning documents that underpin a coordinated foreign policy in general, and DNN nonproliferation policy and programs in particular. These criteria form the basis for the budget advocacy briefings made to each successively higher level of management in the course of transforming strategic planning and programming deliberations into concrete budget proposals and program plans as part of the PPBE process. All program advocates must make their case for funding on the basis of these criteria. Other criteria are possible, and we remain open to the development of new criteria, but these have been shown to be effective in advancing those programmatic proposals that offer the greatest nonproliferation benefit available from funding.

Although there is no mandate for using any particular risk assessment method, we recognize such tools to be valid decision support aids that help us establish and prioritize programmatic funding requirements in general, and help determine how to best use the marginal nonproliferation dollar in particular. We consider the use of this risk assessment methodology to be part of a balanced approach to program management that combines careful risk assessment with long-standing best practices in program management. In the FY 2012-2016 PPBE process DNN plans to continually improve program surveillance; to strengthen our ability to monitor world conditions that play a vital role in the risk assessment process, and; to prudently modify our performance indicators and risk criteria when conditions warrant their adjustment.



Department of Energy

Washington, DC 20585

April 15, 2010

The Honorable David Obey
Chairman, Committee on Appropriations
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Chairman:

The Department of Energy is pleased to provide you with the enclosed *Nuclear Energy Research and Development Roadmap Report to Congress*.

The enclosed report fulfills the provision in House Report 111-203 accompanying the Fiscal Year 2010 Energy and Water Development Appropriations Bill that requested the Department submit its detailed nuclear energy research and development strategy and program plan.

If you have any questions, please contact me or Ms. Tara Hicks, at 202-586-4180.

Sincerely,

A handwritten signature in black ink, appearing to read "Warren F. Miller, Jr.", is written over a horizontal line.

Warren F. Miller, Jr.
Assistant Secretary
for Nuclear Energy

Enclosure

cc: The Honorable Jerry Lewis
Ranking Member



DISTRIBUTION

The Honorable Peter J. Visclosky
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and Water Development
Committee on Appropriations
U.S. House of Representatives
Washington, DC 20515

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Ranking Member

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Chairman, Committee on Energy
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United States Senate
Washington, DC 20510

Dear Mr. Chairman:

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United States Senate
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The Honorable David R. Obey
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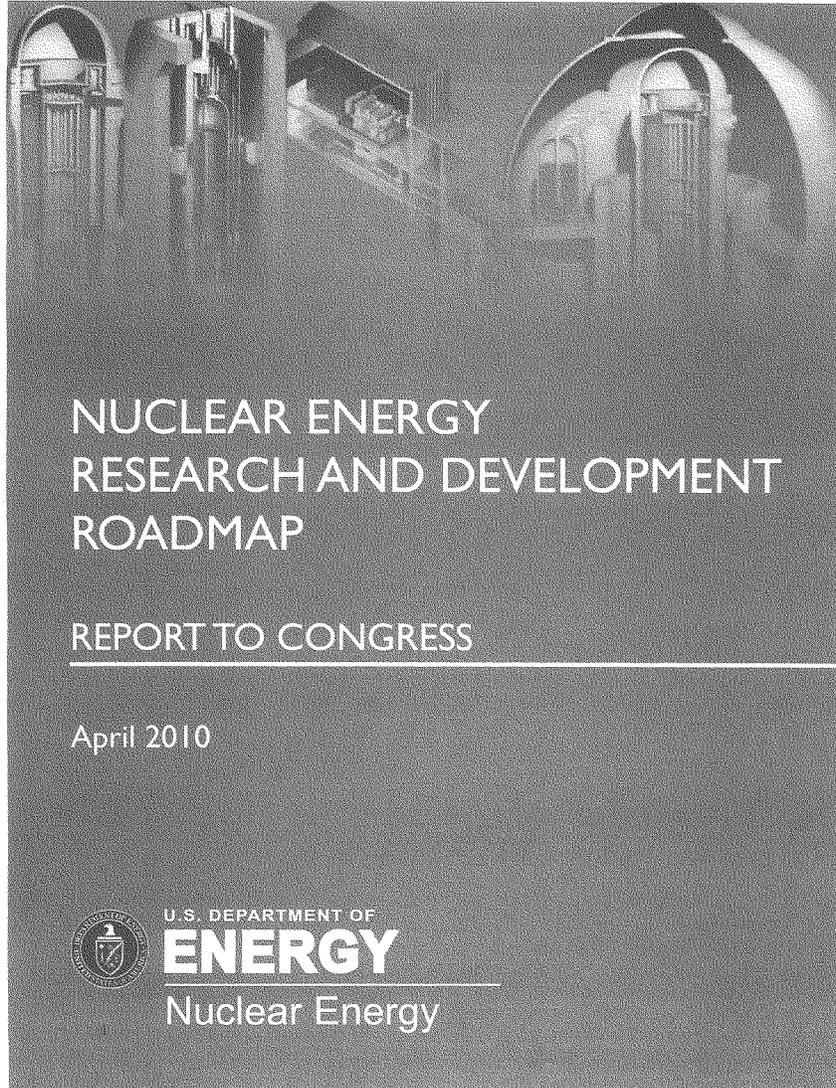
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cc: The Honorable Jerry Lewis
Ranking Member

The Honorable Daniel K. Inouye
Chairman, Committee on
Appropriations
United States Senate
Washington, DC 20510

Dear Mr. Chairman:

cc: The Honorable Thad Cochran
Ranking Member



NUCLEAR ENERGY
RESEARCH AND DEVELOPMENT
ROADMAP

REPORT TO CONGRESS

April 2010



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

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LIST OF ACRONYMS

BTU	British Thermal Units
CO ₂	Carbon dioxide
DOE	Department of Energy
EE	DOE–Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Agency
EPRI	Electric Power Research Institute
FE	DOE–Office of Fossil Energy
GDP	Gross domestic product
GHG	Greenhouse gas
GWe	Gigawatt (electric)
GWe-yr	Gigawatt-year (electric)
HTGR	High-temperature gas-cooled reactor
HTR	High-temperature reactor
IAEA	International Atomic Energy Agency
I&C	Instrumentation, information and control
IPSR	Integral primary system reactor
ITAAC	Inspections, test, analyses and acceptance criteria
kW-hr	Kilowatt-hour
LWR	Light-water reactor
MPACT	Materials Protection, Accounting and Control for Transmutation
MT	Metric ton
MWe	Megawatt (electric)
MWh	Megawatt-hour
NDE	Nondestructive evaluation
NE	DOE–Office of Nuclear Energy
NEA	Nuclear Energy Agency
NGNP	Next Generation Nuclear Plant
NGSI	Next Generation Safeguards Initiative
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OECD	Organization for Economic Cooperation and Development
R&D	Research and development
RISMC	Risk-informed safety margin characterization
SC	DOE–Office of Science
SMR	Small, modular reactor
UNF	Used nuclear fuel

EXECUTIVE SUMMARY

To achieve energy security and greenhouse gas (GHG) emission reduction objectives, the United States must develop and deploy clean, affordable, domestic energy sources as quickly as possible. Nuclear power will continue to be a key component of a portfolio of technologies that meets our energy goals. This document provides a roadmap for the Department of Energy's (DOE's) Office of Nuclear Energy (NE) research, development, and demonstration activities that will ensure nuclear energy remains a viable energy option for the United States.

Today, the key challenges to the increased use of nuclear energy, both domestically and internationally, include:

- The capital cost of new large plants is high and can challenge the ability of electric utilities to deploy new nuclear power plants.
- The exemplary safety performance of the U.S. nuclear industry over the past thirty years must be maintained by an expanding reactor fleet.
- There is currently no integrated and permanent solution to high-level nuclear waste management.
- International expansion of the use of nuclear energy raises concerns about the proliferation of nuclear weapons stemming from potential access to special nuclear materials and technologies.

In some cases, there is a necessary and appropriate federal role in overcoming these challenges, consistent with the primary mission of NE to advance nuclear power as a resource capable of making major contributions to meeting the nation's energy supply, environmental, and energy security needs. This is accomplished by resolving technical, cost, safety, security and proliferation resistance barriers, through research, development, and demonstration, as appropriate. NE's research and development (R&D) activities will help address challenges and thereby enable the deployment of new reactor technologies that will support the current fleet of reactors and facilitate the construction of new ones.

Research and Development Objectives

NE organizes its R&D activities along four main R&D objectives that address challenges to expanding the use of nuclear power: (1) develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors; (2) develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals; (3) develop sustainable nuclear fuel cycles; and (4) understanding and minimization of risks of nuclear proliferation and terrorism.

R&D OBJECTIVE 1: Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors

The existing U.S. nuclear fleet has a remarkable safety and performance record, and today these reactors account for 70 percent of the low greenhouse gas (GHG)-emitting domestic electricity production. Extending the operating lifetimes of current plants beyond sixty years and, where possible, making further improvements in their productivity will generate near-term benefits. Industry has a significant financial incentive to extend the life of existing plants, and as such, activities will be cost shared. Federal R&D investments are appropriate to answer fundamental scientific questions and, where private investment is insufficient, to help make progress on broadly applicable technology issues that can generate public benefits. The DOE role in this R&D objective is to work in conjunction with industry and where appropriate the Nuclear Regulatory Commission (NRC) to support and conduct the long-term research needed to inform major component refurbishment and replacement strategies, performance enhancements, plant license extensions, and age-related regulatory oversight decisions. DOE will focus on aging phenomena and issues that require long-term research and are generic to reactor type.

R&D OBJECTIVE 2: Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals

If nuclear energy is to be a strong component of the nation's future energy portfolio, barriers to the deployment of new nuclear plants must be overcome. Impediments to new plant deployment, even for those designs based on familiar light-water reactor (LWR) technology, include the substantial capital cost of new plants and the uncertainties in the time required to license and construct those plants. Although subject to their own barriers for deployment, more advanced plant designs, such as small modular reactors (SMRs) and high-temperature reactors (HTRs), have characteristics that could make them more desirable than today's technology. SMRs, for example, have the potential to achieve lower proliferation risks and more simplified construction than other designs. The development of next-generation reactors could present lower capital costs and improved efficiencies. These reactors may be based upon new designs that take advantage of the advances in high performance computing while leveraging capabilities afforded by improved structural materials. Industry plays a substantial role in overcoming the barriers in this area. DOE provides support through R&D ranging from fundamental nuclear phenomena to the development of advanced fuels that could improve the economic and safety performance of these advanced reactors. Nuclear power can reduce GHG emissions from electricity production and possibly in co-generation by displacing fossil fuels in the generation of process heat for applications including refining and the production of fertilizers and other chemical products.

R&D OBJECTIVE 3: Develop Sustainable Nuclear Fuel Cycles

Sustainable fuel cycle options are those that improve uranium resource utilization, maximize energy generation, minimize waste generation, improve safety, and limit proliferation risk. The key challenge is to develop a suite of options that will enable future decision makers to make informed choices about how best to manage the used fuel from reactors. The Administration has established the Blue Ribbon Commission on America's Nuclear Future to inform this waste-management decision-making process. DOE will conduct R&D in this area to investigate technical challenges involved with three potential strategies for used fuel management:

- *Once-Through* – Develop fuels for use in reactors that would increase the efficient use of uranium resources and reduce the amount of used fuel requiring direct disposal for each megawatt-hour (MWh) of electricity produced. Additionally, evaluate the inclusion of non-uranium materials (e.g., thorium) as reactor fuel options that may reduce the long-lived radiotoxic elements in the used fuel that would go into a repository.
- *Modified Open Cycle* – Investigate fuel forms and reactors that would increase fuel resource utilization and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed (per MWh), with limited separations steps using technologies that substantially lower proliferation risk.
- *Full Recycling* – Develop techniques that will enable the long-lived actinide elements to be repeatedly recycled rather than disposed. The ultimate goal is to develop a cost-effective and low proliferation risk approach that would dramatically decrease the long-term danger posed by the waste, reducing uncertainties associated with its disposal.

DOE will work to develop the best approaches within each of these tracks to inform waste management strategies and decision making.

R&D OBJECTIVE 4: Understand and minimize the risks of nuclear proliferation and terrorism

It is important to assure that the benefits of nuclear power can be obtained in a manner that limits nuclear proliferation and security risks. These risks include the related but distinctly separate possibilities that nations may attempt to use nuclear technologies in pursuit of a nuclear weapon and that terrorists might seek to steal material that could be used in a nuclear explosive device. Addressing these concerns requires an integrated approach that incorporates the simultaneous development of nuclear technologies, including safeguards and security technologies and systems, and the maintenance and strengthening of non-proliferation frameworks and protocols. Technological advances can only provide part of an effective response to proliferation risks, as institutional measures such as export controls and safeguards are also essential to addressing proliferation concerns. These activities must be informed by robust assessments developed for understanding, limiting, and managing the risks of nation-state proliferation and physical security for nuclear technologies. NE will focus on assessments required to inform domestic fuel

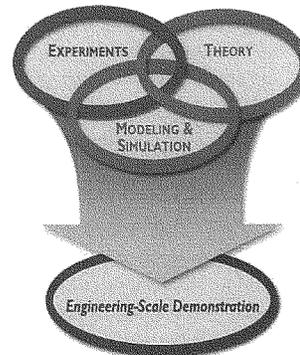
cycle technology and system option development. These analyses would complement those assessments performed by the National Nuclear Security Administration (NNSA) to evaluate nation state proliferation and the international nonproliferation regime. NE will work with other organizations including the NNSA, the Department of State, the NRC, and others in further defining, implementing and executing this integrated approach.

R&D Areas

The Department expects to undertake R&D in a variety of areas to support its role in the objectives outlined above. Examples include:

- Structural materials
- Nuclear fuels
- Reactor systems
- Instrumentation and controls
- Power conversion systems
- Process heat transport systems
- Dry heat rejection
- Separations processes
- Waste forms
- Risk assessment methods
- Computational modeling and simulation

Figure 1. Major Elements of a Science-Based Approach



R&D Approach

A goal-driven, science-based approach is essential to achieving the stated objectives while exploring new technologies and seeking transformational advances. This science-based approach, depicted in Figure 1, combines theory, experimentation, and high-performance modeling and simulation to develop the fundamental understanding that will lead to new technologies. Advanced modeling and simulation tools will be used in conjunction with smaller-scale, phenomenon-specific experiments informed by theory to reduce the need for large, expensive integrated experiments. Insights gained by advanced modeling and simulation can lead to new theoretical understanding and, in turn, can improve models and experimental design. This R&D must be informed by the basic research capabilities in the DOE Office of Science (SC).

NE maintains access to a broad range of facilities to support its research activities. Hot cells and test reactors are at the top of the hierarchy, followed by smaller-scale radiological facilities, specialty engineering facilities, and small non-radiological laboratories. NE employs a multi-pronged approach to having these capabilities available when needed. The core capabilities rely on DOE-owned irradiation, examination, chemical processing and waste form development facilities. These are supplemented by university capabilities ranging from research reactors to materials science laboratories. In the course of conducting this science-based R&D,

infrastructure needs will be evaluated and considered through the established planning and budget development processes.

There is potential to leverage and amplify effective U.S. R&D through collaboration with other nations via multilateral and bilateral agreements, including the Generation IV International Forum. DOE is also a participant in Organization of Economic Cooperation and Development/Nuclear Energy Agency (OECD/NEA) and International Atomic Energy Agency (IAEA) initiatives that bear directly on the development and deployment of new reactor systems. In addition to these R&D activities, international interaction supported by NE and other government agencies will be essential in establishment of international norms and control regimes to address and mitigate proliferation concerns.

I. INTRODUCTION

Access to affordable, abundant energy – chiefly from fossil fuel sources – has been a key enabler of economic growth since the Industrial Revolution. However, as the first decade of the 21st century draws to a close, the United States finds itself confronted with economic, environmental, and national security challenges related in part to the manner in which our society produces, distributes, and uses energy. Continued access to plentiful, secure, and environmentally benign energy is fundamental to overcoming these challenges.

Nuclear energy is an important element of the diverse energy portfolio required to accomplish our national objectives. NE conducts research and development, and demonstrations, as appropriate, that will help enable the benefits of clean, safe, secure and affordable nuclear energy to continue and expand.

Nuclear power is a proven clean, affordable, domestic energy source that is part of the current U.S. energy portfolio.

This document identifies opportunities and challenges associated with continued and increased use of fission energy to enhance our nation's prosperity, security, and environmental quality; outlines the NE role and mission in enabling the benefits of nuclear energy for our nation; and presents a strategy and roadmap to guide the NE scientific and technical agenda. The report presents a high-level vision and framework for R&D activities needed to keep the nuclear energy option viable in the near term and to expand its use in the decades ahead.

Section 2 describes the current energy production and utilization landscape in the United States. Section 3 articulates NE's fundamental mission and role in enabling nuclear energy solutions and presents the four R&D objectives for nuclear energy development that are the focus of NE activities. The details of the roadmap are presented in Section 4. The R&D approach presented in Section 5 embodies a goal-oriented, science-based R&D portfolio that includes both evolutionary and transformational, high-risk–high-payoff R&D, including those research areas that encompass multiple objectives. Finally, Section 6 provides a summary of the objects presented in this report.

This report is not an implementation plan, but rather provides a basis that will guide NE's internal programmatic and strategic planning for research going forward.

The report focuses on R&D activities sponsored by NE. The U.S. nuclear industry plays a central role in overcoming barriers and is ultimately responsible for the commercial deployment of the resulting technologies. NE intends to proceed in a manner that supports a strong and viable nuclear industry in the United States and preserves the ability of that industry to participate in nuclear projects here and abroad.

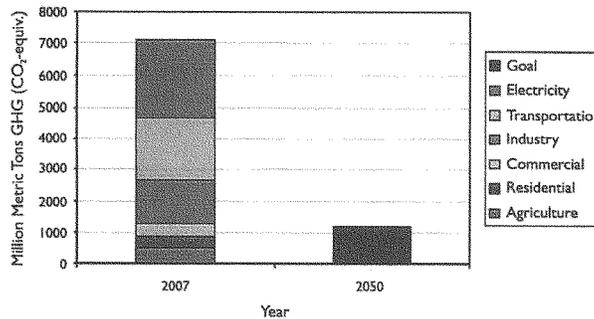
To achieve its energy security and GHG reduction objectives, the U.S. must develop and deploy clean, affordable, domestic energy sources as quickly as possible.

Finally, it should be noted that in some limited cases, NE's mission extends beyond terrestrial deployment of nuclear energy into other arenas, such as space applications of both fission and radioisotope power systems. Some technology development needs identified in this document also benefit space applications, but these mission arenas are not addressed in this roadmap. Educational programs, while vital, are interwoven through the technical programs and are not discussed as separate entities.

2. BACKGROUND

All governments of the world share a common challenge to ensure their people have access to affordable, abundant, and environmentally friendly energy. Secretary of Energy Steven Chu has reiterated the Administration's position that nuclear is an important part of the energy mix. He has recognized the importance of nuclear energy in meeting this challenge and supports R&D that can help increase the benefits of nuclear energy. A key objective that will shape the energy landscape of the United States is the transition to clean energy sources with reductions in GHG emissions (with a quantitative goal of 83% reduction below 2005 emissions levels by 2050, shown in Figure 2).

Figure 2. U.S. Greenhouse Gas Emissions¹



2.1 The Energy Landscape

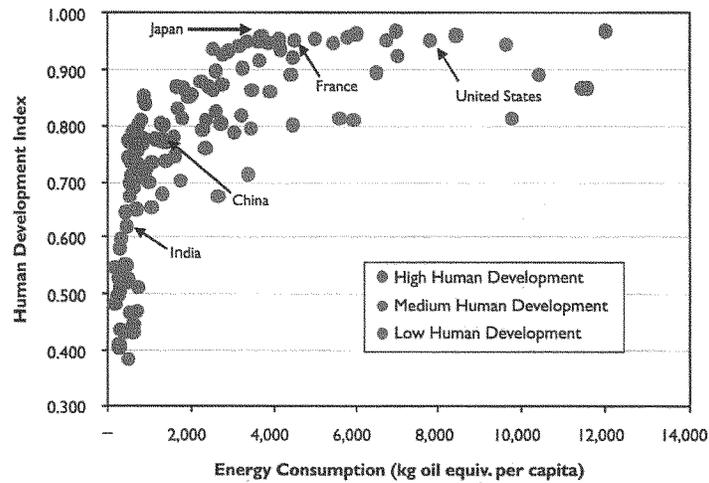
The Human Development Index² is a commonly used measure of quality of life. Figure 3 illustrates that a nation's standard of living depends in part on energy consumption. Access to adequate energy is now and will continue to be required to achieve a high quality of life. Economic development, combined with efforts to limit carbon emissions, will likely lead to a

¹ 2007 GHG emissions reported in EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990 – 2007* EPA 430-R-09-004, April 15, 2009. Administration emission goals taken from the "Testimony of Peter R. Orszag, Director of the Office of Management and Budget, Before the Committee on the Budget, U.S. House of Representatives" on [March 3, 2009](#).

² The index was developed by the United Nations to enable cross-national comparisons of development and is updated in an annual report. The derivation of the index was introduced in United Nations Development Programme, *Human Development Report 1990*, Oxford University Press, 1990.

significant expansion of nuclear power. The U.S., in concert with the international community, must develop the technologies and systems to accomplish such expansion while limiting proliferation risks.

Figure 3. 2005 Human Development Index vs. Energy Consumption
(Per Capita Kilograms Oil Equivalent)

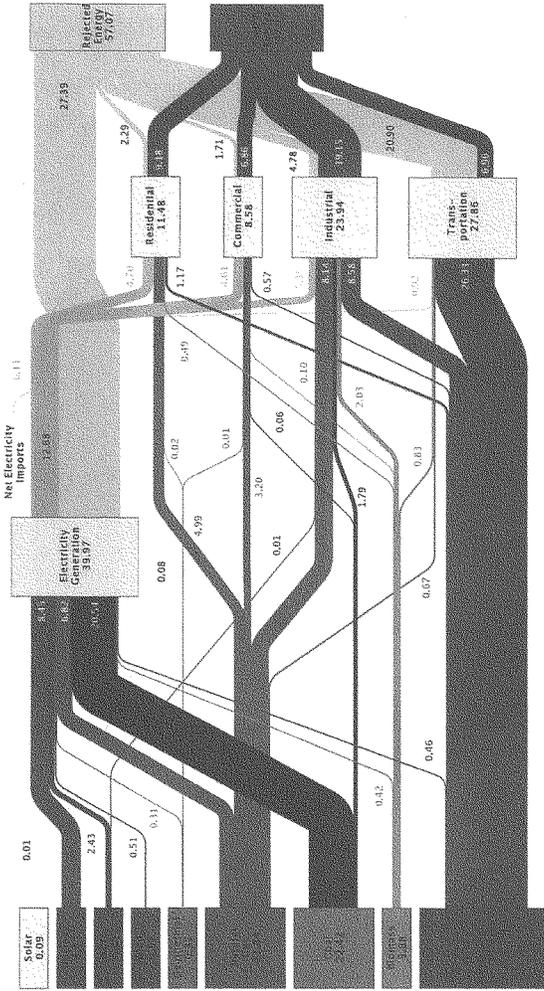


As we move forward, efficiency and conservation will become ever-increasing components of energy policy. However, conservation and energy efficiency alone will not be sufficient to maintain a desirable quality of life.

The United States currently consumes roughly 100 quadrillion British Thermal Units (BTU), or 100 quads, of primary energy.³ This represents 25% of world's energy consumption in a country that produces 30% of the global gross domestic product (GDP). Figure 4 shows energy consumption in the United States as a function of sectors and energy sources. At present, 40% of the total energy consumed is in the form of electricity, of which about 20 percent is generated by nuclear power. With 6 billion metric tons (MT) of emitted carbon dioxide (CO₂) as a result of fossil fuel usage (see Figure 5), the United States contributes 25 percent of global GHGs emitted.

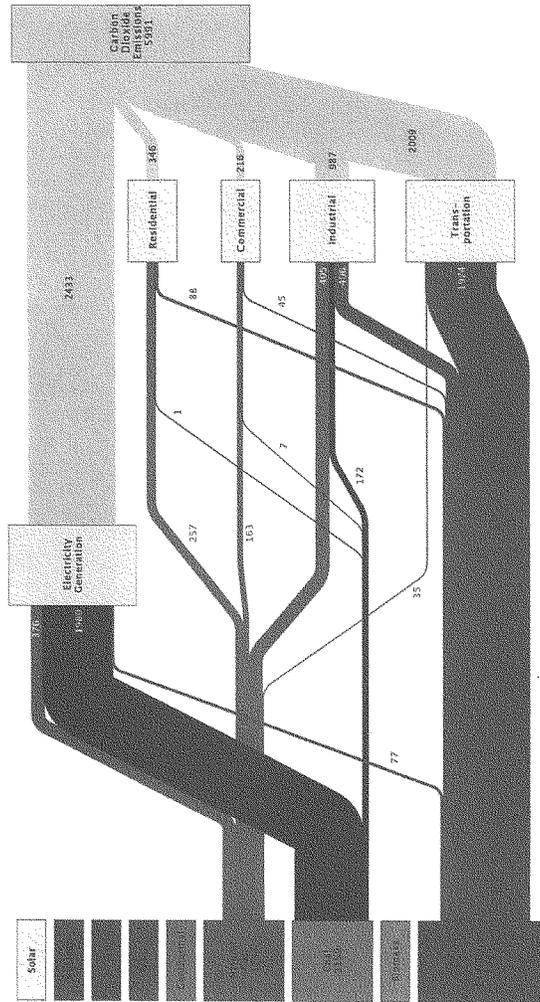
³ The data in Figures 5 and 6 are reported by the U.S. DOE Energy Information Agency "An Updated Annual Energy Outlook 2009 Reference Case," 2009.

Figure 4. U.S. Primary Energy Use in 2008: ~99.2 Quads
Estimated U.S. Energy Use in 2008: ~99.2 Quads



Source: U.S. EIA, 2009. Data is based on DOE/EIA-0386(2008), June 2009. If this information is a reproduction of it, it is used, credit must be given to the Lawrence Livermore National Laboratory report flows for non-thermal resources (i.e., hydro, wind and solar) is a BTU-equivalent value by assuming a typical fossil fuel plant "heat rate". The efficiency of electricity production is calculated as the industrial sector, and as 25% for the transportation sector. Totals may not equal sum of components due to independent rounding. LBNL-410227

Figure 5. U.S. Carbon Dioxide Emissions in 2007
 Estimated U.S. Carbon Dioxide Emissions in 2007:
 ~5991 Million Metric Tons



Source: LLNL, 2009. Data is based on DOE/EIA-0184(2008), June 2009. If this information or a reproduction of it is used, credit must be given to the Lawrence Livermore National Laboratory and the Department of Energy, under whose auspices the work was performed. Carbon embodied in industrial and commercial products such as plastics is not shown. The flow of petroleum to electricity production is not shown. Emissions associated with biofuels are accounted for in the Industrial and Commercial sectors. Totals may not equal sum of components due to independent rounding. LLNL-ML-11167

The Administration's clean energy and climate change objectives are ambitious and achievable. Successful achievement of these objectives will require solutions to technical challenges associated with various energy sectors, including:

- *Electricity Sector GHG Production* – As seen in Figures 4 and 5, the U.S. electricity production sector annually consumes 40 quadrillion BTU of primary energy, producing 4,150 million MWh of electricity, and emitting 2,400 million MT of CO₂. The average carbon intensity of the U.S. electric-generating sector is 0.58 MT-CO₂/MWh of electricity produced. While far from the world's highest carbon intensity (China produces 0.87 MT-CO₂/MWh of electricity), U.S. electric-generating-sector carbon intensity is far higher than some industrialized countries. For instance, France emits only 0.09 MT-CO₂/MWh of electricity produced. There is clearly both the need for, and the real potential for, significant improvement in U.S. electric-generating-sector carbon intensity and GHG emissions.
- *Transportation Sector Energy Use and GHG Emissions* – The transportation sector is currently responsible for 33% of GHG emissions (Figure 5). In addition to more energy-efficient internal combustion engines, electrification of the transportation sector using new low-carbon electricity-generation technologies will assist in reducing these emissions. Successful electrification of the transportation sector is also dependent on improvements in battery technology to enable high-density energy storage to meet vehicle service range requirements.
- *Industrial Sector Energy Use and GHG Emissions* – Industrial use of energy is responsible for 16 percent of the country's GHG emissions (Figure 5). About half of these emissions come from chemical facilities and oil refineries. The development of GHG-free technologies that can generate and deliver significant thermal and chemical energy to industry is needed.

The driver for the new energy policy is to continue to generate energy, mostly from domestic sources, at an affordable price. The policy must meet increasing demand, with considerably reduced GHG emissions, and without stifling GDP growth.

2.2 The Value and Need for an “Energy Portfolio” Approach

Given the issues noted in Section 2.1, an effective energy policy will almost certainly rely on the development and use of a portfolio of domestic clean energy sources. This is true not only because of resource limits at various points in the energy supply chain but also because all

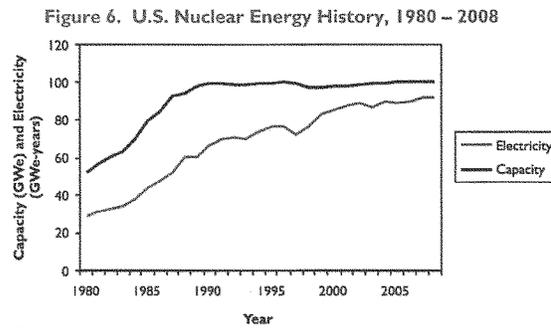
energy sources face economic, technical, and societal risks to their successful deployment.⁴ R. Socolow and S. Pacala, in "A Plan To Keep Carbon In Check,"⁵ have demonstrated the potential for energy portfolio approaches to enhance U.S. energy security and reduce the threat of global warming. The following section discusses the role of nuclear energy as an element of the U.S. energy portfolio.

2.3 Nuclear Energy as an Element of the Future U.S. Energy Portfolio

In 2007, the 104 light-water reactors (LWRs) currently operating in the United States generated 806 billion kilowatt-hours (kW-hrs), equivalent to 92 gigawatt-years (GWe-yrs). As shown in Figure 6, even though the generating capacity of the nuclear fleet has been essentially flat for almost twenty years, the production of nuclear electricity

continued to grow largely as a result of increased capacity factors. The fleet's average capacity factor improved from 56.3% in 1980 to 91.9% in 2008.⁶ This improvement was driven by reactor operators and the efforts of the Electric Power Research Institute (EPRI), spurred by NE-sponsored R&D into high-burnup fuels that allowed utilities to shift from 12-month operating cycles to 18- or 24-month operating cycles that reduced downtime. Additionally, some growth can be attributed to power uprates that increased capacity at existing plants.

While in operation, nuclear power plants do not emit GHGs. Every MWh of electricity produced with nuclear energy avoids the emission of approximately 1.0 MT of CO₂ if the same amount of energy had been generated with conventional coal-fired technologies or approximately 0.6 MT of CO₂ if the energy had been produced with natural gas. Since the per capita electricity consumption in the United States is approximately 14 MWh of electricity per year per person, nuclear energy offers the prospect of avoiding what could otherwise be an annual personal carbon footprint from electricity production of up to 14 MT of CO₂. In addition, nuclear power



⁴ R. Socolow and S. Pacala, "Stabilization Wedges: Solving the Climate Problem for the Next 50 Years with Current Technologies." *Science*, August 13, 2004: 968-972.

⁵ *Scientific American*, September 2006

⁶ EIA, *Annual Energy Review 2008*, Table 9.2.

is dependable. It is available day or night, when the wind is blowing and when it is not. After more than three decades of outstanding safety performance, the public acceptance of nuclear energy has turned in favor of its deployment.⁷ However, continued and increased use of nuclear energy faces several key challenges:

- *Capital Cost* – The current fleet of nuclear power plants produces electricity at a very low cost (approximately 2–3 cents/kilowatt-hour) because these plants have already repaid the initial construction investments. However, the capital cost of a large new plant is high and can challenge the ability of electric utilities to deploy new nuclear reactors. Thus, it is important to reduce the capital cost by innovative designs. The introduction of smaller reactors might reduce capital costs by taking advantage of series fabrication in centralized plants and may reduce financial risk by requiring a smaller up-front investment.
- *Waste Management* – At present, no permanent solution to high-level nuclear waste management has been deployed in the United States. Innovative solutions will be required to assure that nuclear waste is properly managed. The Administration has initiated the Blue Ribbon Commission on America's Nuclear Future to conduct a review of policies for managing the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel and nuclear waste. The results will inform the Government's process to establish a policy for used fuel and waste management. Ultimately, while the need for permanent waste disposal can never be eliminated, transition to nuclear energy technologies that significantly reduce the production of long-lived radioactive waste – rather than deal with it after it is produced – is a desirable goal.
- *Proliferation Risk* – There is considerable interest in the global expansion of nuclear energy. However, such expansion raises concerns about the proliferation of nuclear weapons, including nuclear explosive devices, stemming from access to enrichment and reprocessing activities that might produce weapons-usable materials. Development of innovative technologies and international policies are essential to prevent nuclear proliferation by nation-states as well as nuclear terrorism by rogue entities. Furthermore, a more robust capability to evaluate and compare proliferation and terrorism risks is needed. In addition, it is in the U.S. interest to engage nations contemplating civil nuclear power for the first time in order to help them develop an indigenous infrastructure designed to deploy the technology in a safe and secure manner.
- *Safety and Reliability* – As existing plants continue to operate and new plants and new types of plants are constructed, it is vital that the excellent safety and reliability record of nuclear energy in the United States be maintained. It is also important that the U.S. share its experience with other countries and work with them to ensure safe operation of their plants.

⁷ Ref. <http://www.gallup.com/poll/117025/Support-Nuclear-Energy-Inches-New-High.aspx>.

3. MISSION AND GOALS OF THE OFFICE OF NUCLEAR ENERGY

The analysis presented in Section 2 supports the conclusion that increased greenhouse gas-free electricity production is necessary to achieve the transition to a clean-energy economy.

3.1 The Office of Nuclear Energy Mission

The primary mission of NE is to advance nuclear power as a resource capable of meeting the nation's energy, environmental, and national security needs by resolving technical, cost, safety, security, and proliferation resistance, through R&D and demonstrations, as appropriate. Progress in these areas should promote the deployment of fission power systems in a socially acceptable, environmentally sustainable, and economically attractive manner.

Four specific research and development objectives for nuclear energy development outline NE's approach to delivering progress in the areas noted above. The objectives are:

- *R&D Objective 1* – Develop technologies and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors.
- *R&D Objective 2* – Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals.
- *R&D Objective 3* – Develop sustainable nuclear fuel cycles.
- *R&D Objective 4* – Understand and minimize the risks of nuclear proliferation and terrorism.

The four objectives are discussed more fully in the following sections.

3.2 Nuclear Energy R&D Objectives and the Role of NE in Achieving Them

This section presents a description of the four R&D objectives and NE's role in making progress in these areas.

3.2.1 R&D Objective 1: Develop Technologies and Other Solutions that Can Improve the Reliability, Sustain the Safety, and Extend the Life of Current Reactors

The existing U.S. nuclear fleet has a remarkable safety and performance record, and today these reactors account for 70 percent of the low GHG-emitting domestic electricity production. Extending the operating lifetimes of current plants beyond sixty years and, where possible, making further improvements in their productivity will generate near-term benefits. Industry has a significant financial incentive to extend the life of existing plants, and as such, activities will be cost shared. Federal R&D investments are appropriate to answer fundamental scientific questions and, where private investment is insufficient, to help make progress on broadly applicable technology issues that can generate public benefits.

The DOE role in this R&D objective is to work with industry and, where appropriate, the Nuclear Regulatory Commission (NRC) to support and conduct the long-term research needed to inform major component refurbishment and replacement strategies, performance enhancements, plant license extensions, and age-related regulatory oversight decisions. The DOE R&D role will focus on aging phenomena and issues that require long-term research and are generic to reactor type.

3.2.2 R&D Objective 2: Develop Improvements in the Affordability of New Reactors to Enable Nuclear Energy to Help Meet the Administration's Energy Security and Climate Change Goals

If nuclear energy is to be a strong component of the nation's future energy portfolio, barriers to the deployment of new nuclear plants must be overcome. Impediments to new plant deployment, even for those designs based on familiar light-water reactor technology, include the substantial capital cost of new plants and the uncertainties in the time required to license and construct them. More advanced plant designs, such as small modular reactors (SMRs) and high-temperature reactors (HTRs), will have additional barriers for deployment. These reactors have characteristics that could make them more attractive than today's technology. SMRs, for example, have the potential to achieve lower proliferation risk and more simplified construction than other designs. The development of next-generation reactors could present lower capital costs and improved efficiencies. These reactors may be based upon new designs that take advantage of the advances in high performance computing while leveraging capabilities afforded by improved structural materials. Industry's role in overcoming the barriers in this area is substantial. DOE supports R&D ranging from fundamental nuclear phenomena to the development of advanced fuels that could improve the economic and safety performance of these advanced reactors. Nuclear power can reduce GHG emissions from electricity production and possibly in co-generation by displacing fossil fuels in the generation of process heat for applications including refining and the production of fertilizers and other chemical products.

3.2.3 R&D Objective 3: Develop Sustainable Nuclear Fuel Cycles

Sustainable fuel cycle options are those that improve uranium resource utilization, maximize energy generation, minimize waste generation, improve safety, and complement institutional measures in limiting proliferation risk. The key challenge for the government in this R&D objective is to develop a suite of options that will enable future decision makers to make informed choices about how best to manage the used fuel from reactors. DOE will conduct R&D in this area to investigate the technical challenges involved with three potential strategies for used fuel management.

- *Once-Through* – Develop fuels for use in reactors that would increase the efficient use of uranium resources and reduce the amount of used fuel for direct disposal for each MWh of electricity produced. Additionally, evaluate the inclusion of non-uranium materials (e.g., thorium) in reactor fuel options that may reduce the long-lived radiotoxic elements in the used fuel that would go into a repository.
- *Modified Open Cycle* – Investigate fuel forms and reactors that would increase utilization of the fuel resource and reduce the quantity of long-lived radiotoxic elements in the used fuel to be disposed (per MWh), with limited separations steps using technologies that substantially lower proliferation risk.
- *Full Recycling* – Develop techniques that will enable the long-lived actinide elements to be repeatedly recycled rather than be disposed. The ultimate goal is to develop a cost-effective and low proliferation risk approach that would dramatically decrease the long-term danger posed by the waste, reducing uncertainties associated with its disposal.

DOE will work to develop the best approaches within each of these tracks to inform waste management strategies and decision making.

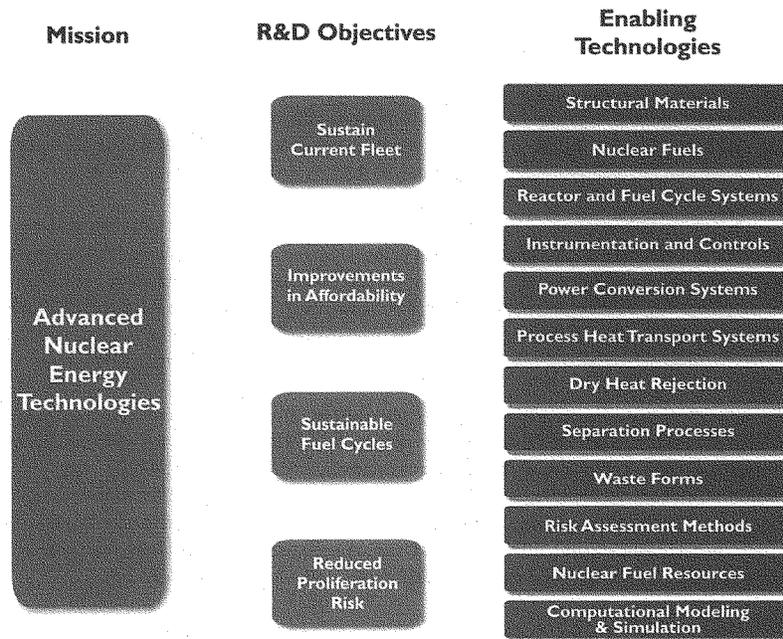
3.2.4 R&D Objective 4: Understand and Minimize the Risks of Nuclear Proliferation and Terrorism

It is important to assure that access to the benefits of nuclear power can be enabled while limiting nuclear proliferation and security risks. This goal requires an integrated approach that incorporates simultaneous development of nuclear fuel cycle technology, safeguards and security technologies and systems, new proliferation risk assessment tools, and non-proliferation frameworks and protocols. These activities must be informed by robust assessments that identify potential approaches for limiting risks of specific technologies and nuclear fuel cycle system options. NE will work with other organizations such as the National Nuclear Security Administration (NNSA), the Department of State, the NRC, and others in further defining, implementing and executing this integrated approach. Aspects of this research may help to inform the exploration of concepts such as international fuel service arrangements.

4. AN INTEGRATED NUCLEAR ENERGY ROADMAP

This section presents an objective-focused roadmap to advance nuclear energy technologies. As depicted in Figure 7, the activities described here ultimately “unpack” to a suite of science and technology development activities, many of which will support more than one R&D objective.

Figure 7. NE Mission, R&D Objectives, and Technologies



The approach incorporates a portfolio of long-term R&D objectives and a balanced focus on evolutionary, innovative, and high-risk–high-payoff R&D in many diverse areas. The organization and coordination of the science and technology thrusts (“Enabling Technologies” in

Figure 7) will be a focus of program and strategic planning follow-on implementation plants, but is briefly addressed in Section 5.2 of this document.

In laying out the activities in each of the R&D objectives described below, we must remain goal-oriented to avoid falling into the trap of doing a great deal of work that, while interesting, fails to address the challenges to the deployment of nuclear energy. The following sections highlight areas in which NE may undertake future R&D. These R&D activities have been considered with the end in mind to ensure that the linkage between research and solution is clear. To that end, in depicting the timelines of activity for the R&D objectives below, the charts show a distinction between near-term milestones toward which the NE R&D plan is designed to progress, represented as triangles, and longer-term potential outcomes that provide a framework for the milestones, which are shown as ovals. The milestone charts attempt to depict the stages of development so as not to leave a sense that new technologies can be immediately deployed at a commercial level. Not every milestone or potential outcome outlined in these charts represent actions that are within DOE's roles and responsibilities, and research paths will include many decision points that require choosing the most promising options for continued R&D. Especially as technology matures, industry has a role and a responsibility to share the costs of making progress. It is ultimately industry's decision which commercial technologies will be deployed. The federal role falls more squarely in the realm of R&D.

These long-term milestones and potential outcomes are not set in stone, and in some cases the following sections outline multiple competing paths within an objective, knowing that ultimately only one direction will be chosen. In all cases, the activities, milestones, and plans outlined in this document will be reconsidered and revised periodically to ensure that NE R&D is consistent with priorities and reflects what we have learned from these efforts. Activities will be reviewed and modified as necessary through the established budgetary and decision-making processes.

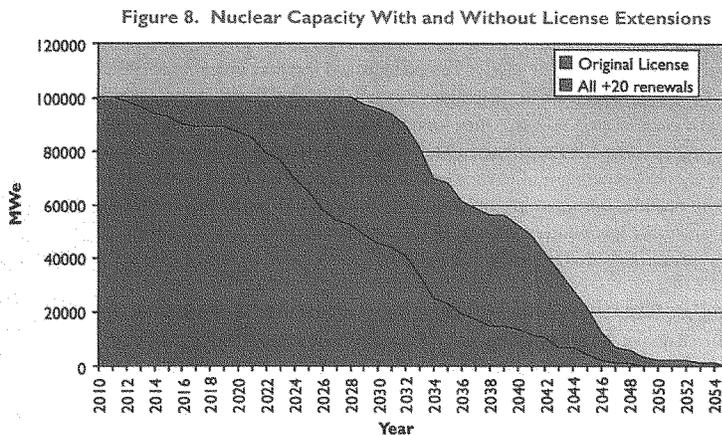
Although some smaller component or process "demonstration" activities are mentioned, these are largely field tests and other actions to provide proof or validation of system elements. They are not large-scale demonstrations like the Next Generation Nuclear Plant (NGNP). Any decisions to embark on such large-scale demonstrations will be the result of decision-making processes that include the relevant stakeholders in the Executive Branch and Congress and will be made in accordance with NEPA and DOE Order 413 requirements. This R&D will enable these stakeholders to understand the potential tradeoffs embodied in these decisions.

4.1 R&D Objective I: Develop Technologies and Other Solutions that Can Improve the Reliability, Sustain the Safety, and Extend the Life of Current Reactors

The current fleet of 104 nuclear power plants has reliably and economically contributed almost 20 percent of electricity generated in the United States over the past two decades. However, by

2030, even those current nuclear power plants that have received 20-year extensions from the NRC authorizing 60 years of life will begin reaching the end of their licensed periods of operation. Figure 8 shows projected nuclear energy contribution to domestic generating capacity from those plants that have already received 20-year license extensions. If current plants do not operate beyond 60 years, the total fraction of generated electricity from nuclear power could begin to decline, even with the addition of new nuclear-generating capacity.

Replacing the current fleet would require hundreds of billions of dollars. Replacement of this 100 GWe-generating capacity with traditional fossil plants would lead to significant increases in CO₂ emissions. Extending operating licenses beyond 60 to perhaps 80 years would enable existing plants to continue providing safe, clean and economic electricity without significant GHG emissions. The objective of this R&D objective is to provide a comprehensive technical basis for extending the life of today's LWRs that could be used to inform licensing and managing the long-term safe and economical operation.



4.1.1 Challenges Facing the Current Fleet

The following are the major challenges facing the current fleet:

- Aging and degradation of system structures and components, such as reactor core internals, reactor pressure vessels, concrete, buried pipes, and cables.
- Fuel reliability and performance issues.
- Obsolete analog instrumentation and control technologies.

- Design and safety analysis tools based on 1980s vintage knowledge bases and computational capabilities.

Industry's economic incentive to meet these challenges in order to continue the safe and reliable operation of existing plants is tremendous. As such, federal activities undertaken in this area will be cost-shared with industry. Industry, working through EPRI or through the various owners' groups, will engage some of these problems directly. Federal R&D investments are appropriate to answer fundamental scientific questions and where private investment is insufficient, to help make progress on broadly-applicable technology issues that can generate public benefits. The government holds a great deal of theoretical, computational, and experimental expertise in nuclear R&D that is not available in industry. The benefits of assisting industry with R&D on life-extension apply not only to current plants but also to the next generation of reactor technologies still in development.

4.1.2 R&D Topics for Life Extension and Performance Improvement

The overall focus of the R&D activities will be to improve a power plant operator's ability to manage the effects of the aging of passive components and increase operational efficiency and economics. In selecting projects for federal investment, it is vital that due consideration be given not only to how each of the R&D activities support achievement of safety and economic sustainability for existing LWRs, but also to how the R&D results will be more broadly applicable to the next generation of reactor technologies. These activities should also be integrated with outside sources of information and parallel R&D programs in industry, the NRC, universities, and other laboratories, both domestic and international. Close coordination with the NRC as appropriate is needed to assure that R&D programs focus on issues relevant to licensing.

The following are R&D topics where NE will focus its efforts to help provide solutions to the challenges listed above, thereby helping enable reactor life extension beyond 60 years with improved performance. Progress on this long-term and high-risk-high-reward R&D, which supports the current nuclear power plant fleet, will provide the scientific underpinnings for plant owners to make billion-dollar investment decisions to prolong the economic lifetime of these assets. R&D findings will also inform improvements in the lifetime of future-generation reactor designs.

- *Nuclear Materials Aging and Degradation* – Develop a scientific basis for understanding and predicting long-term environmental degradation behavior of materials in nuclear power plants. Provide data and methods to assess performance of systems, structures, and components essential to safe and sustained nuclear power plant operation.
- *Advanced LWR Nuclear Fuel Development* – Improve the scientific knowledge basis for understanding and predicting fundamental nuclear fuel and cladding performance in nuclear power plants. Apply this information to the development of high-performance, high-burnup fuels with improved safety, cladding, integrity, and economics.

- *Advanced Instrumentation, Information, and Control (II&C) System Technologies* – Research to address long-term aging and obsolescence of existing instrumentation and control technologies and to develop and test new technologies. Establishing a strategy to implement long-term modernization of II&C systems will be the focus of federal R&D, while industry will focus on the more immediate benefits of adapting existing digital technologies to current plants. NE will work with industry to develop advanced condition-monitoring technologies for reliable plant operation, improved understanding of physical methods of degradation, and the means to detect and characterize these processes.
- *Risk-Informed Safety Margin Characterization (RISMC)* – Bring together risk-informed, performance-based methodologies with fundamental scientific understanding of critical phenomenological conditions and deterministic predictions of nuclear plant performance to provide an integrated characterization of public safety margins in aging nuclear power plants. Such an approach will better characterize safety margins and should improve the reliability and efficiency of plant operations. RISMC will also be applicable to future generations of nuclear power plants.
- *Efficiency Improvement* – Improve the efficiency of the current fleet while maintaining excellent safety performance is one of the primary objectives of life extension. Power uprates have contributed to improving the current fleet's economic performance. This activity focuses on developing methodologies and scientific bases to enable more extended power uprates.
- *Advanced Modeling and Simulation Tools* – Conduct R&D needed to create a new set of modeling and simulation capabilities that will be used to better understand the safety performance of the aging reactor fleet. These tools will be fully three-dimensional, high-resolution, modeling integrated systems based on first-principle physics. To accomplish this, the modeling and simulation capabilities will have to be run on modern, highly parallel processing computer architectures.

The sustainability of light water reactors will benefit enormously from advanced modeling and simulation capabilities. The NE Modeling and Simulation Hub will integrate existing nuclear energy modeling and simulation capabilities with relevant capabilities developed by the Office of Science, the NNSA, and others. The results will leapfrog current technology to provide a multi-physics, multi-scale predictive capability that is a revolutionary improvement over conventional codes. A key challenge will be to adapt advanced computer science tools to an applications environment. The hub is intended to create a new state-of-the-art in an engineering-oriented multi-physics computational environment that can be used by a wide range of practitioners to conduct ultra-high fidelity predictive calculations of reactor performance.

4.1.3 Key Activities

The following chart outlines potential milestones and future national industry aims for this objective. It presents a distinction between near-term milestones toward which the NE R&D plan is designed to progress, represented as triangles, and longer-term potential outcomes that provide a framework for the milestones, shown as ovals. The milestone charts attempt to depict the stages of development so as not to leave a sense that new technologies can be immediately deployed at a commercial level. Not every milestone or potential outcome outlined in these charts represents actions that are within DOE's roles and responsibilities, and research paths will include many decision points that require choosing the most promising options for continued R&D. All DOE R&D activities will be evaluated and revisited regularly and modified as necessary through the budget process to ensure the portfolio reflects past progress and current priorities.

Although some smaller component or process "demonstration" activities are mentioned, these are largely field tests and other actions to provide proof or validation of system elements. They are not costly, large-scale demonstrations like NGNP. Any consideration to embark on such large-scale demonstrations will be the result of decision-making and budget development processes.

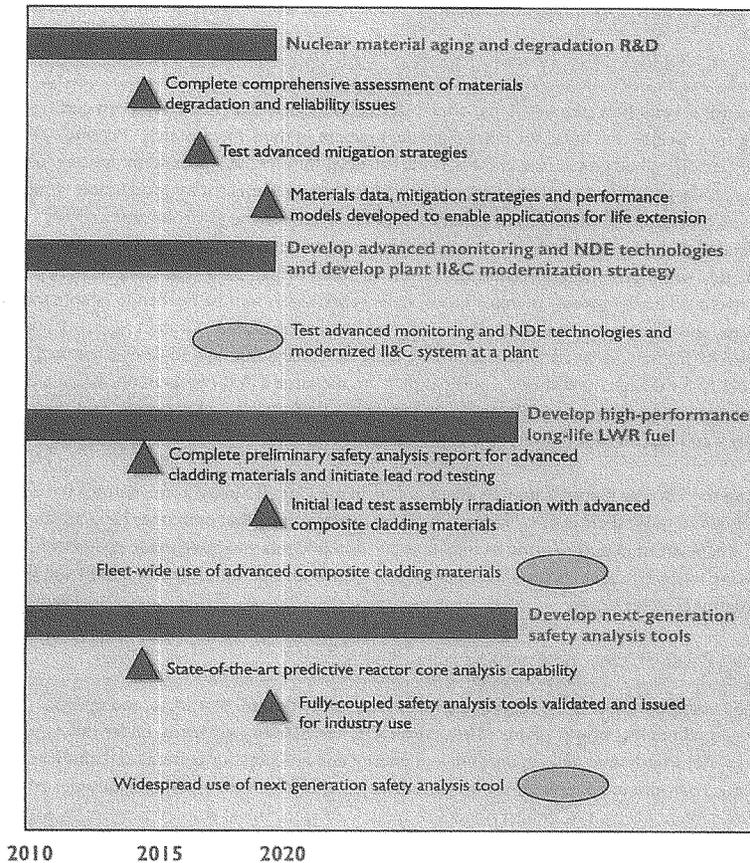
4.2 R&D Objective 2: Develop Improvements in the Affordability of New Reactors to Enable Nuclear Energy to Help Meet the Administration's Energy Security and Climate Change Goals

The previous 30-year U.S. hiatus in new nuclear plant orders presents a number of immediate hurdles for the construction of new plant designs. Utility investors are still wary of the new regulatory framework, which will not be fully exercised until the first new plant begins operation. There are also concerns regarding the large capital costs of plants and associated difficulties in financing their construction.

NE's objective is to assist in the revitalization of the U.S. industry through R&D. By advancing technologies through R&D, NE can help accelerate deployment of new plants in the short term, support development of advanced concepts for the medium term, and promote design of revolutionary systems for the long term. Work will be done in partnership with industry to the maximum extent possible. Elements of NE's strategy in this area include:

- Assist industry to improve light water reactors using existing technologies and designs.
- Explore advanced LWR designs with improved performance.
- Research and develop small modular reactors that have the potential to achieve lower proliferation risks and more simplified construction than other designs.

Figure 9. Key Activities for R&D Objective 1



- In the longer term, support R&D of advanced reactor technologies that offer lower costs and waste generation.
- Investigate revolutionary reactor concepts that promise to significantly reduce costs and improve performance of nuclear energy.
- Support R&D of nuclear energy's potential to displace fossil fuels in the production of process heat.

Implementing this strategy will require that DOE work in partnership with the nuclear industry and, to the degree appropriate, the NRC.

4.2.1 Challenges Facing New Reactor Deployments

There are several new plant designs, often referred to as Gen III+, that have been certified or are being reviewed by the NRC for immediate deployment in the United States. Potential owners of these Gen III+ plants must overcome serious financial hurdles. All near-term options for new plants are large LWR designs that are optimized for baseload electricity production. Smaller reactors that could be deployed in modules might help reduce the up-front capital costs associated with large plants by allowing utilities to incrementally “step up” to larger electrical capacities while generating revenue and repaying initial debts. New reactor designs beyond Gen III+ may also be deployed. In many cases, new technologies will be needed to enable these new designs, and innovative features will need to be fully demonstrated. Certain aspects of the regulatory framework need to accommodate these new technologies and design features, especially for designs that differ significantly from the large LWR plants in operation today. Economic competitiveness will remain the major hurdle for all novel concepts, including smaller reactors and reactors for non-electric applications.

During the 30-year hiatus from new plant orders in the United States, some nations have continued to grow their nuclear industries. As a result, some other countries have advanced the state-of-the art in manufacturing of nuclear plant components and have made progress in applying more efficient construction techniques. The domestic industry can learn from these international experiences.

4.2.2 R&D Topics for Enabling New Builds

In the United States, it is the responsibility of industry to design, construct, and operate commercial nuclear power plants. However, DOE has statutory authority under the Atomic Energy Act to promote and support nuclear energy technologies for commercial applications. In general, appropriate government roles include researching high-potential technologies beyond the investment horizon of industry and also reducing the technical risks of new technologies. In the case of new commercial reactor designs, potential areas of NE involvement could include:

- Enabling new technologies to be inserted into emerging and future designs by providing access to unique laboratory resources for new technology development and, where appropriate, demonstration.
- Working through the laboratories and universities to provide unique expertise and facilities to industry for R&D in the areas of:
 - Innovative concepts and advanced technologies.
 - Fundamental phenomena and performance data.
 - Advanced modeling and simulation capabilities.

- New technology testing and, if appropriate, demonstration.
- Advanced manufacturing methods.

Representative R&D activities that support each of the roles stated above are presented below. The level of DOE investment relative to industry investment will vary across the spectrum of these activities, with a generally increasing trend in DOE investment for longer-term activities. Finally, there is potential to leverage and amplify effective U.S. R&D through collaborations with other nations through multilateral and bilateral agreements including the Generation IV International Forum, which is investigating multiple advanced reactor concepts. DOE is also a participant in OECD/NEA and IAEA initiatives that bear directly on the development and deployment of new reactor systems.

4.2.2.1 Accelerate Advancements in LWR Designs

Given the maturity of the Gen III+ LWR designs, R&D needs are necessarily limited, as the design of these plants is well underway or already complete, some of them are being built overseas, and many have been ordered in the United States and elsewhere. Nevertheless the R&D topics identified jointly with industry for R&D Objective 1 are all applicable to this task.

R&D of more advanced LWR concepts, including novel materials, fuels, and innovative system architectures, is a legitimate role for DOE and its laboratories in partnership with industry. This R&D will help address long-term trends in the capital cost of large LWR plants. Much of this research is also expected to be applicable to non-LWR technologies.

4.2.2.2 Accelerate the Development of SMR Designs

Several U.S.-based companies are seeking to bring new SMR designs to market, including some with potential for deployment within the next decade. Many of these designs use well-established light-water coolant technology to the fullest extent possible to shorten the timeline for deployment. As such, R&D needs for these technologies are minimal. However, these designs may include new features, such as the use of an integral primary system reactor (IPSR) design and components that are not currently used in commercial plants, such as helical-coil steam generators. DOE will hold workshops with LWR SMR vendors and suppliers, potential utility customers, national laboratory and university researchers, DOE, NRC, and other stakeholders to identify potential priorities to enable their commercialization and development. The Administration will evaluate potential priorities in the context of the appropriate federal role to identify the most cost-effective, efficient, and appropriate mechanisms to support further development.

SMR designs that are not based on LWR technology have the potential to offer added functionality and affordability. In this area, NE will support a range of R&D activities, such as basic physics and materials research and testing, state-of-the-art computer modeling and simulation of reactor systems and components, probabilistic risk analyses of innovative safety

designs and features, and other development activities that are necessary to establish the concept's feasibility for future deployment. For SMRs that are based on concepts with lower levels of technical maturity, the Department will first seek to establish the R&D activities necessary to prove and advance innovative reactor technologies and concepts. The Department will support R&D activities to develop and prove the proposed design concepts. Emphasis will be on advanced reactor technologies that offer simplified operation and maintenance for distributed power and load-following applications and increased proliferation resistance and security.

Activities will focus on showing that SMRs provide an innovative reactor technology that is capable of achieving electricity generation and performance objectives that meet market demands and are comparable, in both safety and economics, to the current large baseload nuclear power plants.

NE may also support the development of new/revised nuclear industry codes and standards necessary to support licensing and commercialization of innovative designs and, consistent with NRC guidance and regulations, identify activities for DOE funding to enable SMR licensing for deployment in the United States.

4.2.2.3 Develop Advanced Reactor Technologies

Future-generation reactor systems will employ advanced technologies and designs to improve performance beyond what is currently attainable. Moving beyond LWR technology, for example, may enable reactors to operate at higher temperatures and improved efficiencies resulting in improved economics. Advanced materials may make reactors easier to construct while also enabling better performance. Improved designs utilizing these advances could reduce the capital costs associated with the current set of reactors being considered. Two prominent examples of advanced reactor technologies worthy of further investigation include:

- The high temperature gas-cooled reactor (HTGR), a graphite moderated thermal-spectrum reactor operated at high temperature for efficient generation of electricity and heat delivery for non-electric applications.
- Fast-spectrum reactors that could provide options for future fuel cycle management and could also be used for electricity generation (see R&D Objective 3).

The U.S. is also a member of the Generation IV International Forum, which is investigating additional advanced reactor systems that employ comparatively less mature technologies while offering significant potential for performance, safety, and economic advances.

Key areas of R&D for future systems could include:

- High-performance materials compatible with the proposed coolant types and capable of extended service at elevated temperatures.

- New fuels and cladding capable of irradiation to high burnup.
- Advanced heat delivery and energy conversion systems for increased efficiency of electricity production.
- Advanced modeling and simulation tools that can reduce uncertainties in predicted performance, improve characterization of uncertainties, and streamline the design of new reactor technologies.
- Systems design for revolutionary new reactor concepts.

4.2.2.4 Develop Technologies Consistent with Both Electric and Non-Electric Applications

An additional potential benefit from nuclear power could be realized through new plant designs that would be used to displace GHG-emitting fuels in the industrial sector while also generating electricity. Some industrial process heat applications require temperatures substantially above the 300–325°C outlet temperature of today’s LWRs. Petroleum refining, for example, requires temperatures in the range of 250-500°C while steam reforming of natural gas requires process heat in the 500-900°C range. Achieving higher output temperatures requires switching to a new coolant technology such as gas, liquid metal, or molten salt. With these coolants, it may be possible to achieve outlet temperatures ranging from over 500°C for liquid metal coolants to over 900°C for helium or molten salt coolants. Achieving these temperatures, however, will require the development and qualification of fuels, materials and instrumentation, particularly at the higher end of the temperature range. Also, the use of coolants other than water will require the development of a variety of plant components and systems such as electromagnetic pumps for liquid metal coolants, compact heat exchangers for gas coolants, and chemical purification systems for molten salt coolants. These coolants will also require the development of new licensing requirements and codes and standards. While the economic market for dedicated process heat from nuclear power may be limited, reactors that could produce electricity as well as industrial process heat may have broader applications.

Key areas of R&D for future systems could include:

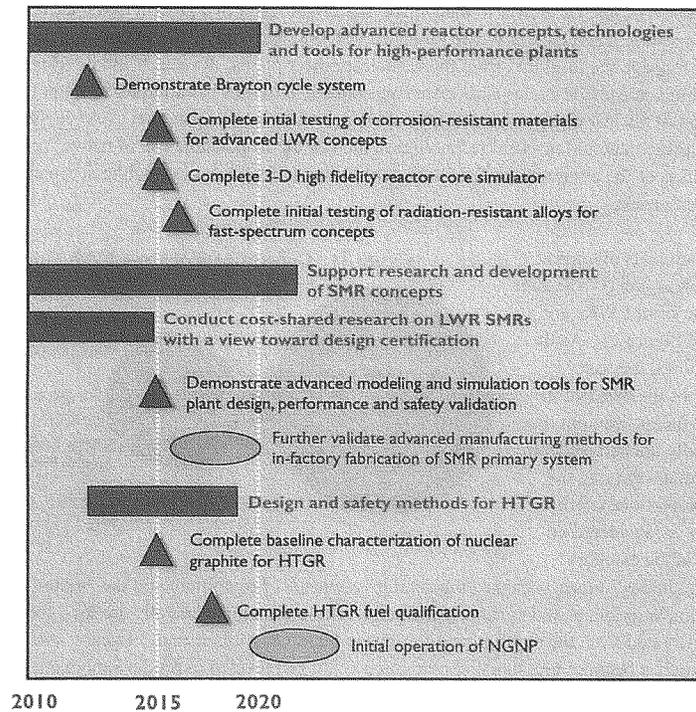
- *Develop interfacing heat transport systems* – Supply process heat with minimal losses to industrial users within several kilometers of the reactor.
- *Develop modeling and simulation capabilities* – These tools would improve understanding of interactions between the kinetics of the various reactor types and the kinetics of the chemical plants or refineries, which they would serve. Modeling may also be used to understand the long-term performance of catalysts and solid-oxide cells at an atomistic level.

4.2.3 Key Activities

The following chart outlines potential milestones and future national industry aims for this objective. It presents a distinction between near-term milestones toward which the NE R&D plan is designed to progress, represented as triangles, and longer-term potential outcomes that provide a framework for the milestones, shown as ovals. The milestone charts attempt to depict the stages of development so as not to leave a sense that new technologies can be immediately deployed at a commercial level. Not every milestone or potential outcome outlined in these charts represents actions that are within DOE's roles and responsibilities, and research paths will include many decision points that require choosing the most promising options for continued R&D. All DOE R&D activities will be evaluated and revisited regularly and modified as necessary through the budget process to ensure the portfolio reflects past progress and current priorities.

Although some smaller component or process "demonstration" activities are mentioned, these are largely field tests and other actions to provide proof or validation of system elements. They are not costly, large-scale demonstrations like NGNP. Any consideration to embark on such large-scale demonstrations will be the result of decision-making and budget development processes.

Figure 10. Key Activities for R&D Objective 2



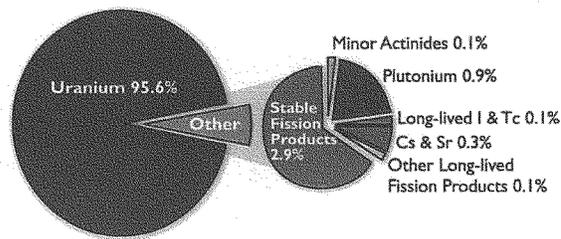
4.3 R&D Objective 3: Develop Sustainable Nuclear Fuel Cycles

Sustainable fuel cycle options are those that improve uranium resource utilization, maximize energy generation, minimize waste generation, improve safety, and limit proliferation risk. The principal challenge for the government in this objective is to develop a suite of options that will enable future decision makers to make informed choices about how best to manage the used fuel from reactors. The Administration has established the Blue Ribbon Commission on America's Nuclear Future to inform this waste management decision-making process. The Commission will review policies for managing the back end of the fuel cycle including alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel and nuclear waste. All research and development activities and plans outlined here will be revisited and revised as needed to reflect the Commission's findings and associated Administration decisions.

An expansion of nuclear power in the United States will result in a growth of the used nuclear fuel inventories. The Nuclear Waste Policy Act of 1982 gave the U.S. government the mission to safely manage the used fuel from these nuclear power plants. Research and development of sustainable nuclear fuel cycles and waste management activities is important to support the expansion of nuclear energy. Some of the attributes of the sustainable fuel cycle, including waste management and disposal technologies, include the responsible use of natural resources, preservation of the environment for future generations, safety, security, public acceptance, and cost effectiveness.

The constituents of current used nuclear fuel (UNF) after discharge from LWRs are shown in Figure 11. As this figure shows, the vast majority of the material in the used fuel is uranium that is generally unchanged from the fuel that went into the reactor to produce energy. Uranium is considered an

Figure 11. Constituents of Used LWR Fuel



element in the category called “actinides,” along with the “transuranic” elements of plutonium and the “minor” actinides: neptunium, americium, and curium, principally. These elements generally are long-lived and must be isolated from the environment for tens or hundreds of thousands of years. Actinides are also of interest because uranium and plutonium could be recycled to produce more energy in reactors, as could the minor actinides in fast-spectrum reactors. The remaining class of elements in the used fuel is fission products, many of which are stable and pose little concern. The short-lived fission products – primarily cesium and strontium – generate most of the hazard for the first hundreds of years of disposal. There are also fission products, notably iodine and technetium, that last for hundreds of thousands of years and must be isolated from the environment.

NE will research and develop nuclear fuel and waste management technologies that will enable a safe, secure, and economic fuel cycle. The NE R&D strategy will be to investigate the technical challenges that would be encountered in each of three potential methods and perform R&D within each of these tracks:

- *Once-Through* – Nuclear fuel makes a single pass through a reactor after which the used fuel is removed, stored for some period of time, and then directly disposed in a geologic repository for long-term isolation from the environment. The used fuel will not undergo any sort of treatment to alter the waste form prior to disposal in this approach, eliminating

the need for separations technologies that may pose proliferation concerns. Less than one percent of the mined uranium is utilized in the present once-through fuel cycle.

- *Modified Open Cycle* – The goal of this approach is to develop fuel for use in reactors that can increase utilization of the fuel resource and reduce the quantity of actinides that would be disposed in used fuel. This strategy is “modified” in that some limited separations and fuel processing technologies are applied to the used LWR fuel to create fuels that enable the extraction of much more energy from the same mass of material and accomplish waste management goals.
- *Full Recycle* – In a full recycle strategy, all of the actinides important for waste management are recycled in thermal- or fast-spectrum systems to reduce the radiotoxicity of the waste placed in a geologic repository while more fully utilizing uranium resources. In a full recycle system, only those elements that are considered to be waste (primarily the fission products) are intended for disposal, not used fuel. Implementing this system will require extensive use of separation technologies and the likely deployment of new reactors or other systems capable of transmuting actinides.

The R&D approach will be to understand what can be accomplished in each of these strategies and then to develop the promising technologies to maximize their potential. One element that crosscuts all potential approaches is disposal and R&D activities will include a focus on those technologies. Additionally, storage will be an important part of any strategy, and R&D will be needed to assess the performance of storage technologies with higher-burnup used LWR fuels, as well as any potential new fuels that may be deployed in the future.

The discussion above is primarily focused on the uranium fuel cycle that is the norm throughout the world. An alternative that could be considered would be the use of thorium to replace at least part of the uranium in the system. Thorium could be used as part of a once-through, modified open, or full recycle fuel cycle. The appeal of thorium is two-fold. First, thorium is more abundant in nature than uranium and can be used to extend or replace uranium in the fuel cycle. Second, the use of thorium enables reduced production of transuranic elements that end up in used fuel. However, there are still technical and economic challenges facing thorium-based fuels. Thus some R&D to address related challenges may be considered. Significant R&D in the use of thorium has been performed previously in the United States and is currently being considered in other parts of the world (particularly in India).

Unlike R&D Objectives 1 and 2, management of UNF and development of fuel cycle technologies are primarily the government’s responsibilities because the government is legally responsible for UNF. Thus, the necessary research, development, and demonstration, if appropriate, will be led primarily by the government. However, early and continuous industrial involvement is important because any technologies that are developed will ultimately be implemented by the commercial entities.

4.3.1 Major Challenges Associated with Fuel Cycle Options

Each of the potential fuel cycle strategies faces challenges, some of which may be shared with other approaches. Similarly, the R&D needed to overcome these challenges may support more than one strategy.

- *Once-Through* – Improving the sustainability of a once-through approach to used fuel management begins with increasing the burnup of the fuel – the amount of energy that can be extracted from fuel in the reactor – which may also have the effect of consuming more actinides in the fuel, leaving less to be disposed. Increasing the burnup of a fuel will require ensuring that both the fuel itself and the structural material designed to keep it in place in the reactor will be able to withstand extended irradiation in the reactor and maintain its integrity when being stored after removal. Deploying advanced fuels will require that they first undergo a qualification process that can take a great deal of time, as researchers must irradiate and conduct examinations on test samples to assure their performance. Also, fuels that are notably different from those currently used in LWRs may drive changes in the fuel processing infrastructure that has evolved to meet current needs. To the extent that the deployed once-through fuel cycle is built upon enriched uranium fuels, the proliferation concerns associated with enrichment technologies will need to be addressed.
- *Modified Open Cycle* – A modified open cycle faces some of the same challenges as the once-through, along with some encountered in a full recycle approach. The modified open cycle introduces the possibility of a used fuel separations step to enable more options for producing fuels. This flexibility enables the inclusion of transuranic elements – notably plutonium – at concentrations capable of supporting ultra-high burnup, along with the attendant difficulties of developing these fuels. The challenges of developing high-burnup fuels discussed in the previous paragraph are applicable to this strategy. The use of separations technology to prepare the ultra-high-burnup fuel introduces difficulties in separations as well as managing proliferation concerns. A key element of this fuel cycle is the likely need to introduce advanced reactors that can utilize these new fuels. The overarching challenge in making a modified open cycle worthwhile is to determine if the improvement in fuel resource utilization and in the waste to be disposed is sufficient to justify the additional complication, potential proliferation concerns, and expense this approach would entail.
- *Full Recycle* – In a full recycle approach, used fuel is not directly disposed in a repository; rather, those elements of the used fuel that are deemed appropriate for recycling are reintroduced into reactors or other systems while the remaining elements are stabilized in a waste form and disposed. This strategy offers the potential of waste forms that pose far less long-term concern, although the approach would require overcoming not only technical challenges but also economic, proliferation, and public perception concerns. This system would rely on multiple separations processes that must minimize process losses and

waste generation while addressing proliferation concerns. Furthermore, fuels must be developed that will allow for the inclusion of all of those elements that are to be recycled in concentrations that vary over time. This is a central tradeoff in the full recycle approach: the more elements that are recycled, the better the waste form will be; however, more separation of elements in the fuel increases the technical and other challenges. Elements that are recycled must be capable of transmutation in a system – likely, but not necessarily, a fast reactor – to eventually eliminate them. In order for a full recycle strategy to be considered, the waste benefits and improved resource utilization produced by such a system must outweigh the complication, expense and potential proliferation concerns associated with it.

4.3.2 R&D for Sustainable Fuel Cycle Options

There are major R&D needs to understand how best to overcome the challenges posed by each of the fuel cycle approaches being considered. The potential R&D efforts that DOE would undertake would have a long-term view and would be science-based. It would take considerable time before the issues in the modified open and the full recycle alternatives would be overcome. Many R&D areas will be applicable to multiple strategies. Prior to beginning major R&D work in these areas, analyses will be performed to gauge the likely value of the efforts.

- *Fuel Resource Exploration and Mining* – The availability of fuel resources for each potential fuel cycle and reactor deployment scenario must be understood. Extended use of nuclear power may drive improvements in defining resource availability and on fuel resource exploration and mining. Primarily, this is work that the private sector would undertake, and how and when this would occur would depend on price and other market conditions. This is most relevant for a once-through approach, but even modified open cycles and full recycle systems may require comparable levels of natural sources of fuel for the foreseeable future. Most appropriate for federal involvement in this area would be R&D to support investigation of long-term, “game-changing” approaches such as recovering uranium from seawater.
- *Used Fuel Disposition* – All radioactive wastes generated by existing and future fuel cycles will need to be safely stored, transported, and disposed. This R&D will identify options for performing these functions, including research into disposal in a variety of geologic environments. This R&D will consider used fuel and high-level waste inventories arising from the current reactor fleet and any additional new builds, including the potential for changing used fuel characteristics from enhanced operations (e.g., increased fuel burnup) and the projected inventories from advanced reactor and fuel cycle systems (e.g., HTRs and SMRs). This research is important to all of the potential fuel cycle approaches.
- *Reduce Transuranic Production In Reactors* – One thrust in developing sustainable fuel cycles will be the exploration of nuclear fuels and reactors that significantly reduce the long-lived actinide content of the used fuel per MWh of energy produced. Exploration of

avenues both to reduce actinide production in present and near-term LWRs and to develop future non-LWR systems that produce lower actinide inventories in their used fuel is important. This research area is central to developing the high burnup fuels that will improve the attractiveness of a once-through or modified open fuel cycle.

- *Separation and Partitioning* – The development of processes to recycle used fuel is needed, as well as an evaluation of the feasibility and risks associated with recycling. The objective is to use a predictive approach to evaluate separation chemistry and processes to achieve the desired performance in terms of product purity, environmental impact, and losses. Though not applicable in a once-through system, this topic would be germane to a modified open cycle approach and central to a full recycle strategy.
- *Waste Forms* – It is necessary to develop understanding of waste form behavior over time to help inform decisions on recycle and disposal options. This understanding must extend over a broad range of potential waste chemistry and disposal environments so waste forms can be adapted and implemented when specific repository conditions are known. This R&D area may be somewhat relevant to strategies that rely on the direct disposal of certain used fuels (such as disposal of high-temperature gas reactor fuels) but the development of improved waste forms is a key component in enabling a full recycle strategy to achieve its promise.
- *Fuel Forms* – The science-based approach will combine theory, experiments, and multi-scale modeling and simulation aimed at a fundamental understanding of the fuel fabrication processes and fuel and clad performance under irradiation. The objective is to use a predictive approach to design future fuels and cladding to enable the development of ultra-high-burnup fuels in a modified open cycle and to demonstrate the inclusion of recovered actinides in transmutation fuels under a full recycle approach. In the early phases of the program, the major fuel fabrication activities include development of innovative processes to enhance the process efficiency and to improve the control of fuel microstructure for enhanced performance, including tailored fuel forms designed to limit excess actinides across the complex.
- *Material Reuse* – The research will focus primarily on recovered uranium for reuse in reactors to obviate the need to dispose of this material once separated from the rest of the used fuel. The critical areas that require process or equipment modifications will be identified, and technologies will be developed to enable the reuse (and in some cases the re-enrichment) of recycled uranium. Efforts will also investigate the potential recycling and reuse of other constituents of used fuel, such as the zirconium cladding, that are potentially useful but not currently being considered by industry because of uncertainties about material characteristics.
- *Transmutation Systems* – Transmutation is a process to change the characteristics of waste by turning recycled elements into elements with more desirable disposal characteristics. While the focus of most recent work has been on fast-spectrum transmutation reactors, thermal-spectrum transmutation can offer some waste management benefits. R&D would

focus on broadly applicable issues including areas such as materials and energy conversion. In addition, studies may be conducted to review the technical and economic aspects of external neutron source-driven transmutation systems to inform whether future investigation in this approach is warranted.

4.3.3 Key Activities

NE's science-based R&D program will provide a more complete understanding of the underlying science supporting the development of advanced fuel cycle and waste management technologies and, therefore, help provide a sound basis for future decision making. The program will also conduct scientific research and technology development to enable storage, transportation, and disposal of used nuclear fuel and all radioactive wastes generated by existing and future nuclear fuel cycles. Over the next decade, the R&D program will mainly be geared to ensuring that the needed breakthroughs and advancements are available and ready when needed. Examples of such technologies would include ultra-deep-burn LWR, HTR, or fast reactor fuel; reactor technologies to support optimized once-through fuel cycles; and advanced fast reactor concepts to support closed fuel cycles. These technologies would encompass all of the known and anticipated advances that could be expected to be available in areas including materials, design methods, components, and energy conversion.

In keeping with Secretary Chu's vision of using science to provide technological breakthroughs to solve America's grand challenges, the program will include long-term, high-risk-high-payoff R&D. This part of the program will seek revolutionary and transformational breakthroughs in systems, materials and components of the fuel cycle that can better meet the program's objectives. Examples of this could include novel reactor concepts such as molten-salt fuel reactors or thorium fuel cycles. Thus while evolutionary advancements are being made, revolutionary advancements will also be pursued such that, if successful, they could replace all or part of existing or near-term technologies. The roadmap includes milestones for selection of technologies as the program matures. Each approach has a set of reference technologies associated with these milestones:

- *Once-Through* – Develop higher-burnup fuel for LWRs.
- *Modified Open Cycle* – Develop ultra-high-burnup fuel for high-temperature gas-cooled reactors using transuranic elements from used LWR fuel. It is assumed that the NGNP or a comparable reactor will be available for fuel testing. Alternative approaches may require access to a fast-spectrum test reactor and nuclear fuel research capabilities.
- *Full Recycle* – Develop technologies to allow repeated recycling of transuranic elements in fast-spectrum reactors. The initial fuel for the fast reactors will come from separated used LWR fuel with successive reloads made from used fast reactor fuel. Access to a fast-spectrum test reactor will be essential for this research, as will nuclear fuel research capabilities.

The following chart outlines potential milestones and future national industry aims for this objective. It presents a distinction between near-term milestones toward which the NE R&D plan is designed to progress, represented as triangles, and longer-term potential outcomes that provide a framework for the milestones, shown as ovals. The milestone charts attempt to depict the stages of development so as not to leave a sense that new technologies can be immediately deployed at a commercial level. Not every milestone or potential outcome outlined in these charts represents actions that are within DOE's roles and responsibilities, and research paths will include many decision points that require choosing the most promising options for continued R&D. All DOE R&D activities will be evaluated and revisited regularly and modified as necessary through the budget process to ensure the portfolio reflects past progress and current priorities.

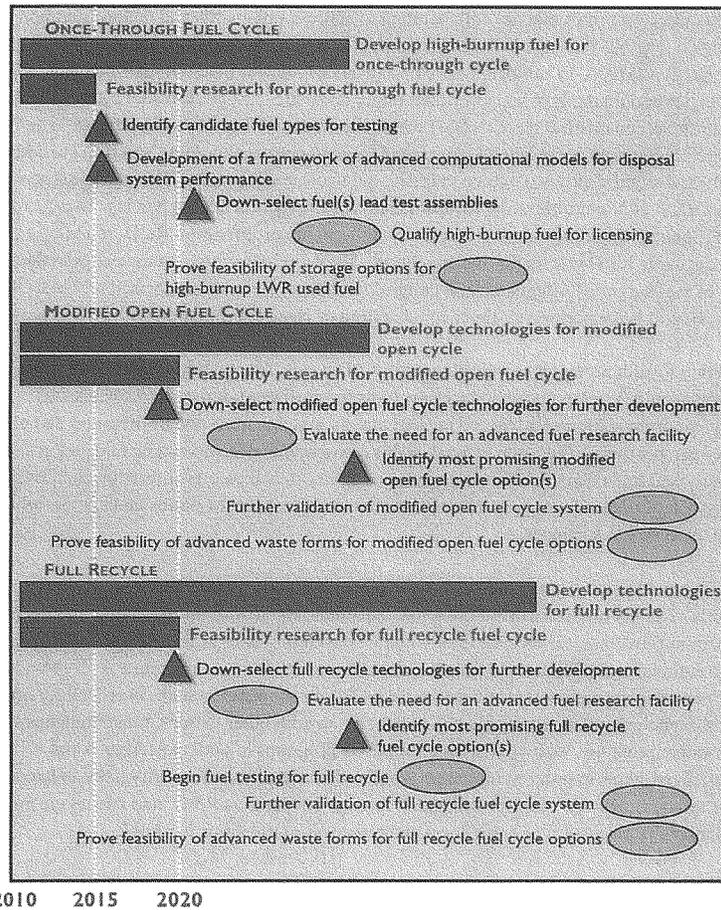
Although some smaller component or process "demonstration" activities are mentioned, these are largely field tests and other actions to provide proof or validation of system elements. They are not costly, large-scale demonstrations like NGNP. Any consideration to embark on such large-scale demonstrations will be the result of decision-making and budget development processes.

4.4 R&D Objective 4: Understanding and Minimizing the Risks of Nuclear Proliferation and Terrorism

The final R&D objective for nuclear energy is to enable secure nuclear energy expansion by developing and demonstrating options that limit proliferation and physical security risks associated with nuclear power while also achieving economic, public health and safety, and environmental goals. These risks include not only the possibility that nations may attempt to use nuclear technologies in pursuit of a nuclear weapon, but also the concern that terrorists might seek to steal material that could be used in a nuclear explosive device. This requires NE advocacy for, and participation in, an integrated program to develop technologies, frameworks, and policy options for the future nuclear enterprise, cutting across all aspects of the fuel cycle.

The United States has extensive experience protecting nuclear materials, from the weapons program that has produced significant quantities of plutonium-239 and highly enriched uranium, to 104 commercial reactors in the U.S. today that handle, use, and store nuclear materials. Internationally, the U.S. has also contributed extensively to the development of technologies now used in the application of international safeguards to monitor used fuel recycling activities in England, France, and Japan. Going forward, safeguards and physical security will become even more integral components in the domestic and global expansion of nuclear power, including the development of future fuel cycle and reactor technologies that further increase the barriers against proliferation and nuclear terrorism.

Figure 12. Key Activities for R&D Objective 3



An integrated U.S. safeguards program provides an opportunity to design improved safeguards and physical security directly into the planning and deployment of new energy systems and fuel cycle facilities. Incorporating safeguards and physical security into the early design phase for new facilities will allow the international community to monitor and verify nuclear material more effectively and efficiently.

DOE has three programs that are collaborating to address safeguards and nonproliferation challenges. The NE Fuel Cycle R&D Materials Protection, Accounting, and Control for Transmutation (MPACT) campaign develops advanced nuclear material management technologies and methods in support of the future domestic U.S. nuclear fuel cycle. The Next Generation Safeguards Initiative (NGSI) within the NNSA Office of Nonproliferation and International Security is designed to leverage U.S. personnel, technology, and R&D to add new capacity and significantly strengthen international nuclear safeguards. The third program, the NNSA Office of Nonproliferation Research and Development's Global Nuclear Safeguards R&D Program, whose mission is to support long-term nonproliferation R&D, rounds out the U.S. safeguards R&D efforts for nuclear energy. The work described in this section reflects NE's aspect of the integrated safeguards and nonproliferation work being performed within DOE. This work will be performed in direct collaboration or close coordination with NNSA activities.

In addition to addressing technical safeguards R&D needs, successful integration of these programs would develop revolutionary new tools for proliferation risk assessments and subsequent optimization of advanced nuclear energy systems from nonproliferation and physical security perspectives. The ultimate goal of this crosscutting effort would be to develop and use new analytical tools that could revolutionize our ability to compare proliferation and physical security risk of nuclear energy system options, including aspects of policy and human behavior as well as technical attributes.

As civilian nuclear power expands across the globe, it becomes more important that high standards of safety and security be implemented around the world. Looking only at how the R&D can improve nuclear technologies without considering who is to use these technologies, and the national and international frameworks under which they are operating, will provide an overly narrow perspective of proliferation risks. NE, in cooperation with other DOE offices and national agencies and in partnership and collaboration with other nations, must implement collaborative programs with civilian nuclear power programs in both experienced and inexperienced states in order to minimize proliferation and physical security risks, enhance reactor safety, maximize resource utilization through cooperative R&D, and encourage methods to minimize the dispersion of enrichment and reprocessing facilities worldwide.

4.4.1 Challenges

A key challenge facing the expanded use of nuclear energy and associated fuel cycles is minimizing the potential for the misuse of the technology and materials for weapons purposes. International treaties such as the Nuclear Nonproliferation Treaty, combined with transparency in the use of technology and materials, provide the basic building blocks to assure the peaceful use of nuclear energy. Fuel cycle infrastructure built upon these tenets while enabling the economic provision of fuel cycle services can help prevent the spread of sensitive nuclear technology and materials.

Today's key challenges are to take the wealth of knowledge and experience that exists within the international safeguards and physical security communities and to deploy advanced, affordable techniques to immediately detect the diversion of nuclear materials or the modification of systems. The key technical challenges that must be addressed include:

- Incorporation of nuclear safeguards and physical security technology into designs for fuel cycle facilities, advanced fast reactors, and associated nuclear materials storage and transportation systems.
- Development of proliferation risk assessment methodologies and tools that allow for an integrated view of fuel cycle options to be studied, optimized, and compared.
- Development of advanced containment and surveillance, smart safeguards information management systems, nuclear facility use-control systems, and next-generation nondestructive analysis and process-monitoring systems.
- R&D of advanced material tracking methodologies, process-control technologies, and plant engineering.
- Remote sensing, environmental sampling, and forensic verification methods.

Addressing these challenges will enable the use and expansion of nuclear energy for peaceful purposes to proceed in a safe and secure manner.

4.4.2 R&D for Understanding and Minimizing the Risks of Nuclear Proliferation and Terrorism

Some potential R&D areas for Objective 4 are:

- *Proliferation Risk Assessments* – Any fuel cycle technologies deployed in the U.S. must be considered in light of how other nations might choose to incorporate them into their own nuclear enterprises. Towards this end, it is important for NE to develop a means of understanding how these new technologies would be viewed by other countries in the context of their national goals. This research effort would develop the tools and approaches for understanding, limiting, and managing the risks of nation-state proliferation and physical security for fuel cycle options. NE will focus on assessments required to inform domestic fuel cycle technology and system option development. These analyses would complement those assessments performed by NNSA to evaluate nation-state proliferation and the international nonproliferation regime. Taken in conjunction, these comprehensive proliferation risk assessments will provide important information for discussions and decisions regarding fuel cycle options. These assessments will:
 - Exploit science-based approaches, to the extent possible, for analyzing difficult-to-quantify proliferation risk factors or indicators (e.g., capabilities, motivations, and intentions); address issues identified in several National Academy of Sciences studies

- related to risk assessment; and leverage current state-of-the-art academic social science research in this field.
- Integrate the diverse decision factors (including economics, public health and safety, environmental benefits, and proliferation and terrorism risk reduction) for different fuel cycle options to understand the tradeoffs and potential synergies between these decision criteria.
 - Apply these tools to study nuclear energy system options, and display the results in a useful format for decision makers.
 - *Safeguards and Physical Security Technologies and Systems* – The NE focus is on the development of safeguards technologies and integrated systems for current and potential future domestic fuel cycle options. These technologies and systems contribute significantly to limiting proliferation and physical security risks while also achieving economic, public health and safety, and environmental goals. This requires that these activities be performed in an integrated program with the fuel cycle technology development activities. Opportunities exist to collaborate with other organizations (e.g. NNSA, the Department of Homeland Security, the Department of Defense) and will be utilized. NNSA will be responsible for evaluating the nation-state proliferation risks of deploying new fuel cycle technologies – particularly recycling technologies – outside of the United States.
 - Advanced Instrumentation – Many advanced fuel cycle processes, such as advanced aqueous reprocessing, electrochemical separations, and recycle fuel fabrication pose new challenges for safeguards and nuclear material management. The safeguards state-of-the-art will be advanced through a developmental program to improve the precision, speed, sampling methods, and scope of nuclear process monitoring and accountancy measurements, and innovative approaches for containment and surveillance. This effort supports the development of advanced safeguards instrumentation such as active interrogation methods based on neutron and photon drivers and advanced passive detectors, such as ultra-high resolution spectrometer and neutron multiplicity counting. Additionally, existing nuclear data is evaluated for the identification of gaps or needed improvements.
 - Advanced Concepts and Integration – Early integration of safeguards concepts into nuclear facility design is optimal to meet U.S. and international standards with minimum impact on operations. This requires development of a framework to codify the safeguards-by-design concept, applicable for both international safeguards and physical security for U.S. fuel cycle facilities. It also includes the evaluation of material attractiveness of relevant fuel cycle materials. A monitoring and control system must be developed that is secure and can rapidly authenticate and investigate summary and raw data to unequivocally distinguish process deviations, maintenance problems, and calibration and component failures from actual diversion events.
 - Modeling and Simulation – Development of modeling and simulation tools to enable new technology development, elucidation of high-impact R&D priorities, and approaches that optimize effectiveness and efficiency of the overall system will be

essential for the integration of new safeguards technologies and techniques into nuclear energy systems.

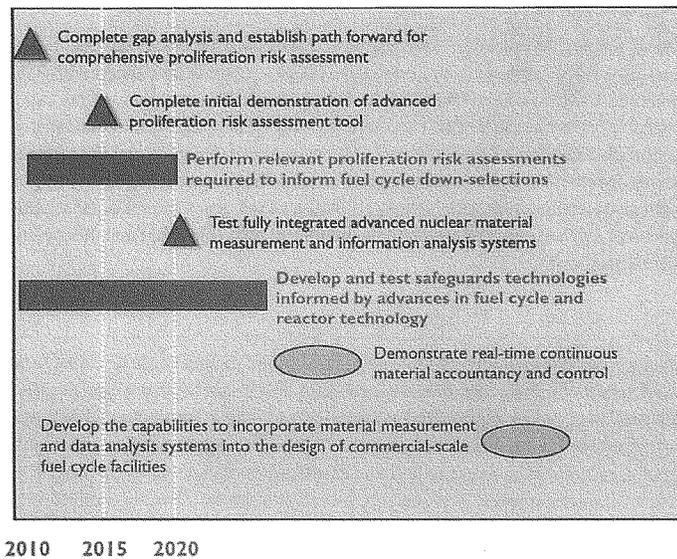
- *Nuclear Energy Technologies and Systems* – This element includes developing and assessing a sufficiently wide and innovative range of options (in concert with R&D Objectives 1–3) to achieve Objective 4. This includes, for example, options that enable decreasing the attractiveness and accessibility of used fuel and intermediate materials, transmuting materials of potential concern, optimizing safeguards and physical security systems approaches, and minimizing the number of needed enrichment and recycle facilities. In conjunction with NNSA, NE will lead the development of these options and implement mechanisms that tightly link and inform both this R&D and other elements of R&D Objective 4.

4.4.3 Key Activities and Milestones

The following chart outlines potential milestones and future national industry aims for this objective. It presents a distinction between near-term milestones toward which the NE R&D plan is designed to progress, represented as triangles, and longer-term potential outcomes that provide a framework for the milestones, shown as ovals. The milestone charts attempt to depict the stages of development so as not to leave a sense that new technologies can be immediately deployed at a commercial level. Not every milestone or potential outcome outlined in these charts represents actions that are within DOE's roles and responsibilities, and research paths will include many decision points that require choosing the most promising options for continued R&D. All DOE R&D activities will be evaluated and revisited regularly and modified as necessary through the budget process to ensure the portfolio reflects past progress and current priorities.

Although some smaller component or process "demonstration" activities are mentioned, these are largely field tests and other actions to provide proof or validation of system elements. They are not costly, large-scale demonstrations like NGNP. Any consideration to embark on such large-scale demonstrations will be the result of decision-making and budget development processes.

Figure 13. Key Activities for R&D Objective 4



5. R&D APPROACH

Section 4 of this roadmap presents NE's four R&D objectives. These objectives show the connection between how nuclear energy will contribute to meeting the nation's energy goals and the R&D that needs to be performed to enable that contribution. This section describes the approach that will be taken to perform this R&D, provides brief descriptions of the key areas of technological development that will be undertaken, presents a brief description of the facilities needed to perform this research, and describes the interfaces with stakeholders that will be required for success.

5.1 Solution-Driven, Goal-Oriented, Science-Based Approach to Nuclear Energy Development

Nuclear power systems were initially developed during the latter half of the 20th century. Their development was greatly facilitated by the nation's ability and willingness to conduct large-scale experiments. The federal government constructed 52 reactors at what is now Idaho National Laboratory, another 14 at Oak Ridge National Laboratory, and a few more at other national laboratory sites. By today's standards, even large experiments and technology demonstrations were relatively affordable. While relying heavily on the Edisonian approach in the 1950s and 1960s, the nuclear energy community was a rapid adopter of high-end computational modeling and simulation during the 1970s and 1980s. During this period, nuclear power plant designers and regulators developed and deployed many of the most demanding simulation models and tools on the most advanced computational platforms then available. Still, the United States embraced a regulatory process that relied, and still relies, heavily on the use of experiments to confirm the ultimate safety of nuclear power systems. Building upon the scientific advances of the last two decades, our understanding of fundamental nuclear science, improvements in computational platforms, and other tools can now enable a new generation of nuclear power plant designers, fabricators, regulators, and operators to develop technological advancements with less of a reliance on large-scale experimentation. The developmental approach employed in this roadmap embodies four elements, as depicted in Figure 14:

Experiments – These are generally small-scale experiments aimed at observation of isolated phenomena or measurements of fundamental properties. However, targeted integral experiments also will be needed in some cases.

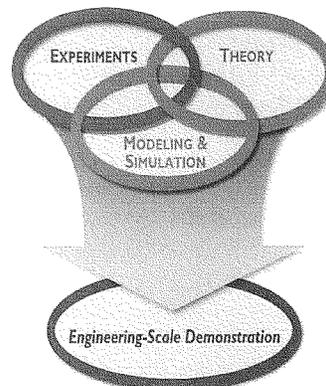
Theory – Based either on first principles or observations made during phenomenological testing, theories are developed to explain fundamental physical phenomena.

Modeling and Simulation – A range of mathematical models for diverse phenomena at much different time and spatial scales are developed and then integrated to predict the overall behavior of the system. Key objectives of the modeling and simulation effort are to reduce the number of prototypes and large-scale experiments needed before demonstration and deployment and to quantify uncertainties and design and operational parameters.

Demonstrations – While the state of knowledge can be significantly advanced through the combination of experiments, theory, and modeling and simulation, there may be instances where it is appropriate to work with the private sector to further develop and validate laboratory findings.

Demonstrations can be a useful element in proving viability of new technologies, but their high cost must be considered in the context of a variety of other factors. There must be sufficient industry commitment for deployment of commercial technologies before such demonstrations would be considered. Any potential future demonstration activities will be evaluated on a case-by-case basis through the established decision-making procedures of the Department and budget formulation.

Figure 14. Major Elements of Science-Based Research, Development & Demonstration



5.2 Enabling Technologies

A set of enabling technologies has been identified that support progress on multiple objectives. Where NE has an R&D role in these technology areas, coordination of NE's activities across these technologies must be implemented. For example, the NE "owner" of the fuel cycle objective in such a case will be responsible for coordination of all nuclear fuel work across objectives.

- *Structural Materials* – Advanced radiation and corrosion-resistant materials with extension to high-temperature applications benefit many of the R&D objectives, especially when conducted using a science-based development approach without relying heavily on empirical experiments. Thus, a synergistic R&D program can be developed to support all the objectives.
- *Nuclear Fuels* – The development of improved and advanced nuclear fuels is clearly a major objective for both existing LWRs and the entire spectrum of advanced nuclear energy systems discussed throughout this document. The short list of potentially needed

fuels include high-burnup LWR, fast reactor, and gas-reactor fuels; coated-particle fuels; fast-spectrum and thermal-spectrum transmutation fuels and targets; thorium fuels; and molten-salt fuels. A tightly coordinated and well integrated nuclear fuels R&D program must be developed to support all of the R&D objectives.

- *Reactor Systems* – The development of advanced reactor concepts and supporting technologies is a core function of NE. Advanced technologies and reactor concepts are needed to improve the economics of electricity production. Multiple advanced reactor concepts (LWR, small modular, gas-cooled, liquid metal-cooled, molten salt-cooled, etc.) may play a role in our nuclear future. The development of a robust advanced reactor system concept definition capability will be an important element of NE strategy development.
- *Instrumentation and Control* – The development and implementation of digital instrumentation and control systems will benefit current reactors as well as future reactors. Advanced instrumentation and control systems will also benefit future fuel cycle facilities. Safeguards technology development also relies on advanced instrumentation and plant control systems through safeguards-by-design.
- *Power Conversion Systems* – Advanced power conversion systems will lead to increased efficiency for the future reactors and facilitate the use of nuclear power in markets requiring process heat.
- *Process Heat Transport Systems* – The development of process heat transport systems that can be combined with multiple reactor technologies will enable the use of nuclear power to deliver needed process heat to the industrial sector.
- *Dry-Heat-Rejection Systems* – Advanced dry-heat-rejection systems will improve the environmental friendliness of the nuclear power plants and enable the deployment of nuclear energy in areas where water constraints might otherwise preclude its use.
- *Separations Processes* – This report has noted the wide variety of fuel cycle options that may be needed in the future to address U.S. energy security, economic, and sustainability goals. Our future ability to sustainably and economically recycle LWR fuels, fast reactor fuels, gas-cooled reactor fuels, molten salt fuels, etc. will depend, in part, on our ability to separate key elements from the waste that will not be disposed in a repository.
- *Waste Forms* – The ability to engineer, produce, and manage fuel cycle waste forms that are chemically and structurally stable over relevant periods of time from decades to hundreds of thousands of years (depending on the radioisotope) is critical to achieving a sustainable fuel cycle and must be closely integrated with both radiochemical research and repository systems research.
- *Risk Assessment Methods* – Advanced methods for risk assessment based on mechanistic modeling of system behavior will benefit the safety assessments of the new nuclear energy systems and fuel cycle technologies. State-of-the-art computational and experimental

techniques will benefit not only novel reactor concepts but other nuclear facilities needed for the fuel cycle.

- *Advanced Modeling and Simulation* – The science-based approach relies heavily on fundamental experiments combined with associated theories for predictive capabilities. However, a comprehensive use of the science-based approach for predictive tools with multiple interrelated phenomenologies requires advances in computational sciences where phenomena at different time and length scales can be bridged into an engineering code using modern computational platforms.

5.3 R&D Facilities and Infrastructure

Ultimately all design and safety tools for nuclear systems must be validated with underpinning experimental data. Without such a foundation in reality, licensing these systems would be virtually impossible. Experiments also provide essential waypoints for guiding the development of technology. Having such an experimental capability requires that nuclear energy R&D maintain access to a broad range of facilities from small-scale laboratories potentially up to full prototype demonstrations. Hot cells and test reactors are at the top end of the hierarchy, followed by smaller-scale radiological facilities, specialty engineering facilities, and non-radiological small laboratories.

Nuclear energy R&D employs a multi-pronged approach to having these capabilities available when needed. The core capabilities rely on DOE-owned irradiation, examination, chemical processing and waste form development facilities. These are supplemented by university capabilities ranging from research reactors to materials science laboratories. Future infrastructure requirements will be considered through the established budget development processes as needs arise.

The high cost of creating and maintaining physical infrastructure for nuclear R&D, including the necessary safety and security infrastructure, requires creativity and periodic realignment of infrastructure planning with programmatic direction. NE successfully employs a solid approach to maintaining infrastructure. The approach concentrates the high-risk nuclear facilities at the remote Idaho site, maintains unique capabilities at other sites if required, supports vital university infrastructure, negotiates equitable capability exchanges with trusted international partners, refurbishes and reequips essential facilities if required, addresses maintenance backlogs to ensure safe operation, and makes efficient use of modeling, simulation, and single-effect experiments.

5.4 Interfaces and Coordination

In order to achieve the objectives under each R&D objective, NE must closely coordinate its activities with other agencies, the nuclear industry, and international partners.

Other Department of Energy Offices –The use of a “science-based” approach to develop innovative nuclear energy systems and components requires a strong collaboration between NE and the Office of Science (SC) to employ the tools developed for science in engineering applications. Such tools include advanced experimental techniques, a fundamental understanding of materials behavior, and advanced computational sciences. R&D on storage and disposal of nuclear waste will be performed in coordination with the Office of Environmental Management (EM) and the Office of Naval Reactors (NR), as there are salient similarities in the disposition challenges facing each.

NNSA – Technology development for safeguards is a crosscutting tool that is applicable for both domestic and international uses. NNSA and NE are implementing a coordinated effort to address the safeguards R&D needs for domestic and international applications. These collaborative efforts address the assessment of proliferation risks, accountancy, and control (domestic) and verification (international) by contributing new safeguards technologies; recruiting a new generation of safeguards specialists into the U.S. national laboratories, universities, and industry; and informing the development of safe and secure nuclear facilities. NNSA will be responsible for evaluating the international nation state proliferation risks of deploying new fuel cycle technologies, particularly recycling technologies, outside of the United States.

NRC – Appropriate collaboration between DOE and the NRC will help assure that nuclear energy remains a viable option for the United States. The development of science-based tools to inform licensing paradigms is one key goal of this collaboration.

Nuclear Industry – The decision to deploy nuclear energy systems is made by industry and the private sector in market-based economies. However, it is important that industry is engaged during the definition and execution of the R&D phase and that industry participate in joint demonstration activities if such demonstration is deemed necessary and appropriate to facilitate commercialization and deployment of the resulting technologies and systems. As technologies are developed, cost-sharing with industry is an integral part of NE’s agenda. DOE will proceed in a manner that recognizes the importance of maintaining a strong and viable nuclear industry.

International Community –Strong participation and leadership by the United States in international nuclear R&D, safety and nonproliferation programs is essential. Nuclear energy worldwide must be deployed with safety and security of paramount importance. In addition, several countries have established strong nuclear R&D programs and specialized expertise from which the United States can benefit, such as the leadership position of Russia, France, and Japan in fast reactor technology. Collaborations in nuclear technology R&D will be implemented through bilateral and multilateral agreements and through international organizations such as the Generation IV International Forum.

In order for nuclear power to continue to be a viable energy option in any country, including the United States, nuclear safety, security, and safeguards must be maintained at the highest levels on a global scale. DOE will help to achieve consensus criteria for safe reactor operation through international organizations, such as the World Association of Nuclear Operators, and seek to enhance safety standards for nuclear power, promote appropriate infrastructure at the national and international levels, and minimize proliferation risks from the expansion of nuclear power through its participation with the IAEA and related organizations.

6. SUMMARY AND CONCLUSIONS

This document presents an integrated strategy and R&D framework for the DOE Office of Nuclear Energy. In order to meet the Administration's goals of energy security and greenhouse gas reductions, nuclear energy must play an important role in the national energy portfolio. NE's derived missions in support of these national goals are to enable the development and deployment of fission power systems for the production of electricity and process heat. Four research and development objectives have been identified, which will guide NE's program and strategic planning. Progress in these areas will help ensure that nuclear energy continues to be among the suite of available U.S. energy options throughout the 21st century. These objectives are:

- *R&D Objective 1* – Develop technology and other solutions that can improve the reliability, sustain the safety, and extend the life of current reactors.
- *R&D Objective 2* – Develop improvements in the affordability of new reactors to enable nuclear energy to help meet the Administration's energy security and climate change goals.
- *R&D Objective 3* – Develop sustainable nuclear fuel cycles.
- *R&D Objective 4* – Understand and minimize the risks of nuclear proliferation and terrorism.

Message from the Secretary

April 9, 2010

The Department is responding to the House Conference Report 111-278, Energy and Water Development Appropriations Bill, 2010, which requested the Department to submit a report detailing an implementation and progress measurement plan for each funded Energy Innovation Hub, and to House Report 111-203, Energy and Water Development Appropriations Bill, 2010, which provides that this report should detail the Department's site selection process, progress measurement plan, and the Hub's specific research goals and milestones.

The Department acknowledges the stated concerns of Congress regarding insufficient detail and communication on the Hubs, and we have now developed a management strategy and plan for moving forward with establishment of the Hubs.

This report summarizes the fundamental tenets of the Energy Innovation Hubs concept, as distinguished from other energy R&D approaches recently initiated by the Department; the Department's management strategy for the Hubs; the Hubs' current status and site selection process; and a progress measurement plan for the Hubs, which includes research goals and milestones. Pursuant to statutory requirements, this report is being provided to the following Members of Congress:

- **The Honorable Daniel K. Inouye**
Chairman, Senate Committee on Appropriations
- **The Honorable Thad Cochran**
Ranking Member, Senate Committee on Appropriations
- **The Honorable David R. Obey**
Chairman, House Committee on Appropriations
- **The Honorable Jerry Lewis**
Ranking Member, House Committee on Appropriations
- **The Honorable Byron Dorgan**
Chairman, Senate Subcommittee on Energy and Water Development, Committee on Appropriations
- **The Honorable Robert Bennett**
Ranking Member, Senate Subcommittee on Energy and Water Development, Committee on Appropriations

- **The Honorable Peter Visclosky**
Chairman, House Subcommittee on Energy and Water Development, Committee on Appropriations
- **The Honorable Rodney Frelinghuysen**
Ranking Member, House Subcommittee on Energy and Water Development, Committee on Appropriations

We in the Department are focused on working with Congress to make the Hubs a success. If you have any further questions, please contact me or Betty A. Nolan, Senior Advisor, Office of Congressional and Intergovernmental Affairs, at (202) 586-5450.

Sincerely,

A handwritten signature in black ink, appearing to read "Steven Chu". The signature is written in a cursive, flowing style.

Steven Chu



U.S. Department of
ENERGY

Energy Innovation Hubs

Report to Congress
April 9, 2010

United States Department of Energy
Washington, DC 20585

Executive Summary

The Department of Energy (DOE) will establish three Energy Innovation Hubs in FY 2010—Fuels from Sunlight, Energy Efficient Building Systems Design, and Modeling and Simulation for Nuclear Reactors—to advance these highly promising areas that are ripe for the close integration of discovery-oriented science with translational engineering research where opportunities for commercialization can be quickly seized. The Hubs will support cross-disciplinary research and development focused on the barriers to transforming energy technologies into commercially viable materials, devices, and systems. Each Hub will embrace within its topical area the goals of both understanding and use, without erecting barriers between basic and applied research.



ENERGY INNOVATION HUBS

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I. Legislative Language

The Department of Energy is responding to the issue presented in House Conference Report 111-278, Energy and Water Development Appropriations Bill, 2010, September 30, 2009, on page 101, wherein it is stated:

DEPARTMENT OF ENERGY

... "The conferees direct the Department to submit to the House and Senate Committees on Appropriations, within 60 days of enactment of this Act, a report included in the House report detailing an implementation and progress measurement plan for each funded Energy Innovation Hub."

The report requirement referred to is presented in House Report 111-203, Energy and Water Development Appropriations Bill, 2010, July 17, 2009, on page 84, wherein it is stated:

RESEARCH AND DEVELOPMENT INITIATIVES

... "The Committee further directs the Department, within 60 days of enactment of this Act, to submit to the Committee a report detailing the Department's site selection process, progress measurement plan, and the Hub's specific research goals and milestones."

II. The Energy Innovation Hub Concept

Transforming our energy system through the development and widespread adoption of clean, cost-effective, and sustainable energy sources is critical to the national, economic, and environmental security of the United States. To achieve this goal, new discoveries and innovative technologies are needed. The Department of Energy is committed to leveraging its premier scientific and technical resources to address this national imperative, and is enhancing its R&D portfolio to hasten our progress. The Energy Innovation Hubs are a critical piece of this portfolio.

How R&D is managed can impact the pace of innovation. The rapid pace of development of radar, the transistor, and the atomic bomb occurred in part because of the management model employed. These achievements were organized around a particular challenge, with a highly integrated management model in which outstanding scientist-leaders actively managed teams of scientists, engineers, and technicians.

The Energy Innovation Hubs represent a structure modeled after the forceful centralized scientific management characteristics of the Manhattan Project (e.g., Los Alamos and the Metallurgical Laboratory at the University of Chicago), Lincoln Lab at MIT that developed radar, and AT&T Bell Laboratories that developed the transistor. A hallmark of these research efforts was the focus of highly collaborative fundamental research and technology development capabilities of peerless quality and significant scale on a specific technological challenge, as well as constant communication with the “users” of the technology. The Hubs are inspired by the lessons of these past successes. They will differ from the Department’s other core energy R&D program activities in their larger scale, higher degree of integration of scientific research with engineering development, and singular focus on driving energy technology solutions to their fundamental limits. Also, unlike the centralized, long-lived laboratories, these are intended to be flexible, non-permanent entities. The DOE Bioenergy Research Centers, formed in 2007 to develop methods for producing cellulosic ethanol and other biofuels, have already adopted some of the organizational aspects that will be incorporated in the Energy Innovation Hubs.

The Hubs will develop and deliver transformational energy technologies that will be commercialized by the private sector. By modeling the organizational structure after the great mission-oriented wartime and industrial laboratories, the Department’s intent is to create a research atmosphere with a fierce sense of urgency to deliver solutions. Critical to the success of the Hubs is an outstanding scientific leadership team that can recruit and nurture extraordinary talent and instill high expectations. These leaders will integrate efforts across a wide range of disciplines by creating a structure designed to promote rapid dissemination of research results through both formal and informal channels. They will follow the day-to-day progress throughout the laboratory so that they can guide and coordinate research directions “in real time.” They will have the authority to respond to new developments by rapidly assessing and reallocating resources when needed.

The Department has certainly made important advances in energy R&D and technology development and deployment, yet fundamental challenges remain for many of the technologies that will lead us to a clean and secure energy future. To meet these challenges, the Department is assessing and adjusting its core energy R&D efforts to accelerate solutions to our critical energy problems. In addition, the Department is augmenting its R&D through three new complementary approaches to marshal the Nation’s brightest scientific and technical talents to accelerate energy breakthroughs:

- The first approach is the **Energy Frontier Research Centers** launched by the Department’s Office of Science. EFRCs are self-assembled groups of approximately six to twelve researchers, with awards ranging from \$2 to \$5 million a year for period of five years, tackling specific and fundamental scientific challenges that would benefit from a dedicated and concerted research effort beyond the scale of supporting one or two principal investigators. EFRCs focus only on a single fundamental scientific challenge at hand, and are not designed to address larger system or performance issues.

- The second approach is spearheaded by the Department's recently formed **Advanced Research Projects Agency-Energy (ARPA-E)**. ARPA-E uses small groups to hunt for game-changing new technologies rather than new scientific knowledge. Grants range from as low as \$500,000 to as high as \$10 million a year and funding is for one to three years. Within that time period, successful projects will be picked up by the private sector or find a funding home elsewhere.
- The third modality are the **Energy Innovation Hubs**. They are large-scale, multi-disciplinary, highly collaborative teams of scientists and engineers working over a longer time frame to achieve a specific high priority goal. Funding is targeted at \$25 million a year for five years. Creating a hub is appropriate when there is a problem ripe for the close integration of discovery-oriented science with translational engineering research to quickly seize opportunities for commercialization.

Taken together, DOE's ongoing programs in energy R&D and technology demonstration and deployment, the recently launched Energy Frontier Research Centers, ARPA-E projects, and the forthcoming Energy Innovation Hubs comprise a robust portfolio of diverse energy R&D modalities that complement each other and maximize the Nation's ability to achieve energy breakthroughs as quickly as possible.

III. DOE Management Strategy for the Hubs

Selection of the Hub Research Areas. The Energy Innovation Hubs will address topic areas that present the most critical barriers to achieving national energy and climate goals while proving the most resistant to solution by conventional R&D enterprise structures. DOE selected each Hub research focus area based on the following considerations:

- The focus area problem represents a significant grand challenge where major advances are likely to have a material impact on energy production or usage, greenhouse gas emissions, and economic growth.
- Although the scientific community may have addressed the focus area problem for decades through research at the individual-investigator or group level, a large-scale coordinated, multidisciplinary, systems-level approach is needed to accelerate the pace of discovery and innovation with an eye towards opportunities for quick commercialization. However, the Hubs are not designed to tackle subsequent demonstration, deployment, and commercial scale-up.

Using funding provided in the Energy and Water Development and Related Agencies Appropriations Act, 2010, the Department of Energy will establish the following three Energy Innovation Hubs in FY 2010: 1) Fuels from Sunlight; 2) Energy Efficient Building Systems Design; and 3) Modeling and Simulation for Nuclear Reactors. The Department already funds some promising R&D in these areas, and the Hubs will be able to build upon this work and other

advances to reach the critical mass of R&D and engineering integration needed to accelerate major breakthroughs in these areas.

Each Hub will focus on a single topic, but with work spanning the gamut from (i) basic research through (ii) engineering development to (iii) facilitating commercialization by industry. Each Hub will be composed of a highly collaborative team utilizing multiple scientific disciplines, engineering fields, and technology areas. By bringing together top talent across the full spectrum of R&D performers—including universities, private industry, non-profits, and government laboratories—each Hub is expected to become a world-leading R&D center in its topical area.

Hub Operations. The purpose of the Energy Innovation Hubs is to assemble the most talented scientists and engineers to focus intense, systems-level research and development efforts on the critical energy focus areas. The Hubs are designed to accelerate current state-of-the-art energy science and technology toward their fundamental limits and to support high-risk, high-reward research projects that produce revolutionary changes on how we produce and use energy. Key elements for the successful management of a Hub include: 1) a clear lead institution with strong scientific leadership and central location for the Hub; 2) to the extent that there is geographic distribution of the Hub participants, a clear commitment to the use of state-of-the-art technology and frequent virtual meetings to enable meaningful long distance collaboration; and most importantly, 3) a clear organization and management plan for achieving the collaborative and synergistic goals of a Hub and infusing a culture of empowered central research management throughout the Hub.

In order to be successful, a Hub must achieve a high level of R&D integration and synergy among its researchers, who will span multiple scientific and engineering disciplines. History is replete with examples in which forceful centralized scientific management has been a central element in successful R&D integration to achieve a targeted result. The leaders of these efforts—scientists themselves—understood the necessity of close-quarters give-and-take between those involved in fundamental research and technology development. The paths of scientific discovery and technological need to inform each other: advances in basic sciences create entirely new technology possibilities; and likewise, technology development efforts identify key roadblocks that require improved scientific understanding or wholly new approaches. Connecting fundamental research and technology development through an integrated team was essential to these rapid achievements. Early and close coordination with the private sector to facilitate transition to deployment was also essential.

The scientific collaborations the Hubs will foster are indispensable to their success and must be backed by a meaningful and sustained investment. Each Hub will be funded at a total of \$22 million in FY 2010, with up to \$10 million to be devoted to infrastructure start-up for the Hub, including building renovation (but no new construction), lease arrangements, equipment, and instrumentation. It is anticipated that each Hub will be funded at \$25 million per year for Hub operations in each of the next four years of the initial 5-year award period, pending annual appropriations.

This substantial five-year funding stream is likely to be more conducive to collaborative teamwork than the three-year funding mechanisms typical of most federal research programs. The five-year award term is intended to liberate researchers from short term funding cycles and provide them the flexibility to embark on more daring approaches. To receive renewed funding after the initial five-year period, each Hub will need to deliver outstanding scientific results and will be expected to demonstrate the potential for exceptional future progress. This funding model, properly managed, will allow the Hub leadership to recruit outstanding scientists, quickly assemble substantial new R&D efforts that emerge from recent developments, and equally quickly abandon directions that turn out to be less promising.

DOE Hub Information and Communication. The Department posted a new web site (<http://hubs.energy.gov>) in December 2009 that contains a description of the DOE Energy Innovation Hubs program, integrated management strategy, implementation plans, and frequently asked questions. The Hubs web site ensures transparency and serves as the one-stop resource for current information on the Energy Innovation Hubs program throughout the entire implementation process, including Hub workshops, issuance of Funding Opportunity Announcements, information updates, and award announcements.

IV. Implementation Status and Site Selection Process

Applications for Hubs are being solicited in FY 2010 via three separate Funding Opportunity Announcements (FOAs), one FOA for each Hub topic area. While the three Hubs share a common management strategy, they differ in the technical nature of their activities across the spectrum of basic research, applied research, and development (R&D), and technology demonstration and deployment (D&D). To this end, each Hub FOA requires tailoring to suit its specific scientific and technical scope, which helps provide fairness, clarity, and openness.

The three coordinated FOAs have been derived from a common template that maintains the DOE Hub management philosophy with appropriate modifications to some specific components of the FOAs to address the individual scientific and technical requirements of each Hub. Precise descriptions of the individual requirements, deliverables, and technical goals of each Hub are important if the competition is to be fair to all applicants. Ensuring that these are open competitions for all segments of the appropriate communities is critical to the receipt of strong applications.

Each Hub FOA is managed by a particular DOE program office, which is responsible for issuing the FOA, managing the application process, conducting the merit reviews according to criteria set forth in the FOA, and selecting the Hub award. These DOE program offices will also be responsible for management oversight of the Hub's operations and will conduct periodic site-visit reviews of the Hub. The DOE program offices are:

- Fuels from Sunlight: Office of Science
- Modeling and Simulation for Nuclear Reactors: Office of Nuclear Energy
- Energy Efficient Building Systems Design: Office of Energy Efficiency and Renewable Energy

Federal program officials representing the three program offices managing these Hubs form the core of a Hubs Working Group that provides the DOE senior management with programmatic recommendations on a coordinated path forward for the establishment of the Hubs. A uniform DOE Hubs policy is vital to the future success of the Hubs. The Hubs Working Group meets regularly to provide integrated programmatic oversight and to ensure commonality and transparency across DOE.

All types of entities, including universities, private for-profit and non-profit institutions, and DOE/NNSA Federally Funded Research and Development Centers (FFRDC) contractors, are eligible to apply as prime applicants. Foreign entities and non-DOE/NNSA Federal Agencies and their FFRDC contractors may not be the prime applicant, but may be proposed as team members and/or subcontractors. Each Hub is expected to have a lead institution, which may be a university, a DOE/NNSA national laboratory, a nonprofit organization, or a private firm.

Funding for all three Hubs is planned to be awarded before the end of Fiscal Year 2010. Obtaining input from the scientific and technical community on the technical scope of each Hub has been an important step in the implementation process. As illustrated by the following table, it is estimated that the implementation process for all three Hubs will be approximately synchronized by the summer 2010 timeframe.

Energy Innovation Hubs	Fuels from Sunlight	Modeling and Simulation for Nuclear Reactors	Energy Efficient Building Systems Design
<i>Implementation Plans</i>	<i>Estimated Dates</i>		
Issued Funding Opportunity Announcement	December 22, 2009	January 20, 2010	February 8, 2010
Full applications due	March 29, 2010	March 8, 2010	May 6, 2010
Conduct review of applications	March–May 2010		May–August 2010
Announce award	June 2010		August 2010
Negotiate award with recipient	June–August 2010		
Issue Award	August–September 2010		

Funding will be competitively awarded to Hubs selected on the basis of external peer-review of proposals submitted in response to the FOA for each Hub. The Department's primary objective is to select the Hub proposals that are the most likely to deliver transformative energy breakthroughs. The Hubs will be selected solely on the basis of a competitive merit review; there are no preconceived goals for specific locations or geographical distribution of the Hubs.

V. Progress Measurement Plan, Research Goals, and Milestones

The Department recognizes that effective management of scientific facilities, programs, and projects is critical to the success of research. The Hub must have a well-conceived management plan for the establishment and operation of the Hub. Each plan should include provisions for coordination with other basic and applied research and development activities supported by the Department. Management of the Hub's initial establishment, research, technology development, resources (both personnel and physical resources), and scientific data is critical to the success of the Hub, to its overall contribution to the Energy Innovation Hubs initiative, and to the Department's missions. A detailed Hub management plan covering all of the elements described above will be required from each applicant in response to each Hub FOA. Along with the scientific and technical merit of the proposed R&D, the proposed management plan will be subject to a complete merit review by external experts. In addition, each Hub must have an advisory board that includes industry participation.

After the Hub's establishment, the responsible Department program office will periodically review Hub progress and subject the Hub to regular and rigorous external peer review of their scientific program and their management structure, policies, and practices. Within DOE, there will be an Energy Innovation Hubs Oversight Board that will periodically review the progress of the Hubs. The Hub Oversight Board will consist of the Secretary and/or his designate, the Under Secretaries for Energy and Science, and their senior scientific/technical advisors.

VI. Conclusion

The overarching mission of each Energy Innovation Hub is to make substantial long-term impact on the Nation's energy and environmental security in the selected topic area within the five-year award period. The research goals of each Hub will be stated broadly in the FOA so that applicants have sufficient latitude to propose the best approach to achieve that mission. Specific and measurable research goals and milestones for each Hub will then be determined by DOE and the award recipient as part of the award negotiation process. In summary, the general research goals for the three Hubs during the competition phase are the following:

- *Fuels from Sunlight*. Develop an effective solar energy to chemical fuel conversion system. The system should operate at an overall efficiency and produce fuel of

sufficient energy content to enable transition from bench-top discovery to proof-of-concept prototyping.

- *Energy Efficient Building Systems Design.* Develop systems-based approaches to designing, building, and operating commercial and residential buildings by pursuing a research, development, and demonstration program that addresses two areas: (1) systems integration of energy technologies in buildings; and (2) economic, policy and behavioral factors influencing building energy consumption. The Hub will develop and demonstrate practical, replicable strategies for reducing overall energy consumption in buildings. This Hub will be part of a multi-agency Energy Regional Innovation Cluster (E-RIC) initiative that will spur regional economic growth while developing innovative energy efficient building technologies, designs, and systems. More information on E-RIC is available on the Hubs web site (<http://www.energy.gov/hubs/eric.htm>).
- *Modeling and Simulation for Nuclear Reactors.* Produce a multi-physics computational environment to conduct predictive calculations of the performance of commercial nuclear reactors for both normal and off-normal conditions. Create a “virtual model” that allows engineers and a range of other practitioners to address important issues about the operations and safety of the physical reactor, such as power uprates and life extensions.

5. STAFF HIRING AT THE DEPARTMENT

Question: How does the Office of Chief Human Capital Officer explain the vast difference in NAPA's estimate and the Department's estimate for the average time to hire a headquarters employee? Are these two numbers calculated differently – in other words, are we comparing apples and oranges?

Answer: The two numbers are different. The 43 days reported by DOE you reference in your question was measured against the 45-day hiring model defined by OPM. The 45-day model measured the workdays between the time a vacancy announcement closed and a job offer was made. DOE met this measure. The 113 days was actually a goal set by DOE several years ago and communicated to NAPA which measured the calendar days from the time a job fill request was received by our human resources offices and the time a job offer was made. We are no longer using either of these measures.

Question: If you believe the Department's hiring practices have in fact improved so greatly as to reduce the average time to hire from 113 days to 43 days, then what specifically has the Office of the Chief Human Capital Officer done to so vastly improve its track record? The Department has indicated that using automated systems, presumably database systems and other information technology tools, have contributed to these improvements-but has moving from paper to computers been solely responsible for so vastly improving the Department's track record for hiring through its headquarters office?

Answer: We have been diligently and aggressively working with OPM through their Hiring Reform initiative and other internal initiatives to improve our hiring process. We have set an aggressive goal of 100 calendar days measured from the time a job fill request is initiated and the time a new employee is actually on board. These are some of the improvements we are in the process of implementing. We are streamlining job opportunity announcements to make them more concise and understandable to applicants. We improved the communications process so that job applicants are kept up to date on their status. We are standardizing high volume and critical position descriptions to accelerate classification review within the hiring process. We are promoting more efficient and effective interview and selection practices for hiring managers. We are also implementing an automated tracking system to provide more timely measures of key phases of the hiring process at human resources offices throughout DOE. These initiatives and others have my strong support.

Question: This Committee's fiscal year 2010 appropriations report directed the Department to contract with an expert independent entity to explore alternative service delivery models for recruiting, hiring and development of the Department's workforce. Some other federal agencies have used external or shared hiring offices with great success, and it seems natural for the Department to consider this as an option since its hiring capabilities have trailed those of most other federal agencies. What is the status of this effort?

Answer: The Committee's appropriation report strongly encouraged the Department to explore alternative organizational requirements. DOE is exploring several pilots in order to

improve its performance. For example, one Program Office is currently using another agency's human resources office to conduct their hiring on a trial basis. DOE is also conducting a pilot in which a select number of major Program Offices at Headquarters are using their field human resources offices for the recruitment and hiring of new employees. Upon completion of these pilot efforts, DOE will assess their effectiveness and efficiency. These pilots are being conducted in addition to the extensive internal hiring reform efforts previously mentioned.

6. MANAGING ACROSS SILOS

Question: The Department of Energy has received frequent and longstanding criticism that “stovepipes” have developed across the agency that create a firewall between activities in the different offices. These independent “silos”, such as the Office of Science and the applied research and development offices, historically have not communicated well with each other, have not coordinated their activities, and have acted territorially in ways that prevent collaboration or programs that bridge the gaps between energy technologies or between basic and applied research. It is one thing for Department leadership to meet regularly to discuss issues that cross program offices, and it is another thing to transform the decades-old stovepipe culture of territorial infighting into one of cross-office collaboration that advances energy innovation. What management practices have you put in place among your leadership team to break down these longstanding stovepipes, and how are you doing the hard work of changing the culture of the basic and applied offices to more effectively and collaboratively accomplish the agency’s goals?

Answer: Historically, silos at DOE have been a significant issue; so I continue to focus on better integrating the creativity and work of the Department’s various parts so that we can meet our country’s most pressing energy challenges in more effective and timely ways. The goal is to foster curiosity and collaboration, not internal competition.

One important effort in this direction has been our appointment of an Under Secretary for Science as well as a separate Director of the Office of Science, as envisioned in the Energy Policy Act of 2005. This allows the Under Secretary for Science to concentrate on being the chief research officer for the Department with a focus on reviewing and advising as to what is needed at all levels of research, from basic to applied, to demonstration and technology transfer. Under Secretary for Science Steven Koonin is now leading the development of several collaborative efforts that tie together the basic science, energy technology, and national security elements of the Department. The President’s FY 2011 budget for the Office of Science requests funds for three crosscutting efforts: combustion simulation, climate modeling, and development of the next generation of extreme scale computing. Under Secretary Koonin is directing working groups on such crosscutting issues as energy storage, modeling and simulation for energy systems, radiation resistant materials, and inertial fusion energy in civilian applications. These efforts involve both program leadership and technical personnel, and ensure an easier, more continuous flow of relevant knowledge and data among traditionally separate DOE offices and programs. Additionally, we are also establishing Energy Innovation Hubs—large, multi-disciplinary, highly-collaborative teams of scientists and engineers working over a longer timeframe to achieve a specific high-priority goal. We ask for a Hub when we see a problem ripe for the close integration of discovery-oriented science with translational engineering research, allowing us to quickly seize commercialization opportunities. The Funding Opportunity Announcements for the initial three Hubs—Nuclear Energy Modeling and Simulation, Fuels from Sunlight, and Efficient Buildings—were developed by a single group of program managers drawn from multiple DOE programs. This Hubs Working Group is also expected to play a key role in the Hubs’ peer review processes and performance reviews.

7. WAIVERS FOR COST SHARE REQUIREMENTS

Question: Mr. Secretary, the law requires that recipients of Department of Energy grants for research and development, demonstration, and some other purposes share of a portion of the total project cost. The federal statute mandating this cost share was intended to stretch federal funding as far as possible by leveraging non-federal dollars, but may also at times prevent recipients, such as universities, from participating in federal grants if they cannot meet the cost-share requirements.

In your time at the Department of Energy, in what specific instances have you granted cost share waivers or modifications?

Answer: There have been four such waivers granted during my tenure.

On March 17, 2009, I granted a waiver that reduced the cost share for all non-Federal recipients of Energy Efficiency and Renewable Energy Recovery Act funds. For newly-initiated research and development activities of an applied nature, I reduced the non-Federal cost share requirement from 20 percent to not less than 10 percent of the total project costs, except for Indian tribes or Tribal Energy Resource Groups, for whom the cost share requirement is waived. For newly-initiated demonstration and commercial application activities, I reduced the non-Federal cost share requirement from 50 percent to not less than 25 percent of the total project costs for private industry recipients and not less than 10 percent of the total project costs for academic institutions, non-profit organizations, Indian tribes or Tribal Energy Resource Development Organizations, and state and local governments. I granted the waiver because I determined that the cost share requirements would place an undue burden on recipients and would likely delay implementation of ARRA and delay job growth. I also determined that, notwithstanding the provisions of the delegation to the Assistant Secretary for Energy Efficiency and Renewable Energy, that Assistant Secretary may, if determined to be necessary and appropriate, set the non-federal cost share for particular programs which are subject to a determination at a rate higher than the limits I set in this waiver.

On December 10, 2009, the Under Secretary of Science granted a waiver that reduced the cost share for 3 Energy Innovation Hubs. He granted that waiver because he determined that the extraordinary span of a Hub across basic and applied research and development and technology development and deployment and the desire to have the Hubs interact closely with industry to transfer energy technology required an adjustment in the cost share to expedite implementation of the 3 Hubs in FY 2010.

The Under Secretary of Energy was delegated the authority to make such a waiver under Department of Energy Delegation No. 00-002.00I, subparagraph 1.22, dated November 10, 2009, and to the Under Secretary for Science under Delegation No. 00-006.00A, subparagraph 1.9, dated October 24, 2007.

I granted the third waiver that reduced cost sharing for Universities from 20% to 10% for the second round of financial assistance agreements under the ARPA-E program. I approved the waiver on December 4, 2009, because of the impact of the on-going economic recession on

Universities due to reduced public funding and charitable contributions that results in Universities having difficulty meeting the 20% requirement. Reducing the requirement to 10% fulfills the goal of having a financial stake in the projects that DOE funds through the ARPA-E program. I believe that the reduced requirement improved the number of proposals from such institutions.

I granted a fourth waiver that extended the rationale used for the third waiver to the third round of financial assistance agreements under the ARPA-E program. I approved that waiver on March 21, 2010.

Question: In each of these cases, what specifically justified waiving this statutorily required cost share?

Answer: The rationale for each waiver has been detailed in the answer to the question above.

8. USE OF "OTHER TRANSACTION" AUTHORITY

Question: ARPA-E has indicated that it used "other transaction" authority when negotiating three contracts in its first round of Recovery Act grants – which means it gave up intellectual property rights in ways not usually permitted when negotiation federal grant contracts.

Have any other Department of Energy programs used the "other transaction" authority? If so, please provided the specific programs and instance in which the authority was exercised.

Answer: One other Department of Energy program, the Office of Energy Efficiency and Renewable Energy, has used the "other transaction" authority to make two awards, termed "technology investment agreements" or "TIAs" under DOE regulations. These awards were for design, construction, building and operation of integrated biorefineries. The awards were made to Range Fuels Soperton Plant, LLC and POET Project Liberty, LLC.

The Range Fuels award provides funding to help facilitate the design, construction, and operation of a commercial scale biorefinery for production of ethanol and other products from a minimum of 700 dry metric tonnes per day [772 dry tons per day ("DTPD")] of lignocellulosic feedstocks. This funding is intended to partially reimburse the initial construction costs with this first-of-its-kind integrated biorefinery and enable the development of a biofuels industry. This purpose is consistent with Section 932 of the Energy Policy Act of 2005. DOE is providing \$76 million dollars of a total budget of \$355,954,968 for this project which began in October 2007 and runs through September 2012.

The POET award provides funding for final design, construction, equipment, start-up, commissioning, and operational reporting of a plant capable of processing a minimum of 700 Dry Metric Tonnes per day of lignocellulose to produce ethanol product, that is integrated with POET's existing corn-based ethanol plant located near Emmetsburg, Iowa and for POET to use the operational data from the plant to make a commercially-reasonable decision (in POET's sole discretion) whether it will replicate the core technology used in the processing of the lignocellulose. This purpose is consistent with Section 932 of the Energy Policy Act of 2005. DOE is providing \$76,236,713 towards a total budget of \$193,836,713 for a project that started in October 2008 and end in September 2014.

Question: In each of these instances, what justified this deviation from standard federal requirements for grant contracts?

Answer: Under the Range Fuels and POET awards, a commercial entity will participate with DOE in a design-build of a first-of-its-kind facility and the commercialization of a new U.S. industry. DOE will be able to act much like an equity partner, along with the other financial institutions, to fund the construction of this Project. This arrangement would not normally be available through a contract, grant, or traditional cooperative agreement with DOE because it allows flexibility in establishing creative disbursement techniques that, in turn, allow the Recipient to leverage DOE's involvement to attract other equity and debt partners. Such provisions are very attractive for a Recipient in a newly developing industry that has difficulty

attracting traditional financing. The use of tailored intellectual property terms in the TIA provides the technology rights holders' greater incentive to replicate the technology. Due to this incentive, the development of this commercially replicable technology will be significantly accelerated. To effectuate the goal of supporting commercially replicable technology, DOE obtained legally enforceable rights to assure that, if an additional biorefinery would not be built by the awardee at private expense, DOE could require the awardee to license its enabling technology at a reasonable royalty to someone else willing to build a second biorefinery. Such a provision would not normally be included in a DOE award.

9. CONTRACTS AND CONTRACTOR PERFORMANCE

Question: The Government Accountability Office continues to monitor the Department's project management. Most recently, in January 2010, it found that the cost-estimating practices were so underdeveloped it made it difficult to oversee the development of contractor cost-estimates. Contracts must be made in the most transparent way possible and in a manner that minimizes the prospects of waste, fraud, and abuse. What actions has the Department taken in the last year to improve contracting and contractor performance?

Answer: The Department has undertaken several reforms that are being implemented under the Root Cause Analysis/Corrective Action Plan (RCA/CAP) to improve contracting and contractor performance. Specific actions undertaken (starting Fall 2007 and continuing into the future) as part of the RCA/CAP include:

Improved project front-end planning and requirements definition by the Department utilizing industry best practices – the Construction Industry Institute's Project Rating Definition Index (PDRI) and Technology Readiness Assessments (TRA). This will help ensure contractual requirements are adequate and improves cost estimates and contractor accountability. This also enables a shift to awarding more firm fixed-price contracts.

Segmenting large projects into smaller, more manageable, complete, and useable projects. This will help improve monitoring of contractor performance and ensure contracts and projects are manageable and properly executed.

Provided a Departmental staffing model and guidance to Government Federal Project Directors to influence their project staffing level by functional areas (e.g., construction oversight and management). This will help ensure projects have adequate resources to perform project and contract management and oversight.

Improved independent government cost estimates through the establishment of the Office of Cost Analysis and, with the Office of Engineering and Construction Management, conducting independent cost estimates and reviews of projects.

Improved project oversight and management by procuring, improving, and piloting the Project Assessment and Reporting System (PARS II) in which the contractor's project data is directly uploaded into the Departmental system. This will provide timely, accurate, consistent, and auditable project information.

Instituting more rigorous change control and risk management processes to mitigate cost growth.

Improved integration of contract and project management functions in the acquisition planning process. This will help ensure that contractor accountability is built into the contract terms and conditions and enforcement mechanisms are in place.

Expanded use of project peer reviews modeled on those in the Office of Science, whose successful project performance has been recognized by GAO resulting in their being removed from the GAO High Risk List.

Improving knowledge management including piloting a lessons learned system to collect and disseminate information and knowledge from past work for continuous improvement.

10. CONTRACTS AND CONTRACTOR PERFORMANCE

Question: Does the Department have a corporate method of sharing contractor performance information, to ensure that recent performance is incorporated into the evaluation process when contracts are being awarded?

Answer: Yes, past performance is a meaningful source selection factor DOE considers in the award of negotiated acquisitions. DOE collects past performance information centrally using the Federal-wide suite of applications under the Integrated Acquisition Environment. DOE ensures its past performance information, which is reported electronically through its Contractor Performance Assessment Reporting System to the Past Performance Information Retrieval System, is accurate by its systems of internal procedures and control. These controls include DOE's Procurement Management Review, Balanced Scorecard Self Assessment, and Data Quality Review programs.

Fiscal Year 2008 Contracts

CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000015	CONTINENTAL, INC.	08/15/2008	08/20/2008	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$212.76	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 - FUNDING TO COVER REMAINING BALANCE DUE ON INVOICE DEDUCTIBLE FROM THROUGH AUGUST 15, 2008
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000015	SPARKS PERSONNEL SERVICES, INC.	06/20/2009	07/15/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$298.42	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES PAYMENT (SC-3) (SPARKS PERSONNEL SERVICES, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000016	SPARKS PERSONNEL SERVICES, INC.	07/24/2009	07/24/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$24,182.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES AS THE BUYER
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000017	SPARKS PERSONNEL SERVICES, INC.	07/27/2009	07/27/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$1,200.97	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (SPARKS PERSONNEL SERVICES, INC.) - ALSO COVERS TWO PRIOR INVOICES
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000019	SPARKS PERSONNEL SERVICES, INC.	08/02/2009	08/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$15,264.82	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES AS THE BUYER
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000020	SPARKS PERSONNEL SERVICES, INC.	08/02/2009	08/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$1,044.52	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES PAYMENT FOR SC-3 (SPARKS PERSONNEL SERVICES, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000021	SPARKS PERSONNEL SERVICES, INC.	08/02/2009	08/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$18,922.84	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (SPARKS PERSONNEL SERVICES, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000022	SPARKS PERSONNEL SERVICES, INC.	08/02/2009	08/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$6,424.80	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (SPARKS PERSONNEL SERVICES, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000024	ME-SHAREDOLUTION, INC.	08/20/2009	08/20/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$15,000.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (ME-SHAREDOLUTION, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000025	P.E. CONSULTANTS, LLC	08/20/2009	08/20/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$12,250.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (P.E. CONSULTANTS, LLC)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000026	P.E. CONSULTANTS, LLC	09/02/2009	09/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$0.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (P.E. CONSULTANTS, LLC)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000027	THOMAS ELECTRONICS NORTH AMERICA, LLC	09/25/2009	09/25/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$92,000.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (THOMAS ELECTRONICS NORTH AMERICA, LLC)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000028	ADVANCED TECHNOLOGICAL SERVICES, INC.	07/15/2010	07/15/2010	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$12,784.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (ADVANCED TECHNOLOGICAL SERVICES, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000029	CAMERA NOUTREA, INC.	08/04/2009	08/04/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$11,480.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (CAMERA NOUTREA, INC.)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000030	ANT'L'S, SUSHAM	07/02/2009	07/02/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$12,784.00	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (ANT'L'S, SUSHAM)
CHICAGO SERVICE CENTER OFFICE OF SCIENCE	DEES000032	SPECTRA LOGIC CORPORATION	07/29/2009	07/29/2009	FIRM FIXED PRICE	PURCHASE ORDER	NOT COMPLETED	NO SET ASIDE USED	ONLY ONE SOURCE - OTHER	\$5,108.91	REVISION: DELEGATION OF TEMPORARY ADMINISTRATIVE SUPPORT SERVICES FOR SC-3 (SPECTRA LOGIC CORPORATION)

Fiscal Year 2008 Contracts

Contract Number	Contract Description	Quantity	Unit Price	Total Price	Contract Type	Contract Status	Contract Source	Contract Notes
0000000001	LAKEWOOD HOTEL							
0000000002	LAKEWOOD HOTEL							
0000000003	LAKEWOOD HOTEL							
0000000004	LAKEWOOD HOTEL							
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0000000100	LAKEWOOD HOTEL							

Fiscal Year 2008 Contracts

CONTRACT ID	ISSUE DATE	ISSUE PRICE	STATUS	USE	AMOUNT	DESCRIPTION
DEE0000004	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES INTERNATIONAL BANK OF CHICAGO, ILL. THE TRUSTEE BANK PROVIDES WRITTEN AND ORAL COMMUNICATIONS WITH NOTIFICATIONS TO AMITY INSTITUTIONS OF THE CERTIFICATES OF AUCION BATES AND INTEREST AMOUNT DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER. THE TRUSTEE BANK PROVIDES WRITTEN AND ORAL COMMUNICATIONS WITH NOTIFICATIONS TO AMITY INSTITUTIONS OF THE CERTIFICATES OF AUCION BATES AND INTEREST AMOUNT DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000005	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES CARTER STATE BANK ALL PARTICIPATING AMITY FINANCIAL INSTITUTIONS, INCLUDING WRITTEN REPORTS ISSUE DATES, MATURITY DATES, SIX MONTH TREASURY BILL REPORTS AND INTEREST AMOUNTS DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000001	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES FIRST INDEPENDENCE FIDELITY INVESTMENTS THE TRUSTEE BANK PROVIDES WRITTEN AND ORAL COMMUNICATIONS WITH NOTIFICATIONS TO AMITY INSTITUTIONS OF THE CERTIFICATES OF AUCION BATES AND INTEREST AMOUNT DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000002	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES INDUP FINL BANK NATIONAL ASSOCIATION ALL PARTICIPATING AMITY FINANCIAL INSTITUTIONS, INCLUDING WRITTEN REPORTS ISSUE DATES, MATURITY DATES, SIX MONTH TREASURY BILL REPORTS AND INTEREST AMOUNTS DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000003	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES CITIZENS BANKS BANK & TRUST CO. THE TRUSTEE BANK PROVIDES WRITTEN AND ORAL COMMUNICATIONS WITH NOTIFICATIONS TO AMITY INSTITUTIONS OF THE CERTIFICATES OF AUCION BATES AND INTEREST AMOUNT DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000004	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES GATWAY BANK OF ST LOUIS ALL PARTICIPATING AMITY FINANCIAL INSTITUTIONS, INCLUDING WRITTEN REPORTS ISSUE DATES, MATURITY DATES, SIX MONTH TREASURY BILL REPORTS AND INTEREST AMOUNTS DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000005	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES EASTMAN, N.Y. THE TRUSTEE BANK PROVIDES WRITTEN AND ORAL COMMUNICATIONS WITH NOTIFICATIONS TO AMITY INSTITUTIONS OF THE CERTIFICATES OF AUCION BATES AND INTEREST AMOUNT DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.
DEE0000006	09/12/07	100.0000	NOT COMPLETED	NO SET ASIDE USED	\$1,500.00	HEADQUARTERS PROCUREMENT SERVICES FIRST STATE BANK ALL PARTICIPATING AMITY FINANCIAL INSTITUTIONS, INCLUDING WRITTEN REPORTS ISSUE DATES, MATURITY DATES, SIX MONTH TREASURY BILL REPORTS AND INTEREST AMOUNTS DUE A MATURITY. ADDITIONALLY, THE REPORTS CONTAIN COMPLETE LISTINGS OF AMOUNTS DEPOSITED WITH EACH FINANCIAL INSTITUTION AS WELL AS STATEMENTS OF RECEIPT AND DISBURSEMENTS DURING EACH QUARTER.

Fiscal Year 2008 Contracts

CONTRACT NUMBER	BUYER	DATE	PRICE	STATUS	DESCRIPTION	AMOUNT	REVISION
DEE0000043	SPAWNS PERSONNEL SERVICES, INC.	04/02/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$411.52	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000073	SPAWNS PERSONNEL SERVICES, INC.	04/02/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$2.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000073	SPAWNS PERSONNEL SERVICES, INC.	04/02/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$8,876.20	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000073	SPAWNS PERSONNEL SERVICES, INC.	04/02/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$1,199.45	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000095	CONTIMPORES, INC.	11/18/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$24,100.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000096	CONTIMPORES, INC.	11/18/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$18,832.28	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000123	CONV GOVERNMENT INC.	06/04/09	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$5,250.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000124	CONV GOVERNMENT INC.	06/04/09	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$3,028.24	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000125	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$9,771.60	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000126	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$89.31	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000127	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$1,200.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000128	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$28,800.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000129	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$15,736.40	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE
DEE0000130	CONV GOVERNMENT INC.	07/24/08	FIRM FIXED PRICE	NOT COMPLETED	NO SET ASIDE USED	\$11,960.00	REVISION: DELEGATION AND CHANGE OF COMPLETION DATE

Fiscal Year 2009 Contracts

NEVADA SITE OFFICE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$0.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.
STOLLER/MANWARO JOHN VENTURE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$0.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.
STOLLER/MANWARO JOHN VENTURE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$0.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.
STOLLER/MANWARO JOHN VENTURE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$1,000,000.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.
STOLLER/MANWARO JOHN VENTURE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$0.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.
STOLLER/MANWARO JOHN VENTURE	DEACONS09M005	02/01/2009	02/01/2009	COST PLUS AWARD FEE	DEFINITIVE CONTRACT	NOT COMPLETED	ONLY ONE SOURCE - OTHER	\$0.00	ASSESSMENT, CHARACTERIZATION AND STREAMLINED APPROACH FOR ENVIRONMENTAL RESTORATION UNDER ENVIRONMENTAL SERVICES WILL BE PROVIDED IN ACCORDANCE WITH THE FEDERAL FACILITY AGREEMENT AND THE DEPARTMENT OF DEFENSE NUCLEAR AGENCY FROM THE DEFENSE THREAT REDUCTION AGENCY. IN ADDITION, THE REQUIRED ENVIRONMENTAL SERVICES MUST BE PERFORMED IN COMPLIANCE WITH THE RESOURCE CONSERVATION AND RECOVERY ACT (RCRA), APPROPRIATE STATE NATIONAL ENVIRONMENTAL POLICY ACT (NEPA), APPROPRIATE STATE REGULATIONS, OCCUPATIONAL SAFETY AND HEALTH ACT AND DOE ORDERS AND REGULATIONS.

Contract #	Contract Name	Contract Description	Contract Type	Contract Status	Contract Value	Contract Start Date	Contract End Date	Contract Location	Contract Notes
DE000045	GOB SOFTWARE INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$4,950.00	08/22/19			FRM FSD PRCE
DE000046	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$14,540.45	08/19/19			FRM FSD PRCE
DE000047	FRONTWAVE	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$7,911.40	09/20/19			FRM FSD PRCE
DE000048	TEBC SOFTWARE INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$8,200.00	08/20/19			FRM FSD PRCE
DE000049	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$14,877.00	08/20/19			FRM FSD PRCE
DE000050	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$10,378.90	08/27/19			FRM FSD PRCE
DE000051	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$4,111.40	08/27/19			FRM FSD PRCE
DE000052	ATX MARKETING LLC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$24,000.00	12/17/19			FRM FSD PRCE
DE000053	ATX MARKETING LLC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$12,000.00	12/17/19			FRM FSD PRCE
DE000054	CONNECTION INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$3,018.90	08/29/19			FRM FSD PRCE
DE000055	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$12,344.35	08/14/19			FRM FSD PRCE
DE000056	CONNECTION INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$52,246.67	08/29/19			FRM FSD PRCE
DE000057	CONNECTION INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$5,000.00	08/29/19			FRM FSD PRCE
DE000058	CONNECTION INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$14,877.90	08/29/19			FRM FSD PRCE
DE000059	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$3,666.40	08/29/19			FRM FSD PRCE
DE000060	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$4,111.40	08/29/19			FRM FSD PRCE
DE000061	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$5,666.80	08/29/19			FRM FSD PRCE
DE000062	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$11,800.00	08/29/19			FRM FSD PRCE
DE000063	CONNECTION INC	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$21,122.87	08/29/19			FRM FSD PRCE
DE000064	BELL MARKETING LP	FRM FSD PRCE	PURCHASE ORDER	NOT COMPLETED UNDER	\$1,719.90	08/29/19			FRM FSD PRCE

Contract Number	Contract Title	Contract Description	Contract Type	Contract Status	Contract Value	Contract Location
DEF-2008-00078	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$1,100.00	SECURITY ADMIN SVCS
DEF-2008-00079	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$2,054.09	SECURITY ADMIN SVCS
DEF-2008-00080	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$1,695.37	SECURITY ADMIN SVCS
DEF-2008-00081	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$14,962.00	SECURITY ADMIN SVCS
DEF-2008-00082	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$4,462.00	SECURITY ADMIN SVCS
DEF-2008-00083	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,702.24	SECURITY ADMIN SVCS
DEF-2008-00084	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,862.00	SECURITY ADMIN SVCS
DEF-2008-00085	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,862.37	SECURITY ADMIN SVCS
DEF-2008-00086	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$17,729.95	SECURITY ADMIN SVCS
DEF-2008-00087	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,577.65	SECURITY ADMIN SVCS
DEF-2008-00088	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,344.41	SECURITY ADMIN SVCS
DEF-2008-00089	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$24,721.45	SECURITY ADMIN SVCS
DEF-2008-00090	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$8,072.14	SECURITY ADMIN SVCS
DEF-2008-00091	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$4,198.00	SECURITY ADMIN SVCS
DEF-2008-00092	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,298.28	SECURITY ADMIN SVCS
DEF-2008-00093	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$24,402.00	SECURITY ADMIN SVCS
DEF-2008-00094	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$8,170.00	SECURITY ADMIN SVCS
DEF-2008-00095	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,000.00	SECURITY ADMIN SVCS
DEF-2008-00096	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$14,433.00	SECURITY ADMIN SVCS
DEF-2008-00097	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$13,178.31	SECURITY ADMIN SVCS
DEF-2008-00098	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,000.00	SECURITY ADMIN SVCS
DEF-2008-00099	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$7,402.00	SECURITY ADMIN SVCS
DEF-2008-00100	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$3,000.00	SECURITY ADMIN SVCS
DEF-2008-00101	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$16,831.50	SECURITY ADMIN SVCS
DEF-2008-00102	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$8,842.00	SECURITY ADMIN SVCS
DEF-2008-00103	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$14,729.00	SECURITY ADMIN SVCS
DEF-2008-00104	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	SECURITY ADMIN SVCS	\$23,944.10	SECURITY ADMIN SVCS

Contract Number	Contract Title	Contract Type	Contract Status	Contract Value	Contract Start Date	Contract End Date	Contract Description	Contract Location	Contract Agency	Contract Officer	Contract Award Date	Contract Modification Number	Contract Modification Description	Contract Modification Value	Contract Modification Date	Contract Modification Description	Contract Modification Value	Contract Modification Date	Contract Modification Description	Contract Modification Value
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$1,450.00	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$4,296.84	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$4,172.58	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$808.67	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$28,500.83	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NON-COMPETITIVE	\$24,650.00	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NON-COMPETITIVE	\$37,000.00	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NON-COMPETITIVE	\$37,000.00	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NON-COMPETITIVE	\$37,000.00	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									
HEADQUARTERS PROCUREMENT SERVICES	HEADQUARTERS PROCUREMENT SERVICES	SOLE SOURCE	NOT AVAILABLE FOR COMPETITION	\$4,772.48	09/20/10	09/20/10	WORK TO BE DONE BY SOLUTIONS UNDER CONTRACT	WASHINGTON, DC	SOLUTIONS	STATUTE	09/20/10									

Procurement	Item	Quantity	Unit	Unit Price	Total Price	Competition	Order Type	Order Number	Order Date	Order Description	Order Status	Order Value	Notes
HEADQUARTERS PROCUREMENT SERVICES	DECT000134	1	SOLUTIONS			NOT AVAILABLE FOR COMPETITION	DELIVERY ORDER		04/12/2010	04/12/2010	FORM FASD PRICE	\$70,303.05	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
	DECT000134	1	SOLUTIONS			NOT AVAILABLE FOR COMPETITION	DELIVERY ORDER		04/02/2010	04/02/2010	FORM FASD PRICE	\$40.00	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
	DECT000131	1	CONTRACTING INC			NON-COMPETITIVE DELIVERY ORDER	DELIVERY ORDER		04/02/2010	04/02/2010	FORM FASD PRICE	\$31,662.38	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
HEADQUARTERS PROCUREMENT SERVICES	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$11,483.30	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$11,483.30	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
HEADQUARTERS PROCUREMENT SERVICES	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$13,314.41	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$13,314.41	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
HEADQUARTERS PROCUREMENT SERVICES	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$13,314.41	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>
	DECT000132	1	TOTAL CONTRACTING INC			NOT COMPLETED	DELIVERY ORDER		03/26/2010	03/26/2010	FORM FASD PRICE	\$13,314.41	<p>FOR THE PURPOSE OF THIS MODIFICATION TO ADD TELEPHONE AND ELECTRIC INSTALLATION IN ACCORDANCE WITH THE TERMS AND CONDITIONS OF WORK ATTACHMENT 2) AND DRAWING ATTACHMENT 3) ALL OTHER TERMS AND CONDITIONS REMAIN UNCHANGED.</p> <p>ALL WORK MUST BE IN ACCORDANCE WITH THE TERMS AND CONDITIONS UNDER SOLUTIONS CONTRACT DE-MA000200.</p> <p>TAB 88 400 TAB</p>

Fiscal Year 2010 Contracts

Contract ID	Contract Description	Contract Dates	Contract Type	Contract Status	Contract Price	Contract Location
DEEM000294	THE WARNER ENTERTAINMENT COMPANY	11/04/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000295	PRINHAMBI & ASSOCIATES	10/22/09 - 10/22/09	PURCHASE ORDER	NOT COMPLETED	\$9,437.00	NO SET ASIDE USED
DEEM000296	PRINHAMBI & ASSOCIATES	10/22/09 - 04/05/10	PURCHASE ORDER	NOT COMPLETED	\$4,092.00	NO SET ASIDE USED
DEEM000297	HUNT BUILDERS CORPORATION	10/01/09 - 10/06/09	PURCHASE ORDER	NOT COMPLETED	\$3,713.00	NO SET ASIDE USED
DEEM000298	ORACLE USA, INC	12/01/09 - 12/01/09	PURCHASE ORDER	NOT COMPLETED	\$7,863.00	NO SET ASIDE USED
DEEM000299	DOLLA & ASSOCIATES, INC	12/02/09 - 12/02/09	PURCHASE ORDER	NOT COMPLETED	\$14,592.00	NO SET ASIDE USED
DEEM000300	CINCINNATI BELL TELEPHONE COMPANY	09/02/09 - 02/05/11	PURCHASE ORDER	NOT COMPLETED	\$4,000.00	NO SET ASIDE USED
DEEM000301	CINCINNATI BELL TELEPHONE COMPANY	09/02/09 - 02/07/11	PURCHASE ORDER	NOT COMPLETED	\$1,200.00	NO SET ASIDE USED
DEEM000302	UNITED STATES GOVERNMENT PRINTING OFFICE	09/04/09 - 09/04/09	PURCHASE ORDER	NOT COMPLETED	\$4,313.00	NO SET ASIDE USED
DEEM000303	Summy Manning Co. Inc.	09/05/09 - 09/05/09	PURCHASE ORDER	NOT COMPLETED	\$3,600.00	NO SET ASIDE USED
DEEM000304	HERMAN MILLER, INC	09/24/09 - 09/24/09	PURCHASE ORDER	NOT COMPLETED	\$5,274.54	NO SET ASIDE USED
DEEM000305	HERMAN MILLER, INC	09/25/09 - 09/25/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000306	USA FEDERAL ASSOCIATION SERVICES CO	09/22/09 - 09/15/09	PURCHASE ORDER	NOT COMPLETED	\$9,200.00	NO SET ASIDE USED
DEEM000307	STANDARD BANKING CORPORATION	03/01/09 - 06/02/09	PURCHASE ORDER	NOT COMPLETED	\$4,490.00	NO SET ASIDE USED
DEEM000308	INTECH SOLUTIONS FEDERAL INC	01/01/09 - 01/05/09	PURCHASE ORDER	NOT COMPLETED	\$300,000.00	NO SET ASIDE USED
DEEM000309	AT CONSULTING INCORPORATED	09/09/09 - 09/09/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000310	CALIFORNIA INSTITUTE OF TECHNOLOGY	09/01/09 - 09/01/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000311	CALIFORNIA INSTITUTE OF TECHNOLOGY	09/09/09 - 09/09/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000312	CONRAHL CONSULTANTS INC	09/02/09 - 09/02/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000313	CONRAHL CONSULTANTS INC	09/05/09 - 09/05/09	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000314	SHEPHERD ASSOCIATES	11/02/09 - 03/10/10	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000315	SHEPHERD ASSOCIATES	12/02/09 - 03/10/10	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000316	SHEPHERD ASSOCIATES	01/12/10 - 04/05/10	PURCHASE ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED
DEEM000317	INNOVATIONS GROUP INCORPORATED	12/10/09 - 09/30/10	DELIVERY ORDER	NOT COMPLETED	\$0.00	NO SET ASIDE USED

Fiscal Year 2010 Contracts

RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	01/02/2010	09/05/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES FOR THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	03/02/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$2,275.24	PROVIDE ADMINISTRATIVE SUPPORT SERVICES FOR THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	12/01/2009	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,276.54	PROVIDE ADMINISTRATIVE SUPPORT SERVICES FOR THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	01/02/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES FOR THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	02/25/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$21,148.12	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	12/01/2009	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,276.54	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	01/02/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1489	WASSIS LIMITED LIABILITY COMPANY	02/25/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1487	WASSIS LIMITED LIABILITY COMPANY	02/25/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$1,225.38	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1487	WASSIS LIMITED LIABILITY COMPANY	01/02/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.
RICHLAND OPERATIONS OFFICE	DEAT0901N1487	WASSIS LIMITED LIABILITY COMPANY	01/02/2010	09/02/2010	TIME AND MATERIALS	DELIVERY ORDER	NOT AVAILABLE FOR COMPETITION	MA SOLE SOURCE	AUTHORIZED BY STATUTE	\$13,026.58	PROVIDE ADMINISTRATIVE SUPPORT SERVICES TO THE OPERATIONS OFFICE, RICHLAND, WASHINGTON, THROUGH JANUARY FISCAL YEAR 2010. THIS TASK ORDER TO BE INCREMENTALLY FUNDED THROUGH FISCAL YEAR 2010.

11. CONTRACTS AND CONTRACTOR PERFORMANCE

Question: Please provide, for the record, a list of all non-competitive contracts or cooperative agreements issued by the Department of Energy in fiscal year 2009 and to date in 2010, including the type of sole-source contract (Small Business set aside, etc), type of contract (fixed price, etc.), firm or individual, the dollar amount, and the purpose of the contract or cooperative agreement.

Answer: The requested data is attached. The list of cooperative agreements does not contain an explanation for the noncompetitive status because that data element is not collected on such awards in the federal-wide reporting system nor is it collected within DOE's internal systems.

12. DEPARTMENTAL MODELING AND SIMULTAION

Question: Modeling and simulation capabilities are spread throughout the Department's program offices to help solve a host of science and energy challenges. The Committee report last year expressed concerns that these capabilities are not adequately coordinated. Carbon sequestration, nuclear energy research, science, and other activities could all benefit from improved modeling and simulation efforts. What have you done to ensure the Department's modeling and simulation capabilities are coordinated and made available to all of the program offices?

Answer: DOE's high performance computing capabilities are led by the Office of Science's Advanced Scientific Computing Research (ASCR) and NNSA's Advanced Simulation and Computing (ASC) programs. Under ASC, computer simulation capabilities are developed to analyze and predict the performance, safety, and reliability of nuclear weapons and to certify their functionality. The primary mission of the ASCR program is to discover, develop, and deploy the computational and networking tools that enable researchers in the scientific and engineering disciplines to analyze, model, simulate, and predict complex phenomena important to the Department. Science maintains leadership computing capabilities at the Oak Ridge and Argonne Leadership Computing Facilities (LCFs), and capacity computing at the National Energy Research Scientific Computing Center (NERSC) at Lawrence Berkeley Laboratory. NNSA supports comparable world-class facilities at its three national laboratories; much of this work is classified.

Following the intent of Congress in the DOE High-End Computing Revitalization Act of 2004, the Office of Science's computational resources are made available to all researchers through the Innovation and Novel Computational Impact on Theory and Experiment (INCITE) program. INCITE projects address topics of interest to many parts of the Department. The latest round of 69 INCITE awards was made in January 2010. Two examples of energy applications from this group of awards are the award of 32 million processor hours to a senior researcher (Paul Fischer) at Argonne National Laboratory for advanced reactor thermal hydraulic modeling—a nuclear energy simulation project—and an award of 19 million hours to a group of researchers at General Electric working to overcome turbulence problems and develop designs for next-generation wind turbines, gas turbines, diesel/hybrid engines, and aircraft engines.

Last year, the Department established another allocation program, the ASCR Leadership Computing Challenge, that allocates up to 30 percent of the computational resources at NERSC and at the LCFs at Argonne and Oak Ridge for special situations of interest to the Department. These "situations of interest" include high-risk, high-payoff simulations in areas directly related to the Department's energy mission, simulations in support of responses to national emergencies, and opportunities to broaden the community of researchers capable of using leadership computing resources.

DOE's efforts in developing modeling and simulation relevant to nuclear energy comprise the Office of Nuclear Energy's Advanced Modeling and Simulation (NEAMS) activity and the Modeling and Simulation for Nuclear Reactors Energy Innovation Hub. NEAMS creates the modeling and simulation capabilities needed by the Office of Nuclear Energy's Reactor and Fuel

Cycle R&D programs. As such, it receives its support directly from those programs. These efforts will marry the Department's achievements in computation with experiments and test data in the energy sector. The Hub will utilize existing advanced modeling and simulation capabilities (e.g., computational fluid dynamics) that have been developed by the Office of Science, NNSA, and others to provide a predictive capability for life extension and power up-rate calculations while NEAMS will focus on developing new multi-physics computational capabilities for a variety of areas beyond the scope of the Hub that are applicable to nuclear energy research and development (e.g., advanced fuels, advanced and small modular reactors, waste forms, and repositories).

The Offices of Nuclear Energy and Science worked together closely on the Funding Opportunity Announcement for the Modeling and Simulation Hub. The opportunity to apply to this announcement closed on March 8, 2010; and during the week of April 19–23, 2010, members from the Office of Nuclear Energy, NNSA, and the external review panel will conduct site visits at the applicant sites to review the location of the location being proposed as the center of gravity for each of the applicant's research and development efforts. The site visits are one of the last steps in the merit review evaluation process and will directly contribute to recommendations from both the Federal and external review panels to the source selection official by early May.

Both NEAMS and the Modeling and Simulation Hub are coordinated with the NNSA and Office of Science ASCR activities. The NEAMS efforts heavily leverage the application codes and tools developed by these two other programs. Also, NEAMS has been awarded millions of hours of CPU time through the ASCR INCITE program. Once the Modeling and Simulation Hub has been selected and announced, it too will be coordinated with these other programs.

The predictive combustion simulation program is a second move along these lines. Our energy security and emissions goals require that automobile engines become much more efficient and handle a greater diversity of fuels. Major improvements are plausible, even before hybridization, but radical design innovation will be required, particularly to manage vehicle costs. NNSA and ASCR methods and experience can be applied fruitfully to understand and optimize engines, improve designs, and compress the design cycle. Creating these applications in partnership with industry and bringing them to commercial relevance can enhance American manufacturing capabilities and competitiveness while directly addressing energy problems.

Other longer-range but still highly attractive energy applications of advanced simulation methodology include fission reactors, carbon capture and storage (gasification and capture technologies), the electrical grid, and fluids underground (CO₂ behavior, contaminant fate and transport, enhanced oil recovery, and methane hydrate production).

The Office of Science is also using Recovery Act funds to expand computational resources useful to a broad spectrum of programs. The \$33 million Magellan research project will demonstrate and build tools to enable scientists to utilize cloud computing for mid-range computing research needs. Recovery Act funding of \$30 million has been used for Scientific Discovery through Advanced Computing-Energy (SciDAC-e) to supplement and leverage existing SciDAC investments to advance the high performance computational capabilities of the Basic Energy Sciences program's Energy Frontier Research Centers, to provide extra user

support for energy related projects at the Leadership Computing and NERSC facilities, and to start applied mathematics research in support of DOE electric grid efforts. The Department will continue to develop crosscutting computational capabilities and partnerships that leverage the advances and expertise of the ASC and ASCR programs.

13. BEST MANAGEMENT PRACTICES FROM LABORATORIES

Question: We understand you have solicited input from the Laboratory Directors on best practices that could strengthen the management and operations at the Department. What improvements have resulted from the Laboratory Director feedback?

Answer: The Department and its contractor community to include the National Laboratory Directors Council (NLDC) and Energy Facilities Contractors Group (EFCOG) have been actively working to fine tune project management processes and institute best practices that improve project performance. Our collective focus is toward delivering 90% of our projects at no more than a 10% over the original project budget. As a result, we are working with our contractor community to implement the following initiatives:

Incorporate best practices into our ongoing update of DOE Order 413.3A, *Program and Project Management for the Acquisition of Capital Assets*, scheduled for release this summer.

Improve earned value management system certification and surveillance review processes with assistance of the EFCOG's Project Management Working Group.

Improve the project management certification and qualification process for both contractor and government personnel focusing on competency and strong leadership skills.

Share lessons learned between project teams.

Institute a risk management process that is forward-looking, informative and continues through the project life cycle with baselines that reflect a high confidence level of success.

14. NEW DOE PENSION POLICY

Question: A portion of DOE's budget will be used to reimburse the costs of DOE contractor contributions to DB pension plans. Increased contributions began to be required for some of these pension plans in fiscal year 2009 as a result of the economic downturn. The Department has recently changed its former policy to require contractors to maintain an 80% funded status in these plans and now requires pension plans to be funded at a level equivalent to the minimum required by ERISA, or higher if necessary for a pension plan to have a funded status of at least 60%.

This subcommittee suggested this action last year and the Department resisted, what information does the Department now have that makes this policy workable in your opinion?

Answer: As a result of the challenges encountered last year, the Department undertook an extensive review of contractor defined benefit (DB) pension plans. Specifically, the Department executed a comprehensive data call across the contractor community and gathered in a centralized database the requisite detailed plan and participant information to estimate with confidence the revised reimbursement action's potential impact of benefit restrictions on plan participants. These restrictions would impact the timing of benefits paid (not the value).

Using the information from the comprehensive data call executed in late 2009, the Department estimated that benefit restrictions could impact potentially 0.1% of all plan participants (approximately 240 people) in FY10 under the revised reimbursement action. We worked closely with the Department of Labor as we reviewed the results of our analysis.

We recognize that these recent actions addressing the reimbursement of contractor DB pension costs may be questioned for their consistency with the full funding requirements of the Pension Protection Act; ultimately, however, we determined that this action was prudent and consistent with the Department's goals of achieving its mission objectives while meeting its contractual obligations to reimburse the costs of the contractors' DB pension plans. Exceptions to this reimbursement practice will be reviewed on a case-by-case basis. We will also review the long-term impact of the action and related practices regarding the application of cost accounting standards.

Question: What are the implications for the Department's budget and management?

Answer: The new reimbursement action requires the Department to reimburse contractors for the amounts required to fund their DB pension plans at a level equivalent to the minimum amount required by the Employment Retirement Income Security Act (ERISA) as amended by the Pension Protection Act (PPA), or higher if necessary for a contractor DB pension plan to have a funded status of at least 60 percent. Exceptions will be reviewed on a case-by-case basis.

We believe eliminating the requirement that every contractor employee DB pension plan be funded at the 80 percent level is consistent with the Department's goals of achieving its mission objectives. We will review the long-term impact of this action and consider adjustments as may be necessary.

Based on the information provided by the contractors during the annual pension management plan review for DB pension plans, the Department anticipates FY10 contributions of approximately \$650M. Although contractor contributions are appropriately an indirect cost and are not broken out as line items in the FY10 budget request, these contributions are covered by the FY10 budget.

For FY11, the Department currently estimates these contributions will be approximately \$1B, which is reflected in its FY11 budget request. Actual contributions may change, as they are highly sensitive to underlying data, methods, assumptions, and capital market performance.

Additionally, the Department has institutionalized an annual pension management plan review process for contractor DB pension plans with the specific objective of improving cost predictability and containing current and future costs. Each contractor is required to provide annual DB pension plan data and information to DOE for review in January of each year so that DOE and the contractor can engage in fact-finding and discussions concerning the contractor's management approach and plans for its contractor DB pension plans prior to the contractor's actuarial certification of the DB plan, as required under the PPA. In an effort to improve planning and budgeting accuracy, contractor representatives will discuss with DOE personnel, among other things, assumption elections, usage of credit balances, investment performance, and future year contribution estimates. Although actual contributions cannot be known prior to the start of the fiscal year, the Department has acquired modeling capabilities to estimate funding requirements and will work closely with the contractors to include accurate contribution estimates in future budget requests.

Question: Does the Department now have adequate information for all sites to make detailed determinations of the impacts of this policy?

Answer: Yes. The Department has gathered (and will update annually) the requisite detailed plan and participant information for all sites to assess, if a DB pension plan's funded status falls below 80%, the potential impacts of benefit restrictions on participants.

Question: What are the impacts of this policy to employees, by site?

Answer: This new reimbursement action is expected to impact only the Savannah River Site (SRS) in FY10 because the SRS multiple-employer DB pension plan is the only contractor DB pension plan subject to benefit restrictions that will not achieve a funded status at or above

80% in FY10. Based on information provided by the SRS DB pension plan sponsor in January 2010, the Department estimates that of the 18,000 participants in the SRS DB pension plan, less than 1% is expected to be affected in FY10 by benefit restrictions as a result of the funded status dropping below 80%. The average impact per person will be approximately \$191 per month deferred for later commencement. (The estimated cost to avoid these restrictions for these potentially affected participants exceeds \$1M per participant).

Employees who retire are given eight different payment options for their pensions. As a result of the changes, seven of those options remain the same. Only employees who decide to retire after February 28th of this year, and only those who elect the income leveling option (one of eight options available), would be affected. Employees electing the affected payment option will receive the same actuarial total lifetime benefit from the retirement plan as they would have otherwise received. The affected payment option will be restructured so that it pays out more evenly over time rather than frontloading pension benefit payments. A plan participant's choice of retirement payment option is entirely voluntary.

On June 25, 2010, the Preservation of Access to Care for Medicare Beneficiaries and Pension Relief Act of 2010 was signed into law. Among other things, the law exempts plans that offer the income leveling option from related benefit restrictions (if certain requirements are met). Once formal guidance is released, the Department will work with SRS to understand the impact on participants.

Question: How is the Department ensuring best practices are communicated across all sites?

Answer: The Department has worked closely with the contractor community – namely, the National Lab Directors Council (NLDC) and Lab CFOs – to gather feedback and share information on the management and oversight of contractor defined benefit (DB) pension plans, and will continue to do so in the future. At the annual DOE CFO Conference this May, the Department facilitated a workshop on contractor best practices, and will subsequently communicate and coordinate with the NLDC and Lab CFOs regarding any future developments and best practices.

Question: Please provide for the record, the current projected funding requirements by plan and the estimated cost savings of this policy change.

Answer: The projected funding requirements, prior to this action, are approximately \$850M in FY10 and \$1.2B in FY11. By deferring reimbursements due to this change, the Department currently estimates that this reduces FY10 and FY11 contributions by the contractors to DB pension plans by approximately \$400M over two years.

The current projected funding requirements by plan are based on information submitted by the contractors to the Department as part of the annual DB pension management plan review process. Projections of future DB pension plan contributions are highly sensitive to underlying data, methods, and assumptions. The actual actuarial valuations may yield different contribution levels.

#	Plan Name	FY10 Projected Contribution
1	Rocky Flats	\$ 91,000,000
2	Hanford Multi-Employer Pension Plan	\$ 81,131,229
3	LANS Defined Benefit Pension Plan	\$ 76,000,000
4	Sandia Corporation Retirement Income Plan	\$ 75,000,000
5	Idaho National Laboratory Employee Retirement Plan	\$ 54,900,000
6	Pension Plan of the Pacific Northwest Laboratories, Battelle Memorial Institute	\$ 52,000,000
7	Honeywell Retirement Earnings Plan For Aerospace Employees at the Kansas City Division	\$ 32,890,000
8	Savannah River Nuclear Solutions Multiple Employer Pension Plan	\$ 31,288,286
9	Retirement Plan for Employees of Certain Employers at the U.S. Department of Energy Facilities at Oak ridge, Tennessee-UTB	\$ 30,000,000
10	Salaried Employee Pension Plan for KAPL Employees and Retirees	\$ 21,000,000
11	B&W Pantex, Non Bargaining	\$ 18,047,356
12	National Security Technologies, LLC (NSTec) Employee Retirement Plan	\$ 15,947,316
13	The Kansas City Division (Honeywell International Inc.) Hourly Employees Pension Plan	\$ 13,200,000
14	Pension Plan for Eligible Bettis Employees and Retirees	\$ 12,300,000
15	National Renewable Energy Laboratory Retirement Plan	\$ 10,318,000
16	WSI Pension Plan for Employees at Oak Ridge, TN	\$ 6,000,000
17	B&W Pantex, Metal Trades Council	\$ 4,561,719

18	Bechtel Jacobs Pension Plan for Grandfathered Employees	\$ 4,500,000
19	University of California Retirement Plan - Lawrence Berkeley National Laboratory	\$ 4,000,000
20	Pension Plan for KAPL Employees in Participating Bargaining Units	\$ 2,700,000
21	WSI Indep. Guard Assoc. of Nevada	\$ 2,480,000
22	Mound	\$ 1,900,000
23	B&W Pantex, Pantex Guards Union	\$ 1,818,249
24	Yucca Mountain Salaried Pension Plan	\$ 1,800,000
25	TRU Solutions Pension Plan	\$ 1,346,000
26	WSI Las Vegas	\$ 1,300,000
27	Uranium Disposition Services	\$ 710,000
28	CSC Occupational Health	\$ 383,000
29	Argonne National Laboratory Firefighters	\$ 5,897
30	University of California Retirement Plan - Lawrence Livermore National Laboratory	0
31	University of California Retirement Plan - Los Alamos National Laboratory	0
32	West Valley Pension Plan	0
33	Retirement Plan for Employees of Certain Employers at the U.S. Department of Energy Facilities at Oak ridge, Tennessee-BW Y12	0
34	Lawrence Livermore National Security	0
35	SLAC	0
36	Argonne National Laboratory Guards	0
37	Argonne National Laboratory Machinists	0
38	Lockheed Martin Specialty Plan	0
39	Sandia Corporation Pension Security Plan	0

40	Ames Laboratories	0
41	Fernald	0
42	Rocky Flats Hourly	0
SUB-TOTAL OF QUALIFIED PLANS (#1-42)		\$ 648,527,052
43	Nonqualified Pension Plan - Sandia Corporation	\$ 1,132,003
44	Executive and Supplemental Pension Plans for Designated Bettis Employees	\$ 614,446
45	The Savannah River Nuclear Solutions, LLC Nonqualified Pension Plan - Savannah River Nuclear Solutions, LLC	\$ 453,368
46	Washington Government Services Executive Pension Plan - West Valley Environmental Services, LLC	\$ 151,000
47	Washington Government Services Executive Pension Plan - Washington Division of URS Corporation	\$ 49,398
48	LLNS 401(a)(17) Restoration Plan - Lawrence Livermore National Security, LLC	\$ 21,460
49	Excess Benefit and Supplemental Executive Pension Plan - Battelle Memorial Institute	\$ 9,335
50	LLNS Restoration Plan - Lawrence Livermore National Security, LLC	\$ 3,377
51	LANS 401(a)(17) Restoration Plan - Los Alamos National Security, LLC	\$ 2,585
52	LANS Restoration Plan - Los Alamos National Security, LLC	\$ 965
SUB-TOTAL OF NON-QUALIFIED (#43-52)*		\$ 2,437,937
GRAND TOTAL		\$ 650,964,989

*Note: FY10 projected contributions for non-qualified plans based on September 30,2009 FAS87 financial reports.

15. MANAGEMENT REFORM

Question: The budget request includes \$2 million for a new office of management reform to provide the Department with “strategic direction, coordination, and oversight of both external and internal transparency and operational performance improvement”. I have got to say external transparency could take up all of the time of this office. To get to the point though, while I support the stated objectives, the Department seems to be good at creating more bureaucracy to deal with operational issues without dealing with the underlying causes. Please provide a more detailed justification for this new office, beyond the three sentences in the budget justification, including staffing levels, lines of responsibility and reporting, and examples of the cost savings you hope to achieve through “management and operational efficiencies” and any other information that might be helpful in evaluating this request.

Answer: The Office of Management Reform (OMR) is critical to leading and implementing DOE’s management reform efforts. A single point of coordination, OMR, will facilitate reform execution and ensure reforms comport with DOE’s strategic and programmatic objectives. The Director of the Office of Management Reform will report directly to the Deputy Secretary (the Chief Operating Officer of the Department). The Director will have four to six direct reports to carry out the Office’s program and work support coordination. The work of the OMR will support, and be informed by, the Deputy Secretary’s participation on the President’s Management Council.

Responsibilities of the office include:

- Advise and provide strategic options to the Deputy Secretary and Secretary on best management practices (e.g., Lean Six Sigma, integrated performance plans) to support reform and mission goals.
- Work with DOE line management to define reform objectives.
- Act as a change agent within the Department, applying lessons from best practices (e.g., Recovery Act, ARPA-E, Kansas City Model, etc.) drawn from across the DOE complex.
- Develop metrics to monitor progress toward meeting management reform goals
- Educate DOE managers on innovative management ideas from other areas of government and the private sector.
- Monitor Recovery Act project implementation and apply Recovery Act successes and innovations elsewhere in DOE.
- Identify and eliminate inefficient management practices within DOE.
- Identify and implement cost-cutting opportunities within DOE.

Examples of cost-savings, streamlined processes, and root-cause solutions to be considered include the following:

- Applying NNSA’s Supply Chain Management practices across the Department.
- Reforming the Funds Distribution / Budget Allotment process through Lean Six Sigma findings.
- Using management tools used by ARPA-E and the Recovery Act (e.g., enhanced customer service through a call center/clearinghouse, iPortal data integration and reporting) to streamline practices across DOE.

The OMR is funded through equal contributions from the Office of the Chief Financial Officer, the Office of the Chief Information Officer, the Office of the Human Capital Officer, and the Office of Management.

16. NATIONAL ACADEMY OF PUBLIC ADMINISTRATION REPORT

Question: The National Academy of Public Administration finalized a report “Managing at the Speed of Light: Improving Mission-Support Performance” in July 2009. The Report contained a number of recommendations, such as elevating the mission support function to be coordinated at the highest levels of the Department. Please provide an update describing the extent to which recommendations have been implemented.

Answer: Improving management at the Department is a top priority for me and my leadership team. I appreciate having the report from the National Academy of Public Administration (NAPA) entitled “Managing at the Speed of Light - Improving Mission-Support Performance” and am pleased to be implementing many of its recommendations.

As NAPA recommended, we have established an Operations Management Council, chaired by the Deputy Secretary with membership comprised of the leadership of the program and staff offices to determine and assess mission-support requirements that will enable the Department to accomplish its mission. In addition, we have implemented regular program reviews, led by the Deputy Secretary, focusing on achieving goals, resolving challenges that impact mission accomplishment and enhancing coordination between program and staff offices.

Consistent with NAPA’s recommendation, internal and external career development programs available to staff include a variety of developmental activities that support and/or supplement employee growth. Details, action teams, shadowing assignments, rotational assignments, as well as on the job training and developmental assignments are key elements of an ongoing blended learning approach to employee development. Individual development plans are a requirement within DOE. Professional Development training delivered department-wide presents a variety of courses that are customized to the DOE environment, emphasizing the mission and mission related operations. The corporate learning and development office maintains an ongoing training services contract that supports organizational needs for program specific training and development services that can be delivered on a just-in-time basis.

Also consistent with the Panel’s recommendations, the Office of the Chief Human Capital Officer (OCHCO) is managing a series of strategic initiatives, outlined in detailed action plans, targeting improvements in Department of Energy Human Resources (HR). OCHCO is leveraging technology to improve, and measure service delivery performance. DOE is also piloting different service delivery models to assess the most viable means of achieving ambitious efficiency and effectiveness goals for the hiring process. Further, OCHCO has effectively utilized the Senior Management Review Board to improve efficiency in the Executive Resources arena. Additional changes in the Executive Resources Board Charter are being considered by the Deputy and me. OCHCO is providing weekly updates and monthly in-depth reviews to the Deputy Secretary on the reform initiatives.

The Office of Management conducted a Business Process Reengineering initiative that addressed NAPA's recommendations pertaining to Contracting and Acquisition. As a result, approximately thirty actions to improve the Department's operational procurement function as well as the Office of Procurement and Financial Assistance Management's oversight and control processes were implemented. These improvements include ensuring that the Senior Procurement Executive reports directly to the Chief Acquisition Officer; reengineering the Department's procurement oversight functions to provide increased emphasis on results based system assessments and streamlined processes for Headquarters review of major acquisitions; implementation of a revised framework governing the delegation of procurement authority from the Headquarters to field contracting activities; establishment of a formal knowledge management program; and an assessment of the Department's acquisition workforce to identify and fill resource and skill gaps.

The NAPA study team found that the Office of the Chief Financial Officer (OCFO) had made significant improvements in its services and the efficiency and effectiveness of its operations; however, the NAPA report also identified a need for improvement, principally in two key areas. The first key recommendation was to add a long-term planning, programming, and evaluation component to the Department's budget formulation process. The Department is now linking a long-range strategic planning effort to the formulation of its fiscal year 2012 budget. The second key recommendation concerned improving the budget allotment process. The OCFO has conducted a review of the Department's end-to-end funds distribution process, utilizing the Lean Six Sigma methodology, to reduce transaction cycle-times and costs. As a result of this review, the OCFO is now implementing short term improvement measures, as well as formulating a strategy to improve the funds distribution process in the long-term. Improvement initiatives are ongoing as the OCFO continues to evolve its culture to increase its value to decision-makers, and improve operations by reducing cycle times and transaction costs.

The NAPA report will continue to be a very important roadmap as we continue making the changes required to achieve management excellence at the Department of Energy.

17. NOT CONSISTENT WITH BEST PRACTICES

Question: Mr. Secretary, cost-overruns for the Department's major projects are far too frequent. The Government Accountability Office (GAO) concluded in 2007 that 8 of the Department's 12 major construction projects had exceeded initial cost estimates by a total of nearly \$14 billion. In 2008, GAO concluded that 9 of 10 clean-up projects experienced increases of \$25 to \$42 billion above the original cost estimates. More recently, in this past May's fiscal year 2010 request, the Total Project Cost of the Salt Waste Processing Facility at Savannah River increased from \$900 million to \$1.3 billion. The complex engineering associated with the Department's projects does create uncertainty in early cost estimates. However, the employment of best practices in cost-estimating would reduce this variability to more tolerable levels. The Department largely accepted the recommendations of the GAO. What is the schedule for implementing these recommendations?

Answer: GAO clearly recognizes, and I fully agree, that an essential starting point for improving cost estimating in DOE is the issuance of a Departmental order that requires the use of industry and government best practices for cost estimating. On April 12, 2010, DOE Order 415.X, Cost Estimating for DOE Programs and Projects, was entered into the Department's formal review process (referred to as RevCom) and is expected to be issued by the Deputy Secretary in early August, 2010. This Order, developed by the Office of Cost Analysis, will put in place industry and government best practices for cost estimating.

Cost estimating requirements cover the full range of projects in the Department (referred to as Major Investment Projects), not just traditional construction projects which comprise roughly only 30% of DOE's budget. This is particularly important because many of the upcoming alternative energy projects are financial assistance projects which fall outside of traditional construction, and currently have no project requirements. Cost estimating requirements include:

- a first-ever corporate DOE cost database so actual costs from similar projects can be used to estimate costs for new projects;
- an independent cost review and budget analysis that confirms, as part of mission need approval, that the cost range estimate is reasonable and the project is affordable;
- development of corporate cost escalation rates based on project type that factors in labor, equipment, and material requirements for the various projects;
- professional development including training and certification requirements for cost analysts in the Department;
- requirements for cost reviews at Critical Decision -0 (CD-0) or Mission Need, and independent cost estimates (ICE) at CD-1/ Alternative Selection, CD-2/ Project Baseline, and, when appropriate, CD-3/ Start of Construction ;
- development of a product-oriented Work Breakdown Structure; and finally
- a requirement for all procurements to have independent government estimate.

I am keenly aware that DOE has not had a cost estimating order in place for more than 10 years. I am confident that the upcoming Order and implementation by my Office of Cost Analysis will be instrumental in improving cost estimating in DOE. In the near term we will still have some bumps in the road, but I can assure you that we are on the right path to accurate and reliable cost estimates.

18. OUTDATED COST ESTIMATING POLICY

Question: Mr. Secretary, a January 2010 Government Accountability Office (GAO) report concluded that, "DOE has not had a policy that establishes standards for cost-estimating for over a decade and its guidance is outdated and incomplete, making it difficult for the Department to oversee the development of high quality cost estimates by its contractors." The GAO has published best practices on cost-estimating. This provides an extensive framework for developing improved guidance. When do you plan to update internal policy guidance and regulations on cost-estimating?

Answer: As included in my answer to Question 17, the Department will have a cost estimating order in effect, for the first time in over ten years, by August of this year.

19. INDEPENDENT COST ESTIMATES

Question: Mr. Secretary, in January 2010, the Government Accountability Office (GAO) issued a very critical report of the Department's cost-estimating. One of the recommendations included Independent Cost Estimates (ICE). An ICE is a review of cost estimates conducted by an independent entity with no stake in the approval or disapproval of a project. There is currently no requirement in the Department's regulations to conduct an ICE of major projects at critical milestones 1, 2, and 3. This undoubtedly contributes to the dramatic changes in Total Project Costs in many of the Department's major projects. As the GAO recommends, will you commit to conducting ICEs at critical decision milestones 1, 2, and 3 for all major projects? Please provide a list of major projects that are at or beyond Critical Decision 3 that have *not* received ICEs at Critical Decisions 1, 2 and 3.

Answer: I will commit to conducting ICEs at Critical Decisions 1 and 2 for all major projects, and for conducting an ICE at Critical Decision-3 for any major project that is having performance issues or is otherwise at high risk for success. Additionally, beyond the GAO recommendation, I will commit to conducting an independent cost review at Critical Decision-0 for all major projects. I believe that starting with an accurate cost range is an important element in the overall success of the project, and thus plan to implement this requirement as part of the new cost estimating order.

In accordance with DOE Order 413.3A, the Department conducted an Independent Cost Review (ICR) for major projects as part of the performance baseline validation external independent review performed by the Office of Engineering and Construction Management. The following projects have not received an Independent Cost Estimate (ICE) at Critical Decisions 1, 2, and 3:

- Waste Treatment and Immobilization Plant (WTP) at the Office of River Protection (ORP)
- Mixed Oxide Fuel Fabrication Facility (MOX) at the Savannah River Site (SRS)
- Salt Waste Processing Facility (SWPF) at SRS (at CD-3 only)
- National Synchrotron Light Source-II (NSLS-II) at the Brookhaven National Laboratory (BNL)

20. OFFICE OF COST ANALYSIS

Question: Mr. Secretary, the Government Accountability Office has concluded and this Committee has directed (in fiscal years 2010 and 2011) that the Office of Cost Analysis (OCA) be moved organizationally out of the Office of the Chief Financial Officer (CFO). The CFO is not the correct organization to support Independent Cost Estimates. The direction from this committee did not prescribe where OCA would be housed, though a direct line to the Deputy Secretary or nested within the Office of Engineering and Construction Management would be reasonable alternatives. Why do you continue to disregard this direction, particularly now that the GAO has concurred with the Committee's direction?

Answer: It is vital that I balance Congressional direction with Administration priorities to ultimately implement an energy program that best serves the interests of the Nation. After extensive discussions with my Deputy Secretary and other key Departmental leadership, I have concluded that the interests of the Nation are best served by having the Office of Cost Analysis in the Office of the Chief Financial Officer.

As you know, I am in the process of refocusing the Departmental strategic goals so that a much greater emphasis is placed on energy independence. As I have already testified, "President Obama stated that the Nation that leads the world in creating new energy and clean sources will be the nation that leads in the 21st economy." To this end, I will need to know that future projects are not only linked to these goals but also that they are affordable.

The organization that plays and will continue to play a leading role in this effort is the Office of the Chief Financial Officer (CFO). For the CFO to be effective in this effort, it needs an independent capability for cost analysis that will be fully integrated with the Office of Program Analysis and Evaluation (PA&E) and the Office of Budget, and is Department wide in view. The Office of Cost Analysis (OCA) is linked closely to PA&E and Budget in the development and implementation of the DOE planning, programming, budgeting and execution system which will result in my ability to create a balanced multi-year budget plan that will achieve the energy independence goals of Department. OCA is also responsible for cost estimating policy, escalation rate guidance, cost analysis training, cost analyst professional development, development of a Department-wide cost database, and independent cost estimates -- an inherently governmental function accomplished by federal employees. Key outcomes from these analyses tie directly into the responsibilities of Budget, PA&E and the CFO's overall fiduciary responsibilities and provides information necessary to make informed decisions.

The Office of Engineering and Construction Management (OECM) has a more limited focus. As delineated in DOE Order 413, OECM is concerned with validating cost estimates and assessing project performance for capital asset projects (construction and environmental clean-up projects) which comprise roughly 30 % of the DOE budget. Moreover their focus is primarily from selection of a project alternative to the end of the project -- they have a more limited role in the

earliest phases of a project. As indicated, OECM is not involved with cost sharing programs, which are becoming more and more important to developing alternative energy production in the United States.

Finally, I respectfully disagree that the Office of the Chief Financial Officer is not independent. This organization does not have responsibility for or a direct role in, the acquisition decision process. Thus it is fully independent with a direct line to the Office of the Secretary.

21. ACCELERATION OF RECOVERY ACT SPENDING

Question: Mr. Secretary, the Department of Energy has obligated around 70% of all of its Recovery Act funding to recipients, which, through signed contracts and funding commitments, has sent a clear signal of support to the economy at a critical time. However, overall spending of the Department's Recovery Act funding is still very low. Do you expect that the Department's programs will accelerate spending in the coming months?

Answer: As enacted, the Recovery Act's estimated cost of \$787 billion came in three pieces: roughly a third in tax cuts directly to the American people, another third in emergency relief for hard-hit families, businesses, and state governments, and a third in investments in the infrastructure and technology, creating platforms for economic growth. The Department of Energy's Recovery program focuses on the third leg, accelerating innovation to lay the foundation for long-term economic growth.

From the first day after the Recovery Act was signed into law, DOE has been focused on moving the money out the door quickly to create jobs and spur economic recovery. We have used competitive processes to select exceptional projects. We have streamlined DOE operating processes across the board. We are providing unprecedented transparency and insist on clear accountability every day.

DOE has \$36.7 billion in appropriations, including \$32.7 billion in contract and grant authority and \$4 billion in loan credit subsidy authority. We have made selections for over \$32 billion (98%) of our contract and grant authority. In total, we have obligated \$29.4 billion (90%) and outlaid over \$5.1 billion (16%). Environmental Management has paid out \$2.3 billion in outlays and weatherization has now outlaid over \$1 billion. Working with Treasury, we have also supported \$7 billion in additional tax awards: \$4.7 billion in 1603 grants in-lieu of tax credits and \$2.3 billion in 48c tax credits.

We will be finalizing our remaining selections in the next three months.

We have obligated \$29.4 billion (90% of contract and grant authority). We are on track to obligate nearly 100% of our contract and grant authority by September 30th. Since the March 10th resolution of the Smart Grid Investment Grant tax issues, OE has fully obligated all 100 Smart Grid Investment Grant projects and most of the Smart Grid Demonstration Grant projects. We sent nearly 20 HQ staff to the field to help in the negotiation process of the Retro-fit Ramp-Up awards. In just five weeks, they fully obligated all 25 awards (\$450million). For all new selections, programs are using SWAT teams to ensure expeditious obligation. No major delays are expected. Fossil Energy and Loans will be the last to obligate.

We have outlaid over \$5.1 billion (16% of our contract and grant authority). We outlaid nearly \$700 million in May and are on our way to \$750 million in June. In addition to the various

renewable energy research, development and deployment programs, three of the department's largest Recovery Act programs the Environmental Management Program and the Weatherization Assistance Program, and the Science Program are all at run rate. In the last two months, the vehicles program has ramped up operations and surpassed its May target by nearly \$18.5 million. Over the last three months, we have seen an average payment growth rate of 18% month-to-month. We outlaid \$472 million in March and \$569 million in April. We expect to hit reach our optimal monthly spend rate of \$800 million to \$1 billion this quarter.

In the first quarter of 2010, Department of Energy Recovery Act award recipients reported having created and saved nearly 29,000 direct FTEs jobs at the prime and sub-recipient level. DOE has seen an average 50% quarter-to-quarter increase in recipient reported jobs. Recovery Act investments in the Office of Weatherization and Intergovernmental Program (OWIP) and Environmental Management program have seen the largest job creation. The loan guarantee program, Fossil Energy and Office of Electricity have all seen quarterly increases of 200% each quarter. Going forward, there will significant job creation from Recovery Act renewable energy and smart grid projects.

22. MINIMIZING WASTE AND FRAUD IN RECOVERY ACT PROGRAMS

Question: Last year, this Committee asked you how the Department is going to make sure Recovery Act money goes out the door through the state programs and other avenues in a sensible way that minimizes fraud and waste. You pointed this out as an area of some vulnerability, and said the Department would look at it very closely. Mr. Secretary, now nearly a year later, what measures have you taken to keep this close watch, and how would you assess the success of your oversight of Recovery Act funding? How are you conducting oversight specifically at the state and local level to ensure that waste, fraud, and abuse is not occurring? How have you balanced close oversight of state and local entities with the mandate to allow projects to proceed quickly?

Answer: We are providing unprecedented transparency and insist on clear accountability every day. Whether it is working with the states and municipalities or the private sector, we are working hard every to prevent fraud, waste and abuse. This commitment begins with choosing the best projects, and with so many of our programs oversubscribed and with more than 4,500 reviewers we are confident that we were able to choose great projects.

The next step is to ensure that each recipient provides project milestones and timelines in the contracting process that will allow our DOE project officers to hold recipients accountable to their own commitments. These project officers are in constant communication with the recipients. Moreover, in order to increase transparency and accountability of DOE's significant Recovery Act funds, the Office of the Chief Financial Officer has implemented regular deep-dive reviews with all program offices to discuss obligations, costing rates and risk plans. The CFOs office has also developed iPortal, an online financial database, providing everyone one set of numbers for departmental and public review—an unprecedented level of transparency. Through Section 1512 of the Recovery Act, our recipients have to submit hiring, spending and project updates for public release every quarter. Furthermore, the Department has made several emergency information collection requests under the Paperwork Reduction Act in order to require our larger, high-risk projects—including formula grant funding to the states—to report certain project milestones and financial data on a monthly, instead of quarterly basis. In the immediate future, DOE views monthly reporting for such high-risk projects as integral to our ability to ensure Recovery Act funding is spent both quickly and wisely.

In addition, DOE has temporarily expanded its staff in order to meet the increased implementation and oversight needs of the Recovery Act. As of the second quarter of 2010 DOE had 354 employees who have been hired to focus specifically on implementing the Recovery Act, with many more existing staff working hard to implement Recovery Act funding alongside their normal duties. Many of these employees are working in one of DOE's many field offices including states such as OH, PA, CO, TN, and WA, with more than 150 at NETL and Golden.

We are also working with several organizations including the National Association of State Energy Officials, the National Governors Association, the National Association of Counties and

U.S. Conference of Mayors to help provide training and technical assistance for to more than 2,300 recipients of Energy Efficiency Conservation Block Grants.

23. PROGRESS IN THE WEATHERIZATION ASSISTANCE PROGRAM

Question: Mr. Secretary, we understand that there were impediments in implementing the weatherization program in the past year as the Department of Energy worked to translate Recovery Act funding into jobs for Americans and lower energy bills for modest-income households. We'd now like to better understand the progress the Department has made in bringing the benefits of this program to households throughout the nation.

The Department of Energy has obligated more than 95% of the \$5 billion provided for weatherization by the Recovery Act—a good step forward—but outlays are still very low and most of the actual home weatherization have yet to come. How many households will be weatherized per month once the program is running at top speed, and when do you expect the program to "put the pedal to metal", so to speak?

Scaling the weatherization program, as well as the state energy program, to operate at the speed demanded by the Recovery Act was and is a significant challenge for the Department, for states, and for local governments. Can you describe the progress your department has made in this scaling effort?

Beyond the vital short-term benefits of job creation, can you describe the long-term benefits that the weatherization program, and perhaps the other energy-efficiency programs given funding in the Recovery Act, will provide to Americans in low-income households, to our economy, and to our nation's energy sector?

Answer: The Department of Energy has obligated 100 percent of the Recovery Act funding provided for Weatherization Assistance Program (WAP) formula grants, which total in excess of \$4.7 billion. Of the \$5 billion in overall WAP funding appropriated under the Recovery Act, the amounts not yet obligated are for non-formula purposes, include \$90 million for Sustainable Energy Consumer Grants and \$69 million for pending technical assistance projects currently in various stages of procurement.

In 2009, States weatherized 139,485 homes in total (including both Recovery and non-Recovery funds). As States ramped up and prepared to spend Recovery Act funding, for instance by hiring and training workers, purchasing equipment, and putting in place strong accountability and transparency measures, they accelerated the number of homes weatherized with Fiscal Year 2009 funding, making the combined total the best indicator of progress in the program.

WAP grantees weatherized 30,252 homes with Recovery Act funds through December 31, 2009, with 22,863 homes completed in the October through December quarter. Final information about weatherization production in the first quarter of 2010 indicated that 55,714 homes were

weatherized. DOE is confident that we—the department and its partners—have ramped up significantly and “turned the corner” on WAP. Weatherization performance in the first quarter of 2010 represent a 72 percent increase over the production rate achieved in the fourth quarter of calendar year 2009 of 16,461 units. This includes January production of 13,621 units, February production of 16,949 units, and March production of 25,144. In April, States reported 23,320 units being weatherized and another 24,721 units being completed in May thus far. Based on the historical record, peak production for weatherization normally occurs from April through September. DOE has identified a nationwide peak production rate of 25,000 to 30,000 homes weatherized per month. The WAP network will easily meet and exceed this threshold.

As of July 12, 2010, cumulative Recovery Act WAP costing exceeded \$1,156,788,065 or 25.0 percent of the total allocation for formula grants. During the month of June 2010 alone, \$140 million was outlayed.

DOE continues to strive internally and in cooperation with its WAP grantees to scale WAP to operate at the speed demanded by the Recovery Act. At the same time, quality control has remained a strong component of the program. DOE works directly with State Weatherization offices on a continual basis to ensure that together we are able to meet the goals of the Recovery Act. DOE Project Officers maintain at least weekly contact with each of the States and desk monitoring of monthly and quarterly reports are performed. On site visits are occurring quarterly (semi-annually for smaller grantees). DOE is hiring an independent contractor to review up to 5% of the production being performed by the more than 1,000 subgrantees throughout the country. These efforts are intended to develop partnerships with each of our grantees and to identify and resolve any challenges to implementing the program.

Low-income households typically spend more of their total income on energy than other households. WAP reduces energy costs for low-income households by increasing the energy efficiency of their homes, while ensuring their health and safety. By helping to improve energy affordability, weatherization serves to make housing more affordable and thus can help reduce cases of homelessness and demand for public assistance. By reducing energy consumption, weatherization can also contribute to the retention of money within local communities and the improvement of regional air quality.

24. OHIO AND THE WEATHERIZATION ASSISTANCE PROGRAM

Question: Mr. Secretary, reports indicate that the Recovery Act weatherization program has been particularly successful in the state of Ohio since the Act was passed last year. For many households in Ohio, just like in all states and territories, energy bills can be a real burden on the average household and can make or break the wallet for low-income families.

Can you explain in more detail the Ohio weatherization experience, and explain what real impact on both jobs and households weatherization is having for people in the state?

Are other states experiencing this much positive impact from the program? If not, why has Ohio been so successful, and can we expect this kind of success from the program in other states soon?

Answer: Ohio plans to weatherize 32,180 homes using Recovery Act Weatherization Assistance Program (WAP) funds and officially reported the weatherization of 13,209 units through the close of May 2010. Weatherization reduces energy costs for low-income households by increasing the energy efficiency of their homes, while ensuring their health and safety. By helping to improve energy affordability, weatherization serves to make housing more affordable and thus helps to reduce cases of homelessness and the demand for public assistance.

Ohio currently ranks fourth among WAP grantees in terms of the percentage of Recovery Act funds already expended, with 40.5%, or \$108,081,280 million spent through July 13, 2010. Joining Ohio in the "top ten" are the following states:

State	Total Award	% Total Award Spent	Planned Units Total	Units Completed (through Dec 2009)	Q1 Total Units Completed	Units Completed (Apr 2010)	Units Completed (May 2010)
ID	\$30,341,929	61.7%	3,113	551	815	317	295
DC	\$8,089,022	45.4%	785	0	110	27	
OH	\$266,781,409	38.4%	32,180	6,814	3,654	1,220	1,521
HI	\$4,041,461	32.1%	672	0	0	0	0

WI	\$141,502,133	36.7%	16,891	772	1,870	852	1,002
WV	\$37,583,874	36.5%	3,574	660	533	177	
MS	\$49,421,193	35.9%	5,468	1,472	988	124	168
ND	\$25,266,330	34.8%	3,267	310	345	95	89
WA	\$59,545,074	34.8%	7,170	1,007	2,455	593	514
TN	\$99,112,101	33.9%	10,524	1,430	2,701	674	896

Twelve states — Ohio, as well as, Colorado, Idaho, Illinois, Maine, Minnesota, Mississippi, Montana, New Mexico, Nevada, Vermont, and Washington — have satisfied the production and oversight benchmarks required to trigger the release of the hold on the 50% of Recovery Act WAP funds. These States now have access to their entire allocation of Recovery Act WAP funds and are continuing to lead the nation in bringing weatherization's employment and energy benefits to deserving Americans.

In total, the fifty-eight WAP grantees weatherized 30,252 homes with Recovery Act funds during 2009 and an additional 58,344 units during the first quarter of 2010. As of July 11, 2010 they had expended \$1,156,788,065 million, or 24.4% of the allocation for formula grants

One reason for Ohio's success is that Ohio began last summer to utilize Recovery Act funding for WAP projects by using established Davis-Bacon Act wage rates. Unlike other States, Ohio did not wait for the Department of Labor (DOL) to establish special project Residential Weatherization Wage Determinations (WDs) with specific new worker classifications for weatherization workers. DOL established such WDs in September of 2009. Where wage rates differed from those subsequently established by DOL Ohio's subrecipients of WAP Recovery Funds made supplemental payments to workers. This meant that Ohio Recovery Act WAP subrecipients started weatherizing units two to three months ahead of the other States.

As noted, DOL's special WDs were established for all 3,056 U.S. counties in September 2009, and these rates were adjusted in December 2009 to reflect more detailed information from many counties. All grantees are now using these new wage rates and weatherization of units is beginning to climb steadily – over 13,000 units were weatherized in January; over 18,000 in February and over 25,000 in March, April, May. Recovery Act WAP-funded weatherization work is expected to reach its peak production rate of 30,000 units in July May 2010 and maintain that rate through the summer and fall.

25. WORKING WITH GOVERNORS AND MAYORS TO ACCELERATE GRANT PROGRAMS

Question: Mr. Secretary, the State Energy program and Energy Efficiency and Conservation Block Grants program have experienced impediments similar to those experienced by the weatherization program in the last year. Between these two programs, the Department distributes grants to thousands of recipients, including states, territories, tribes, cities and other local governments. These numerous recipients are responsible for implementing energy efficiency and conservation projects funded with grants under these programs.

How is the Department of Energy working with recipients – with the governors and mayors overseeing these grants – to accelerate spending while maintaining strong oversight to minimize waste, fraud, and abuse?

To your knowledge, do you feel that the local recipients of these grants are satisfied with DOE's program? If not, what is the Department doing to improve its process in working with the state and local governments?

Answer: To maintain strong oversight of the State Energy Program (SEP) and Energy Efficiency and Conservation Block Grant (EECBG) program, the Department of Energy (DOE) has implemented an extensive program to monitor the grantees' processes and performance as well as to minimize waste, fraud and abuse. The details of the monitoring program are outlined in DOE's SEP and EECBG Monitoring Plan (available at http://www1.eere.energy.gov/wip/pdfs/owip_monitor_plan.pdf). DOE's Monitoring Plan outlines a comprehensive monitoring program that requires the grantees to electronically submit quarterly (for all grants) and monthly (for grants >\$2M) performance and financial reports that are reviewed by DOE technical representatives regularly to flag any potential issues and monitor performance. The results of the desktop reviews supplement the onsite reviews of grantee performance. DOE technical representatives and available experts visit grantees to review programmatic, financial, and administrative adherence to DOE regulations, federal statutes and OMB procurement requirements. Site visits are also conducted to verify proper spending of Recovery Act Funds. The DOE Monitoring Plan outlines an extensive onsite monitoring schedule based on size and complexity of the grant. Along with DOE Office of the Chief Financial Officer, DOE technical representatives also closely monitor fund withdrawals to ensure proper accounting and spending of Recovery Act Funds.

In addition to what is outlined in the Monitoring Plan, DOE field representatives are regularly trained on project management and monitoring based upon the DOE Monitoring Plan. Continual training ensures consistency among DOE field representatives and ensures the transmission of best practices and new guidance across the program. As part of their routine contact with grantees to provide technical assistance for accelerating spending, DOE technical representatives also monitor grantee project planning to avoid potential violations of the Federal Financial Assistance terms and conditions. A team of Headquarters technical and contract specialists additionally stand ready to rapidly respond and implement corrective action for grantee violations.

The Department has also undertaken numerous measures to accelerate spending:

1. DOE sent “milestone” letters to the leadership contacts at all of the EECBG and SEP grantee entities setting spending goals as a management tool to encourage them to accelerate the obligation and spending of their grants.
2. DOE sent “status alert” letters to all of the grantees who received >\$2M, as well as other select grantees determined to be in need of help with the completion of their applications, laying out exact information required of them to ensure that DOE can un-condition their awarded funds.
3. DOE Project Officers contact their grantees bi-monthly for all grantees receiving >\$2 M or more to ensure that the grantees have all of the information that they need to spend money quickly and well. Those grantees receiving grant amounts below that threshold receive calls from Project Officers regularly as well.
4. DOE has held 10 regional in-person meetings, inviting all grantees in an area to participate in “office hours” where they can receive one-on-one attention. Six hundred grantee representatives availed themselves of this opportunity to ask any questions on costing, payments, program guidance, and many other topics.
5. DOE has organized and managed 31 conference calls to date with grantees receiving anywhere from \$250,000 to \$2 million. These calls permit grantees to pose any questions they may have for DOE and to receive answers in real time.
6. DOE has also worked very hard to streamline the processing of the grants through the federal procurement process by providing program guidance that allowed the funds to be released quickly. As a prime example, DOE developed, and encouraged grantees to use, templates that identify projects that would be categorically excluded under NEPA. DOE has also taken steps to provide its own procurement personnel with greater ability to make rapid determinations and approvals on the use of funds.
7. DOE has provided and continues to provide grantees with extensive training and technical assistance to help them accelerate the obligation and spending of their grants. The Department has created an online solution center that compiles best practices, tools, webinars, project map, events calendar, and a community forum.
8. DOE has also created a Technical Assistance Center (TAC), which grantees can call or access online regarding any technical assistance needs they may have. The TAC then directs their calls to the appropriate technical assistance resource to answer their question and also follows up with the grantee to ensure that the latter is satisfied with the response. The Technical Assistance team

and the project officers work with the grantees individually to ensure that the grantees have all the resources they need to accelerate their spending.

9. DOE holds weekly conference calls with organizations that represent grantees (US Conference of Mayors, National Association of Energy Officials, National Association of Counties, National Governors Association and others) to update them on current topical issues that arise in program implementation and coordinate on ways to accelerate spending by and maintain oversight of grantees.

DOE feels that the recipients are satisfied with DOE's program. Recipients have commented that DOE's availability of technical and other experts through face-to-face meetings, conference calls, emails, letters and Project Officer calls all help to share knowledge, tools and best-practices for faster and wiser execution of Recovery Act funds.

Recipients have said that DOE's continual communications on goal expectations are aggressive but do help their city, county, state and tribal shared resources to plan, benchmark, and execute state and local programs. Recipients have also pointed out that as most recipient staff offices are small, DOE's help, support and outreach are welcome assistance to local city, county, state and tribal governments.

City and county recipients have told DOE the funding has enabled those recipients to execute local energy efficiency and renewable energy projects that would not have been done without the funds. Awardees have commented that DOE's hands-on support of recipients on reporting and guidance has helped the recipients with processing on new systems and requirements.

DOE constantly requests feedback from all grantees to ensure that their needs and voices are heard. In addition, we are following up with those recipients to ensure that the result of DOE's outreach was satisfactory.

26. ENVIRONMENTAL REVIEW AND HISTORICAL PRESERVATION ISSUES WITH STATE ENERGY AND BLOCK GRANTS

Question: There is some concern that NEPA and historic preservation reviews have slowed some projects in the state energy program and energy efficiency and conservation block grant program. What has the Department done to accelerate these reviews, and are these issues still slowing down the program?

Answer: With regard to historic preservation, the Department has undertaken several measures to ensure that historic preservation reviews have not slowed down State Energy Program projects. In cooperation with the Advisory Council on Historic Preservation (ACHP) and the National Conference of State Historic Preservation Officers, DOE drafted the first prototype Programmatic Agreement (PA) ever approved by the ACHP. This prototype PA allows for the expedited processing of historic preservation consultations under the National Historic Preservation Act (NHPA). So far, 26 States have entered into a PA with DOE with another 17 in advanced stages of negotiation. The Department funded a liaison position with the ACHP to work with States to resolve outstanding issues related to historic preservation for the Energy Efficiency and Conservation Block Grant (EECBG), State Energy Program (SEP) and Weatherization Assistance Program (WAP) Recovery Act projects.

With regard to NEPA, DOE has undertaken several measures to streamline its processes to expedite the review and release of funding for Recovery Act projects. DOE created a template for expedited NEPA review which allows applicants to receive immediate NEPA approval if they chose to select projects within the menu of projects identified by DOE as not requiring further NEPA review. In addition, DOE reviewed applications on a rolling basis to ensure that all projects are treated in a timely manner. DOE created dedicated teams of federal personnel and contractors to process the great increase in workload associated with the SEP and EECBG programs. DOE issued guidance to its recipients in August and December of 2009 to assist applicants in understanding the required review process so that applicant projects could be reviewed and processed expeditiously. As a result, DOE has processed over 95% of the NEPA determinations for SEP and EECBG as of May 2010.

27. BUY AMERICAN AND THE RECOVERY ACT PROGRAMS

Question: I understand that the Department has taken actions to uphold the intent of the Buy American provision—which is to direct funding towards American jobs—while still ensuring that the requirement doesn't slow down projects. Can you describe how the Department has approached the Buy American requirement for its Recovery Act programs to uphold the provision's intent but also accelerate Recovery Act work?

Answer: The Buy American requirements of the Recovery Act affect all DOE Recovery Act-funded programs. However, to date, the Office of Energy Efficiency & Renewable Energy (EERE) programs have generated the majority of issues and questions concerning compliance with the Buy American requirements. In particular, Energy Efficiency and Conservation Block Grants (EECBG) and the State Energy Program (SEP) have been the source of many inquiries.

DOE has issued agency-wide guidance for the Recovery Act, including the Buy American requirements, in its "Department of Energy Acquisition and Financial Assistance Guide for the American Recovery and Reinvestment Act of 2009," http://management.energy.gov/policy_guidance/1672.htm. Section 3.9 (p. 3-7) explains the Recovery Act Buy American requirements in general. Additional, specific information is provided in two attachments to that guidance document, Attachment 10 – "Buy American Issues in the Recovery Act for Financial Assistance Agreements," and Attachment 13 -- "Recovery Act Buy American Act Requirements for Information Needed From Financial Assistance Applicants/Recipients for Waiver Requests Based on Unreasonable Cost or Non-Availability." These are detailed explanations of what the Buy American requirements mean, how they apply, and how to request waivers of the Buy American requirements based on unreasonable cost or non-availability.

EERE also has created a web page entitled, "Buy American Guidance," http://www1.eere.energy.gov/recovery/buy_american_provision.html. This web page explains the Buy American requirements, contains the waivers EERE has issued to date (*Nationwide Limited Public Interest Waiver for LED Lighting and HVAC Units; and Nationwide Categorical Waivers for Electronic Ballasts, LED Traffic Lights, and Compact Fluorescent Lights*) as well as additional information including "Guidance on the Buy American Provisions as Applied to EERE Projects funded by ARRA," "Instructions for Waiver Requests," and "Frequently Asked Questions about the Buy American Provision."

Also on the EERE "Buy American Guidance" web page is EERE's Request for Information (RFI) on questions pertaining to the Buy American Provisions of the Recovery Act that was published in the Federal Register. 75 Fed. Reg. 5783, 5784 (Feb. 4, 2010). The RFI requests two categories of information from stakeholders. Part 1 requests technical information from stakeholders seeking to ascertain the availability of manufactured goods produced in the United States that are needed to carry out projects funded by EERE. Part 2 requests information on questions pertaining to the application and implementation (programmatic questions) of the Buy American provisions in Recovery Act projects funded by EERE. The products and technical specifications submitted in response to Part 1 will be catalogued and disseminated to the domestic manufacturing community in order to ascertain the domestic manufacturing capacity for these products before EERE considers issuing any waivers based on non-availability.

Submissions in response to Part 2 (programmatic questions) are addressed by designated program staff.

EERE is collaborating with the Department of Commerce's Manufacturing Extension Partnership and its nationwide network of manufacturing centers to scout for domestic manufacturers of products that are submitted by EERE Recovery Act grantees for waiver consideration under the Buy American provisions. EERE is also coordinating with other manufacturing stakeholders, including labor unions, trade associations, and industry groups, to disseminate the waiver requests received and thus ensure that EERE conducts a thorough and transparent attempt to locate domestic manufacturers before making any waiver determinations.

In addition, in order to ensure that Buy American does not slow down Recovery Act spending, EERE has designated a Buy American Coordinator whose responsibilities are to disseminate information to stakeholders, obtain feedback, and work with various program and staff and support offices within DOE to resolve issues. EERE also has established an e-mail box, buyamerican@ee.doe.gov, to receive inquiries and issue responses.

The DOE General Counsel's office operates an email hotline for legal questions related to the Recovery Act, including the State Energy Program, (SEP), Energy Efficiency Conservation Block Grant (EECBG) and Weatherization Assistance Program (WAP), *GCHotline FAQ Answers to Legal Questions Related to the Recovery Act*, <http://www.gc.energy.gov/GCHotlineFAQ>. Typically, Recipients who submit questions to the GCHotline are given individual responses tailored to their factual descriptions. Responses that are of general interest are posted as FAQs. The FAQ section includes a "Buy American" category. In addition, the Office of General Counsel holds a monthly call with state energy offices to answer questions concerning the EECBG, SEP, and WAP programs; some of the questions raised initially concerned Buy American. In the two most recent monthly calls, no questions concerning Buy America have been raised.

DOE's Recovery Act website, <http://www.eergy.gov/recovery/index.htm>, has a link to the Buy American Guidance on the EERE web page. It also features the DOE Recovery Act Clearinghouse, with a toll free number that operates Monday through Friday, 9 a.m. to 7 p.m. EDT, which provides information on popular topics, including the Buy American requirements, and a link to the web address that accepts email inquiries.

28. DOMESTIC VERSUS FOREIGN MANUFACTURING FOR SECTION 1603 GRANTS

Question: Mr. Secretary, as you know, the section 1603 grants from the Treasury Department and administered by your agency have very successfully increased installations of new renewable energy generation facilities in the last year, at a time when the economic downturn threatened to stall renewable energy altogether in 2009. That said, there has been recent criticism that the money and jobs to build these facilities-in particular, wind farms-are going abroad.

How do you respond to these criticisms?

How has this section 1603 grant program, which drives domestic demand for wind farms and other renewable energy generation, work in conjunction with the Advanced Energy Manufacturing Tax Credit to bring manufacturing jobs to the United States and get us back in the global race for leadership in the energy sector?

Answer: The Section 1603 grants go to U.S. clean energy projects, which are installed in the U.S. by American workers. It is mistaken to conclude that, because many of the projects have foreign parent companies, the funds are going abroad or the jobs are being created abroad, as that is not the case. The majority of the turbine content (by value) for these projects are manufactured in the U.S., and the average U.S. content of wind turbines continues to rise as more U.S. manufacturing facilities come online every year.

The Section 1603 grants program and the Advanced Energy Manufacturing Tax Credit (48C program) are helping ensure the U.S. is the world's leading market for, and the world's leading manufacturer of, clean energy technologies. These two programs together are creating or saving more than 20,000 U.S. jobs in high-growth clean energy industries, while helping achieve the goal of doubling renewable power generation in the next few years. Through the 1603 program and the 48C program, more U.S. clean energy projects are being built, establishing a robust U.S. manufacturing supply chain that creates or saves thousands of jobs.

29. LONG-TERM BENEFITS AND JUMPSTARTING NEW ENERGY SECTORS

Question: While many Recovery Act programs were intended to create jobs quickly, a lion's share of the Department of Energy's Recovery Act programs were intended to seed the investments that will transform America's energy sector for the 21st century. Some of these programs make investments that will jumpstart new American industries to make us competitive in the race to capture jobs in the rapidly-evolving energy sector for the next ten, twenty, or thirty years. How are Recovery Act programs helping to jump-start new American energy industries? How are DOE Recovery Act programs helping to transform our energy sector to be cleaner, more efficient, and more independent of foreign sources of energy? How will the Recovery Act smart grid demonstration grants not only create jobs in the next year, but also support the long-term modernization of our nation's power grid? Will these grants help to create grid industry leaders in America, instead of abroad?

Answer: As we put people back to work, DOE's Recovery Act is making our homes and buildings more energy efficient, expanding US high technology clean energy manufacturing and generation, modernizing our power infrastructure, transforming the transportation sector, and laying the foundation for the next generation of technological and scientific innovation.

Under the Recovery Act, we are making the largest single investment in home energy efficiency in U.S history. For low-income families that are hit hardest by high utility bills, the Recovery Act provides \$5 billion for the Weatherization Assistance Program, which funds local agencies to perform home energy audits and weatherization services. We are working closely with our partners to deliver this vital program. Each state has made clear performance commitments and we have worked directly with the Governor's office in every state towards a shared plan to reach these performance targets. We have taken steps to address barriers that we have identified, as well as issues raised by GAO and the DOE Inspector General. The Department undertook a broad-based restructuring program to address the initial challenges in program implementation. As a result of these efforts, states reported that they weatherized more than 125,000 homes in 2009, including more than 25,000 with Recovery Act funds and based on this reporting are on pace to deliver at least 250,000 homes with Recovery Act funds this year. Through May of 2010, 132,269 units have been weatherized with Recovery Act funding. The Department will remain focused on providing each of the states and local agencies with the resources they need to quickly and effectively implement this program. We expect to weatherize nearly 600,000 homes with Recovery Act funds by March of 2012.

The Recovery Act also includes \$3.1 billion for DOE's State Energy Program and \$300 million to states for energy efficient appliance rebates, showcasing cooperation between federal and state governments. The state energy programs are sponsoring very innovative projects. Ohio is using some of their state energy grant money to increase industrial energy efficiency, helping companies reduce cost and become more competitive in the market. Idaho is improving energy efficiency in 210 K-12 schools across the state, putting money back into school budgets. By the end of June, the state energy program had contracted (i.e., states obligated funds) more than \$2 billion of their \$3.2 billion. All of the states already have their appliance rebate funds and most have completed their program offerings, helping consumers improve appliance efficiency significantly.

The Recovery Act provided \$3.2 billion to fund the Energy Efficiency and Conservation Block Grant program for the first time, which this committee was instrumental in creating. This program will help over 2,300 cities, counties, states, territories and Indian tribes to develop their own efficiency programs, including: building code development, energy audits and retrofits, efficient public lighting and landfill gas capture. Standing up a new program always takes a little more effort—it took a dedicated 125 person SWAT team in the basement of DOE to process all the new EECBG applications, working with recipients directly on the phone to ensure each application met the statutory requirements and to minimize bureaucratic back and forth. This hard work will pay dividends in the coming months, as states and communities bring innovative projects on line. We are particularly excited about the competitive portion of the energy conservation block grant program, known as Retrofit Ramp up. The leading projects under this program will define new approaches to make energy efficiency services available to all Americans at significantly lower cost.

These formula grant programs have created opportunities for innovation in how the Department of Energy works. Our expanded call center has handled more than 20,000 calls from formula grant recipients, guiding people through the process. We now have dedicated account representatives for each state, providing service continuity. We collaborate with the national weatherization and state energy organizations weekly, building a shared view on performance. Each innovation not only moves this program faster every day, but better positions DOE for long-term base performance as well.

Recovery Act investments and incentives are putting us on track to meeting our goal of *doubling* both renewable electricity generating capacity (excluding conventional hydropower) and advanced energy manufacturing by 2012. Recovery Act programs are also quickly expanding high technology, clean energy manufacturing in the U.S.

We are funding a range of renewable energy generation technologies, including wind, solar, and geothermal. DOE has supported Treasury in implementing the 1603 program, which has provided \$4.7 billion in 1603 payments to 833 renewable energy generation projects across the country. By partnering with private industry, Treasury and DOE have already funded enough new renewable energy projects through these payments to power over one million homes, enough clean energy to power the homes of everyone living in Boston, Seattle, Atlanta, Kansas City, and Cincinnati combined. These projects have already been completed.

DOE has also supported Treasury in awarding \$2.3 billion in tax credits for 183 clean energy manufacturing projects in 43 states under the 48C program. The manufacturing capacity supported by these grants will produce solar panels, wind turbines, geothermal equipment, nuclear plant components, and energy efficient building products, putting the US on track to double our capacity to manufacture these high technology, clean energy components by 2012. These facilities represent some of the premier companies in renewable manufacturing. The award recipients estimate that these projects will generate more than 17,000 jobs. This investment will be matched by as much as \$5.4 billion in private sector funding. The interest was extraordinary and the program was oversubscribed by a ratio of more than 3 to 1. The Administration has called on Congress to provide an additional \$5 billion to expand the program.

Because there is already a deep pipeline of projects, these funds could be deployed quickly to create jobs and support economic activity.

We have announced more than \$4 billion in conditional commitments to build renewable energy and grid electrification projects in the US under the Recovery Act including Solyndra (CA), Nordic (ID), and Beacon (NY), and Brightsource (CA). These conditional commitments have proven very effective in bringing private capital off the sidelines and into the market at scale. Solyndra, Nordic, and Beacon are all in construction.

We're also investing over \$600 million in grants in the research, development and deployment of renewable energy. For example, \$24 million in Recovery Act funding has gone to three universities (in IL, ME, and SC) around the country to improve wind turbine performance and reliability. The Solar Incubator is providing \$10 million in Recovery Act funds to help 4 companies in North Carolina and California lower the cost and improve performance of promising PV technologies. We are awarding up to \$81 million to 45 geothermal projects in 20 states developing innovative approaches to enhanced geothermal systems, potentially unlocking vast amounts of baseload power.

The Recovery Act provided \$3.4 billion to help develop the next generation of vehicles and the fueling infrastructure to support these innovative new technologies. This is in addition to \$8.4 billion in direct loans to manufacturers provided so far from our Advanced Technology Vehicle Manufacturing loan program outside the Recovery Act. These projects aim to transform the transportation sector by creating competition among electrification, natural gas vehicles, advanced biofuels, hydrogen and improvements in internal combustion engine efficiency.

Over the next six years, we expect to support three new electric vehicle plants – the first ever in the United States – and 30 new battery and other electric-vehicle component manufacturing plants fully operational. We've made investments in battery and component suppliers like A123, Enerdel and Cellgard, as well as manufacturers like Nissan, Tesla, Fisker and Ford to make advanced vehicles in the United States. By 2015, these plants will be expected to have capacity to produce 250,000 electric-drive cars and batteries to power 500,000 plug-in hybrid electric vehicles. We are also building the infrastructure to support these vehicles, including more than 10,000 charging locations in a dozen cities.

We've selected \$300 million in Recovery Act grants to 25 Clean City coalitions of public and private fleets. These grants significantly expand city- and county-led efforts to reduce petroleum consumption and deploy high-efficiency cars, trucks and buses that run on alternative fuels. The 25 projects support over 9,000 alternative-fuel vehicles, 70 percent of which will run on natural gas, mainly for heavy-duty trucks.

At the same time, Recovery Act investments will support the development and deployment of the next generation of biofuels. Nearly \$600 million in Recovery Act grants will support 19 pilot, demonstration, and commercial-scale bio-refineries. These facilities will convert biomass into fuels and chemicals that otherwise would be produced from oil, while creating jobs and raising farm incomes in rural communities across the country. Before these investments, the

development of an advanced biofuels industry was at a virtual standstill as numerous facilities at the pilot stage had faltered during the economic downturn.

More than \$100 million from the Recovery Act, plus an additional \$87 million in base budget funding, will go to improving the efficiency of heavy-duty trucks and passenger vehicles. With private sector cost-sharing, this will support nearly \$375 million in total investment, positioning the US as a leader in heavy duty fuel efficiency and reducing transportation costs across the country.

Our electrical grid is a critical piece of infrastructure, but today it uses century-old technology. It wastes too much energy, it costs us too much money, and it's too susceptible to outages and blackouts. Just as President Eisenhower's investment in an interstate highway system revolutionized the way Americans travel, our Recovery Act investments in the smart grid and new transmission lines is revolutionizing how we produce, transport and use energy.

The more than \$4 billion in Recovery Act smart grid investments are being matched by more than \$5.5 billion in private sector funding, supporting 132 projects that may reduce electricity costs, increase reliability, and give consumers more choice and control over their energy use. By 2013, we expect a combination of public and private investment to lead to the deployment of 18 million smart meters nationally (more than double the number currently in service). The Recovery Act is also funding the installation of more than 850 sensors on the electric transmission system to improve reliability and security, for the first time providing visibility and control across the entire U.S. transmission system. More than 200,000 smart transformers and more than 650 automated substations will allow power companies to replace units before they fail, and respond more effectively to restore service when bad weather knocks down power lines. These are important first steps toward the modernization of our power infrastructure.

With \$3.4 billion from the Recovery Act, we are making unprecedented investments in carbon capture and sequestration technologies, attracting approximately \$7 billion in private capital. Projects we are supporting are projected to capture more than 10 million tons of CO₂ annually by 2015 and put us on a path to demonstrating that carbon capture and sequestration can be economical by 2020.

Realizing the promise of low-carbon electricity from coal requires an economical solution to capturing CO₂. The leading processes today are amine and ammonia-based processes that cost \$60 per ton and have a very significant energy penalty. New CO₂ capture technologies, using different solvents, adsorbents and absorbents, hold the promise to significantly reduce the energy penalty, cut capital costs and reduce the cost per ton by more than half. Our grants are funding innovative approaches such as synthetic enzymes or conversion of CO₂ into valuable fuels or chemicals that could reduce the cost even more.

The Recovery Act is accelerating the pace of scientific and technological innovation in the energy sector, laying the foundation for sustained future economic growth. There is widespread agreement in the economic community that innovation is a primary driver of long-term economic growth and prosperity. Innovation also drives job creation. Long-term, high-quality jobs stay in industries where there is a high degree of innovative content.

For instance, the Recovery Act included \$400 million for the Advanced Research Projects Agency – Energy (ARPA-E), modeled after the Defense Department’s famed DARPA. DARPA is widely credited for enabling development of, among other things, the Internet. ARPA-E will fund high-risk, high-reward energy technology research. Not every project will succeed, but those that do have the potential to radically transform our energy system.

Potentially game-changing research funded through ARPA-E so far includes: Grid-scale liquid metal batteries that could cut battery costs by 90% while doubling energy density; Direct solar fuels – photosynthetic organisms that produce hydrocarbons instead of carbohydrates, combining CO₂, sun and water to produce ultra-clean gasoline; and Super-high-efficiency small wind turbines, leveraging advanced aerospace designs and materials to reduce the cost, improve the reliability and expand the range of wind energy. The projects we have funded under the Recovery Act highlight the opportunity for the United States to accelerate clean energy innovation and take a global leadership position in clean energy industries globally.

The Office of Science has invested \$1.6 billion to advance basic research (e.g., 16 new energy frontier research centers, the world’s fastest super computer at Oak Ridge), to expand science infrastructure (e.g., national synchrotron light source at Brookhaven, a new Continuous Beam facility at TJ lab, new battery user facilities at Argonne) and to increase funding for promising early career scientists.

Answer: The Recovery Act catapults the U.S. into a leadership position with respect to smart grid implementation. Although the Recovery Act funding is substantial, it is only a small fraction of the investment that will be needed over the next several decades to modernize the U.S. electric system. In this way, Recovery Act funds will support job creation and new business formation in the U.S. in the near term, and if the projects are successful in proving net benefits for smart grid deployments, then the groundwork will be laid for expanded job creation and business formation in the future.

Already in regions across the U.S. where grid modernization projects are underway, there is evidence of growing needs for skilled manufacturing personnel to build the smart equipment such as meters, transformers, capacitors, and power electronics necessary for the smart grid. In addition, because smart grid involves innovation in both electricity delivery and information systems and communications infrastructure, there is a need for systems developers and IT professionals including enterprise architects, system infrastructure designers and network and cyber security specialists.

Project implementation also means new jobs for engineering technicians and installation/maintenance personnel including meter installers and substation construction and installation contractors.

With the deployment of smart grid technologies, tools, and techniques comes new ways of doing business and a greater need for effective knowledge management processes. This means job

opportunities for data processing and business systems developers such as database administrators and data entry staff, as well as business and engineering analysts such as business process modelers, power system analysts, financial analysts, and rate designers.

Furthermore, smart grid is not just about equipment; it is also about innovation in business models and regulatory approaches. Over the next 3-5 years, as the Recovery Act smart grid projects are implemented, U.S. electricity markets will have the opportunity to be a proving ground for new ideas, approaches, and business strategies. From there, it will be up to the U.S. electric power industry to move out with expanded grid modernization projects across the U.S. and around the world.

30. FUTUREGEN

Question: \$1.073 billion of ARRA funding is allocated to the FutureGen project. In recent months, the Department and the FutureGen Alliance have been working to come to agreement on an initial cost-estimate that will determine whether the project will move forward.

Could you provide the Subcommittee an update on the decision regarding this effort?

Answer: Following review of project cost and funding plan documentation received from the Alliance in December 2009, the Department determined that additional information was needed in order to make an informed decision on how best to advance the project. The Department of Energy (DOE) extended the date for submission of the Alliance's Renewal Application, which was received on March 19, 2010. The Alliance's Renewal Application is currently undergoing a comprehensive evaluation by DOE. The Department is working with the FutureGen Alliance to establish a path forward to implement a successful project.

Question: The Subcommittee understands one issue preventing agreement is the potential need for appropriated dollars above the \$1.073 in the fiscal year 2013-2014 timeframe to complete the project. Could you please comment?

Answer: The FutureGen Alliance submitted its Renewal Application to DOE on March 19, 2010. The latest estimate of capital costs from the FutureGen Industrial Alliance has grown from the earlier one provided. Currently, the Department is in discussions with the FutureGen Alliance about the most promising path forward to ensure a successful project.

31. ENVIRONMENTAL MANAGEMENT LIFE-CYCLE COSTS

Question: Mr. Secretary, the Recovery Act invested \$6 billion to clean-up the legacy of the nation's nuclear activities. Will this investment reduce the life-cycle costs of clean-up of the projects?

Answer: Yes, this investment is reducing the life-cycle costs of the cleanup projects.

Question: If yes, what will be savings at the two largest sites, Hanford and Savannah River?

Answer: The Office of Environmental Management (EM) estimates the savings to be \$2.1 billion at Hanford and \$1.2 billion at Savannah River Site.

Question: If no, how is such a large investment not reducing the cost in future years?

Answer: The \$6 billion investment is creating savings and cost avoidances throughout the cleanup complex that will reduce the life-cycle costs of the EM program.

32. INCREASED FUNDING FOR ENERGY EFFICIENCY AND RENEWABLE ENERGY

Question: The budget request increases funding for energy efficiency and renewable energy applied research and development by 5% over the fiscal year 2010 level.

Can you explain where the funding increases will be focused?

How will the increases to this account further the goal of transforming our energy sector to run on clean, domestic sources of energy and to create new American industries?

Answer: The FY 2011 portfolio is aimed at accelerating revolutionary change in the Nation's energy economy through three distinct technical areas:

First, it will achieve rapid gains in the efficient use of energy through the development of new building materials, equipment, designs, and tools that can cost-effectively reduce commercial and residential energy use. These advances will cut energy consumption in new residential buildings, for example, by 50% or more by 2018. Identifying improved industrial processes, materials, and systems that can drive productivity advances in industry to increase profits while slashing demand for fuels and electricity is also a focus.

Second, EERE will help the U.S. shift to a portfolio of new transportation technologies based on electricity, renewable fuels, and advanced technologies that can decouple the U.S. vehicle fleet from fossil fuels.

Third, EERE will achieve rapid growth in renewable energy supplies using biomass, wind, solar, geothermal, water power, fuel cells, and other energy resources to produce competitive sources of fuels and electricity through carefully targeted applied research. Energy storage systems will be an important part of this investment.

In addition, DOE's RE-ENERGYSE program will reinvigorate the investment in education at all levels to support the next generation of scientists and engineers that are needed to address the country's energy challenges.

EERE continues to work to transform our energy sector to run on clean, domestic sources of energy and to create new American industries. DOE estimates that with the continued leveraging of EERE technologies: U.S. net oil imports can decline by 57 percent; consumers can spend 24 percent less on energy; the Nation can emit 19 percent less CO₂; and primary energy consumption can decline by 16 percent, all relative to 2050 baseline projections.¹

¹ Additional information on EERE's impact analysis methodology and assumptions can be found at http://www1.eere.energy.gov/ba/pba/program_benefits.html

33. HYDROGEN AND FUEL CELLS TECHNOLOGY

Question: The budget request reduces funding for the hydrogen and fuel cells program to \$137 million, \$37 million below the 2010 level.

Can you explain the reduction to this program?

You have said recently that an industry consortium may be a sensible approach to move hydrogen and fuel cell transportation forward. Can you expand on this? What would this consortium look like, what would it accomplish, and how would federal funding and programs be involved?

Maybe this discussion is best put in a global context. Germany has committed to policies, government funding, and an industry consortium that hopes to roll out 225,000 hydrogen-powered cars and 500 hydrogen fueling stations by 2018. At the same time, the Department of Energy's budget request makes the assumption that fuel cell and hydrogen technologies are not ready for widespread commercialization until 2020. Are we missing the boat? Are we setting ourselves up to lose the race for this new market, or do you believe Germany is misguided in its attempt to commercialize hydrogen vehicles?

Answer: The Department's reduction of the Hydrogen and Fuel Cell Technologies (HFCT) budget by \$37 million allows for a balanced portfolio of transportation solutions and continued focus on battery and advanced vehicle approaches for more near term impact. The Department will also maintain a strong effort in key areas of hydrogen and fuel cell research and development. In addition to \$137 million in the EERE HFCT program, DOE requested \$50 million for the Solid State Energy Conversion Alliance (SECA) Program on high temperature megawatt-scale fuel cells and expects to maintain funding levels at approximately \$38 million through the Office of Basic Energy Sciences for long-term and crosscutting research in hydrogen and fuel cells.

Both Japan and Germany established industry consortia to move hydrogen infrastructure forward. A similar approach could be an option for the U.S., rather than relying completely on government funding. It is premature to define what the consortium would look like. For example, industry could take the lead based on their assessment of commercial viability of the technology and market needs.

DOE works closely with Germany, Japan and other countries through the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) to evaluate their strategies. Germany is working on the business case to roll out infrastructure with a goal of 500,000 fuel cell vehicles in 2020. In fact, in February DOE co-organized a global workshop through IPHE to better understand the needs and options for hydrogen infrastructure. Rather than dictate the numbers of vehicles or stations, DOE plans a strategic assessment of market needs, technology gaps and policies or other actions to enable a sustainable business case for hydrogen. The U.S.

continues to be a leader in this technology and the Department's balanced portfolio of basic research and applied development and deployment will continue to contribute to progress.

34. PROGRAM SUPPORT AND POLICY ANALYSIS

Question: Last year's request for the Office of Energy Efficiency and Renewable Energy (EERE) proposed to increase program support in that office to \$120 million, up from just \$18 million the year before. This increase, as I understand it, would have significantly expanded policy analysis staff and activities within the EERE office. But it's no secret that program managers and analysts who work within a single technology program can be champions for the technologies they work with—not the unbiased analysts we would hope would provide policy analysis. The most unbiased analysis would instead come from a centralized Departmental policy group that is wed to analysis and the Department's mission outcomes, not any particular technology. And in fact, there are such groups in the Department, including the Office of Policy and International Affairs. In last year's bill, we encouraged you to consider expanding policy analysis capabilities in that type of centralized office, rather than creating a patchwork of potentially redundant and biased analysis shops across the Department; however, this year's request seeks to double the analysis capabilities buried within the Office of Energy Efficiency and Energy Reliability, while it keeps funding flat for the Office of Policy and International Affairs.

Have you considered the Congress' concerns? If so, why do we see this decentralized approach for the second year in a row as the request seeks to expand policy analysis within the program offices?

How is this consistent with the new office of management reform and your ongoing efforts to break down the silos at the Department?

Answer: Analysis at the EERE corporate level can help integrate and harmonize analysis across EERE programs in order to help the program better target and address issues which cut across the interests of EERE technologies, and to be more responsive to Departmental, Congressional, and Administration priorities. The FY 2011 budget request reflects expanded EERE and Departmental program dimensions, needs and responsibilities (e.g., new programs, directed analyses and reports, accountability and transparency), driven by internal, Departmental, Administration and Congressional needs. These efforts [International, Strategic Priorities and Impact Analysis (SPIA), and Commercialization] add fiscal requirements. International activities were previously funded within the Weatherization and Intergovernmental Program (WIP), and Commercialization was funded through an authorization provided in Section 1001e of EPAAct 2005. SPIA was created in recognition of growing analytic, data, and planning requirements essential for effective EERE portfolio implementation, decision making, and responsiveness.

In response to Congressional guidance, EERE's Program Support activities are pursuing centralized policy analysis in the following two ways:

1) In recognition of the need for and advantages of a centralized effort to policy analysis, EERE is working closely with the Office of Policy and International Affairs (PI) to co-develop inputs and analysis to meet internal needs and Congressional requirements. Specifically, EERE's corporate office has shared all energy-economic models and data with PI, as well as the web resources VIBE and data platform Open Energy Information. EERE is working collaboratively with PI in developing climate and policy analysis, ensuring that analysis efforts are coordinated across the Department and that activities are informed by both Program and Departmental needs.

2) At the EERE corporate level, we are centralizing our approach to *independent* analysis with an action plan that leverages its corporate view by aligning resources and creating enterprise strategy and roadmaps to ensure integrated program and corporate efforts. Because EERE is home to fifteen diverse programs working toward common goals, there is a need for an independent and integrative approach to policy and technology analysis, as proposed by the Program Support budget request.

These two approaches are consistent with the proposed Office of Management Reform as EERE's Program Support activities (through their integrative and transparent approach) will carry forward the mission of this new office by working collaboratively to develop strategies that break down historical silos in the Department. The Office of Management Reform is a proposed office within the Office of the Secretary that will "provide the Department with strategic direction, coordination, and oversight of both external and internal transparency and operational performance improvement initiatives, including those directed by the Office of Management and Budget. This office will be responsible for identifying cost savings through management and operational efficiencies to reinvest in high-priority mission activities." (DOE FY 2011 Congressional Budget Request DOE/CF-0048, Volume 2, pages 131-134). EERE will be well positioned to work with the new office to ensure our internal strategic approach in strategic analysis, performance and transparency is well coordinated with the new office.

EERE's Program Support activities will be planned, designed, and coordinated in collaboration with the relevant DOE offices (PI, PAE, and the energy offices) to complement and provide transparent, common and comparable methods and means for analysis, allowing management portfolio planning and decisions at all levels to be based on comparable information.

Program Support activities performed at the EERE corporate level require a corporate "lens" applied by analysts with both program and topical expertise in EE and RE that includes an impartial view of each technology program and corporate vision. Analysis by corporate-level Program Support is independent, cross-cutting and integrative and includes corporate and strategic planning, comprehensive benefits analysis, and specialized performance evaluation, all necessary to integrate and harmonize activities across the diverse program suite. These tasks require significant capacity in disparate areas of expertise and are best addressed by impartial analytical resources within the EERE corporate office. Integration and analysis at this level addresses critical and potential gaps in the integration of analytic and technical efforts among EERE's

Technology Programs, as well as among EERE and other offices in the Department and Federal government.

35. YUCCA TERMINATION AND THE DEPARTMENT'S CLEAN-UP MISSION

Question: The termination of Yucca Mountain creates uncertainties surrounding the disposition of nuclear spent fuel and high-level defense waste around the country. How does termination affect the Department's clean-up mission and plans to dispose of spent fuel and waste at both Department of Energy and Defense-related sites?

Answer: The Administration's decision not to proceed with the Yucca Mountain repository does not affect the Office of Environmental Management's (EM) plans to retrieve, treat, and store high-level wastes stored in tanks or to treat and store spent nuclear fuel. EM is focused on addressing environmental and health risks by placing high-level waste and spent nuclear fuel in safe and stable configurations for long-term interim storage.

Question: Since the termination of Yucca Mountain, have you consulted with the major stakeholders about the implications for their inventories of spent fuel and waste, as well as the impact on the agreements involving waste disposal and clean-up—e.g. Governors?

Answer: No, we have not consulted with the stakeholders; however, our stakeholders are aware that we intend to continue our tank waste projects as planned and in accordance with our compliance agreements as reflected in the Fiscal Year 2011 budget request.

36. TANK WASTE CLEAN-UP AT SAVANNAH RIVER AND HANFORD

Question: The decision to terminate Yucca potentially brings into question the waste acceptance criteria assumed in the tank waste clean-up strategies at Savannah River and Hanford. Since the Blue Ribbon Commission is going to take 24 months to issue its final report, do you plan to stand-down some aspects of tank waste clean-up until you have clarity?

Answer: No, the Department will not stop tank waste cleanup pending results of the Blue Ribbon Commission review. The Department's ongoing efforts to retrieve and treat tank waste at the Savannah River Site and Hanford Site are not directly impacted by the termination of Yucca Mountain. While the Blue Ribbon Commission will conduct a comprehensive review of policies for managing nuclear waste (including storage and disposal options), the Office of Environmental Management will continue its efforts to reduce risks associated with tank wastes at both sites by retrieving it and converting it to a stable form suitable for long-term, interim storage.

Question: In the aftermath of Yucca Mountain, it has been suggested that the Waste Treatment Plant might need to be torn down and rebuilt to meet a new waste acceptance criteria. What is your reaction to this assertion?

Answer: That assertion is false. The vitrified high level waste form to be produced by the Waste Treatment and Immobilization Plant (WTP) is a highly stable, robust waste form that will be suitable for long-term storage, as well as capable of meeting criteria for disposal. The Department plans to complete construction and begin operating the WTP by 2019. Information on the WTP waste form, as well as other high-level wastes generated at Department of Energy sites, has been provided to the Blue Ribbon Commission for their consider as they perform their evaluations.

37. WASTE TREATMENT PLANT AT THE HANFORD SITE

Question: the Waste Treatment Plant at the Hanford Site is the largest construction project at the Department with a Total Project Cost of \$12.3 billion. This project has been plagued by technical challenges, cost increases and schedule delays. The Defense Nuclear Facilities Safety Board (DNFSB) and the Government Accountability Office (GAO) continue to scrutinize the project.

There had been agreement that \$690 million would be requested through to the completion of the project in 2019. This year, however, the Administration requested \$740 million, \$50 million above fiscal year 2010, to improve project confidence. Given the troubled history of this project, what assurances can you provide the Subcommittee that this request is not another indication of major cost growth in this program?

Answer: In 2009, the Office of Environmental Management (EM) began conducting peer reviews of construction projects within its portfolio. The scope of these reviews included cost and schedule, risk management, project management structure, and resolution of technical issues. These reviews are one mechanism to implement the Secretary and Deputy Secretary's initiative to continuous improvement of project management across the Department. In March of this year the Deputy Secretary issued a memorandum identifying key principles of project management. One of these principles is design maturity, which advocates assuring that advancement of design maturity is essential to project management success.

The request of \$740 million in Fiscal Year 2011 will allow for acceleration of the completion of design and engineering to reduce technical risks so that a higher confidence can be gained.

Question: Significant progress has been made to address the DNFSB's concerns with the elements of the project. Recent concerns involve the proposed re-design of aspects of the Pretreatment Facility and worries about the effectiveness of the Pulse-Jet Mixers. Do you believe addressing these concerns will delay the project any further?

Answer: The Department has been conservative in releasing Pretreatment Facility systems and piping for procurement in areas which the DNFSB has expressed concerns. However, these limited releases have allowed critical activities to proceed without significant impact to project cost and schedule.

With regard to the effectiveness of the Pulse Jet Mixers, the Department has been concerned about the approach to resolution since late 2008. As of now, Bechtel National Inc (Bechtel) is performing tests that DOE expects will confirm approaches to address mixing concerns remaining in 9 vessels. In the event that the testing and data analysis do not demonstrate that modifications will be successful, DOE has directed Bechtel to evaluate alternative approaches that would allow for waste material to be mixed and effectively transported in the Pretreatment Facility without posing the safety risks identified by DNFSB in its December 2009 letter to the Department.

38. URANIUM ENRICHMENT AND DECOMMISSIONING

Question: Mr. Secretary, the request for the Uranium Enrichment Decommissioning and Decontamination (UED&D) Fund is \$730 million, a significant increase over fiscal year 2010. However, the request assumes the reinstatement of a utility fee that will collect an estimated \$200 million in receipts. Congress rejected the utility fee last year. Beyond a budget gimmick, what is your rationale for reinstating a fee that will be passed on to consumers during a recession?

Answer: The Uranium Enrichment Decontamination and Decommissioning (UED&D) Fund was established in the Energy Policy Act of 1992 to fund the cleanup of the three gaseous diffusion plants at Oak Ridge, Tennessee, Paducah, Kentucky, and Portsmouth, Ohio. In the *Uranium Enrichment Decontamination and Decommissioning Fund 2007 Report to Congress*, the Office of Environmental Management estimated that the UED&D Fund, with current contributions, will not be sufficient to meet its intended purpose; the Fund is projected to become insolvent in the Fiscal Year (FY) 2020 timeframe and have an estimated shortfall of \$8 billion to \$21 billion over the next 30 years.

Therefore, the Administration is proposing to reinstate the special assessment on domestic utilities starting in FY 2011, as well as additional Federal deposits into the Fund, over a 15-year period to address the shortfall in addressing the environmental liability at the three facilities. The Administration believes this proposal is necessary to forward fund the cleanup of these facilities and minimize the financial burden on taxpayers in the future. Decontamination, decommissioning, and remediation of enrichment facilities are the shared responsibility of both industry and the Federal government. The proposal is estimated to address the currently expected shortfall.

Question: The budget request also included a legislative proposal to increase the total amount of receipts authorized to be collected by the Fund and extend the period in which the fund can collect receipts. This proposal, which is an amendment to the Atomic Energy Act of 1954, should be submitted the relevant authorizing Committees. Have you submitted this to authorizing Committees?

Answer: The Administration agrees that this proposal falls within the jurisdiction of the relevant Authorizing Committees because it amends the Atomic Energy Act of 1954. If the Administration were to request that the Authorizers enact this proposal, the legislative language would seek to permit both the collection of the utility fee and the spending to support the cleanup of the nation's gaseous diffusion plants only subject to a trigger in subsequent appropriations action. The Administration would like both the collection and spending of the fee to ultimately be discretionary, similar to the 2011 Budget provisions, so that the budget authority scoring to the Appropriations Committee would be net of the collection and, therefore, emphasize the relationship between the fee and the cleanup. The reason the Administration proposed that the Appropriations Committee essentially enact both the authorization and the appropriation was for expediency. The Authorizers may not have an appropriate vehicle in which to move this

legislation quickly and the Administration feels this fee needs to be enacted as soon as possible in order to help address the shortfall in the Fund.

39. TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

Question: for two consecutive years, the Department has requested significant funds for technology and development in the Office of Environmental Management program (\$75 million in fiscal year 2010 and \$92 million in the fiscal year 2011 request). The intent of this proposed request is to solve many of the technical challenges associated with pumping and treating tank waste. In a budget where there are decreases in the clean-up work at sites, such as Hanford and Idaho, how do you justify increases in technology development when additional work could be conducted at the sites?

Answer: Investments in transformational technology development will accelerate the treatment of radioactive tank wastes and the closure of the Hanford and Savannah River Site tank farms. Technology development may reduce the life cycle cost of tank waste cleanup from modifications to the tank waste system that includes treating waste in modular treatment facilities at the waste tank thereby supplementing existing treatment capacity; optimizing processes to minimize the amount of High Level Waste (HLW) and Low Activity Waste (LAW) glass produced; providing alternate approaches to treat and dispose of Low Level Waste (LLW); reducing the size and/or eliminating the need for constructing major new treatment facilities; reducing the operating life of existing treatment facilities; and reducing the number of HLW canisters produced.

Question: How soon can we expect to see the benefits resulting from this sizable investment?

Answer: Most of the technologies under development will be available in the mid-term (5 to 15 years).

Question: When will the technologies under development be ready for deployment? Or, are they already?

Answer: Some of the technologies may be ready for deployment in the next 5 years. For example, a next generation cesium solvent is being developed for the Modular Cesium Extraction Unit. A Small Column Ion Exchange technology will allow for an in-riser cesium decontamination of dissolved saltcake at Hanford and Savannah River.

40. INERTIAL FUSION ENERGY

Question: We hear the terms “high risk, high reward research” thrown around quite a lot these days, and fusion energy research certainly fits the bill. Of the two avenues for fusion that have been pursued for decades—magnetic confinement and inertial confinement—the Department has to date only funded magnetic confinement programs specifically for the purposes of developing fusion energy generation. The Department’s National Nuclear Security Administration funds inertial confinement fusion programs, but only for weapons purposes, not energy generation.

What is your plan for an inertial fusion energy program at the Department, and does this plan depend on the National Ignition Facility successfully demonstration ignition?

Answer: Inertial Confinement Fusion (ICF) has been supported by the NNSA for many years, primarily for national security and scientific applications, although with a long-term view toward potential energy production. The FY 2011 budget requests \$437.6 million for the ICF program. The dominant mission of the ICF program is support of the Nuclear Weapons program and includes operation of the NIF at about \$160 million per year. The ICF program also contributes to basic science in High Energy Density Laboratory Plasmas (HEDLP), for which the FY 2011 budget requests \$4.0 million in NNSA and \$31.0 million in the Office of Science’s Fusion Energy Sciences program.

The NNSA program will pass a major milestone later this year with the start of the National Ignition Campaign (NIC), a series of experiments aimed at demonstrating laboratory ICF ignition within a few years. Any Inertial Fusion Energy (IFE) program would require a successful NIC, which is anticipated but not guaranteed.

Question: Beginning in what fiscal year budget can we expect to see this plan reflected?

Answer: In anticipation of NIF ignition, the Department has begun laying the groundwork for an IFE program. The Under Secretary for Science is currently leading discussions between NNSA and the Office of Science. The Under Secretary for Science has coordinated several department elements (NNSA, Science, and Nuclear Energy) in chartering a National Academy of Sciences study to define a technology roadmap for IFE. The major technology topics to be considered include high repetition-rate drivers, inexpensive target fabrication, target injection, and the balance of the energy system, none of which is covered by present programs. An interim report is expected in nine months and a final report in 21 months. These discussions and reports, along with the results of the National Ignition Campaign, will inform future budget requests.

Question: The Naval Research Laboratory is currently the only federal fusion facility that researches inertial fusion for energy generation. However, my understanding is that this laboratory is not in the budget request because of the Department’s lack of a plan for inertial fusion energy. How will you preserve the unique expertise and facilities at the Naval Research Laboratory while you develop a long-term plan for inertial fusion energy?

Answer: Various elements central to establishing the scientific basis for inertial fusion energy are now carried out in the research portfolios of both NNSA and the Office of Science, in part through their joint HEDLP program and through the ICF program. We have recently concluded a technical and programmatic review of the Naval Research Laboratory's laser fusion program and have determined that its high cost and narrow technical scope are not consistent with the strategic emphases required to advance fusion energy. NNSA has some funding in the FY2011 budget request for the Naval Research Laboratory to support stockpile stewardship.

41. ITER INTERNATIONAL FUSION ENERGY COLLABORATION

Question: The success of ITER, the international fusion energy collaboration, relies on financial and timeline commitments from all participating countries. There have been reports that participating countries have failed to make these commitments, in part due to ITER management issues, and in part due to significant cost escalations.

What is really happening with ITER, what will be the United States' involvement and level of support for the project moving forward, and how is this reflected in the 2011 budget request?

Answer: We are working with the other ITER members and the ITER Organization (IO) to resolve the two major issues that are creating problems for ITER: establishing a credible project scope, cost, and schedule baseline for ITER, and transitioning ITER Organization management from start-up to full construction mode. The U.S. contribution to ITER over the life of the project is reflected in the Critical Decision-1 (CD-1) range of \$1.45–2.2 billion. The FY 2011 budget request reflects the pace of ITER construction. We are making progress and we expect to have some of these issues resolved by the next ITER Council Meeting (IC-6) in June 2010. The FY 2011 funding request will be used to make substantial progress on the design, R&D, and long-lead procurement activities for the U.S. hardware contribution and will keep the U.S. on track to meet its critical path commitments to the project.

Question: Is the funding level for ITER in the 2011 budget request sufficient to preserve the related staff and expertise at Energy Department sites like Oak Ridge National Laboratory?

Answer: The FY 2011 funding level is sufficient to support staff and preserve expertise at DOE sites responsible for carrying out the U.S. ITER effort, including the U.S. ITER Project Office at Oak Ridge National Laboratory.

42. METHANE HYDRATES

Question: Methane hydrates are an unexploited domestic resource with high-energy content, and significant science and engineering challenges still exist before the resource can be used. The Department has been working for many years to study them.

What is your overall assessment of the potential of methane hydrates as an energy source?

Answer: Methane hydrates occur naturally in a number of environments, and we clearly need to advance our understanding of their basic science. The fundamental stability of methane hydrates needs to be better understood if they are to become an economically viable energy resource. From an economic perspective, the role of methane hydrates in energy markets will be determined primarily by such factors as whether gas volumes are sufficiently large and geographically convenient to enable profitable production. Better characterization of the geographic distribution of gas hydrates and the gas volumes associated with different regions are the main technical issues to be addressed.

Question: The fiscal year 2011 request shifted methane hydrates research from the Office of Fossil Energy (FE) to the Office of Science. Since the methane hydrates research activities remain virtually unchanged, except for the addition of some amount science [*sic*] research, there is a perception that this shift was a way to appear consistent with the President's decision to eliminate oil and gas subsidies while not actually eliminating this activity. Was there a determination that methane hydrates warrant a more basic scientific assessment rather than a more aggressive push toward exploitation and demonstration in the applied FE program, or was this simply a way to appear consistent with the decision to eliminate oil and gas subsidies?

Answer: The Department's Methane Hydrates program has been following two important research tracks: investigating the development of gas hydrates as a fuel resource and investigating the role gas hydrates may play in earth-atmospheric greenhouse gas dynamics. These tracks require fundamentally different research.

The resource opportunity track, where DOE has worked with industrial partners in Alaska and the Gulf of Mexico as well as with international government partners, is poised to reach many of its objectives over the next several years. Continuation of the industrial partnerships beyond the current drilling test programs will be largely dependent on market and business requirements. In contrast, the role of methane hydrates in earth-atmosphere greenhouse gas dynamics can only be understood within a broader program of fundamental science investigations that are better suited to the work of the Office of Science. The transfer of the methane hydrates program from the Office of Fossil Energy to the Office of Science in FY 2011 is intended to strengthen the fundamental understanding of methane hydrates; their formation and occurrence; their role in geological and ecological systems; their stability in natural and engineered systems; and their role in the carbon cycle.

43. NATIONAL NUCLEAR SECURITY ADMINISTRATION

Question: After years of relatively flat budgets, the Administration requests \$11.2 billion for the NNSA, an increase of \$1.3 billion, or 13 percent. This is a very large increase in one year. Can you assure the subcommittee that this increase can be executed in one year?

Answer: The FY 2011 budget request reflects the first year of the multi-year investments needed to carry out the President's nuclear security agenda. The increase requested for the NNSA will be allocated principally to accelerate ongoing projects and activities in the Defense Programs, Defense Nuclear Nonproliferation and Naval Reactors programs. If appropriations are enacted at the President's Request level by the beginning of FY 2011, I am confident that the increased funding will be executed -- that is, obligated onto contracts for the work to be performed -- by year's end. However, due to the longer-term nature of the much of the work -- including research and development for military applications, and nonproliferation work with partners overseas -- the cost of NNSA's work often extends beyond the appropriation year.

NNSA historical obligation rates are very high -- from 96 to 99 percent in the year of appropriation -- and NNSA's annual costing rates and uncosted balances are within prudent levels established by the DOE and the GAO.

44. NUCLEAR TESTING

Question: On the basis of your immense scientific credentials, I have two questions for you. Do you think the United States needs to resume nuclear testing?

Answer: No; the nation does not need to resume nuclear testing. Our Stockpile Stewardship Program provides a robust ST&E workforce and unique science-focused facilities that provide simulation tools and experimental capabilities that permit the acquisition of fundamental knowledge of the weapons whose safety, security, and effectiveness we certify on an annual basis. The transition from underground nuclear testing to stockpile stewardship and management has expanded our knowledge base such that the Directors of the national laboratories have stated: "The technical weapons community has more understanding than ever before of the first-principle physics as it applies to the operation of the nuclear explosive package. This improved understanding enables us to better know what can be done to correct stockpile problems, the limits of what can be done, and how to do it." I concur with the judgment of the directors of our nation's nuclear weapons laboratories.

Question: Do you think that our understanding of nuclear weapons has, overall, increased or decreased since we substituted Stockpile Stewardship for underground testing?

Answer: Our understanding of nuclear weapons has improved dramatically under Stockpile Stewardship. Under the Stockpile Stewardship Program (SSP), experiments are conducted to assess the current state of the stockpile, the results of which are validated against data collected from the underground nuclear tests conducted prior to the end of testing in 1993. A full complement of ST&E capabilities is required, spanning a diversity of discovery science to applied research and development. NNSA's strong ST&E capability has enabled a paradigm shift from a deterrence supported by underground nuclear testing, to a stockpile whose credibility is underpinned by a growing knowledge of weapons performance. Investments in experimental facilities are providing unprecedented access to data only reachable previously through the conduct of a nuclear explosion underground, with all the inherent limitations such a massive experiment entails. Stewardship provides the opportunity to replicate experiments many times over in a laboratory environment. The insights gained via the SSP, and the modern ST&E base, are validated against results from achieved from prior underground nuclear testing. SSP is, in this context, the essential bridge to the data collected through underground nuclear testing.

45. QUANTIFICATION OF MARGINS AND UNCERTAINTIES

Question: The technique of Quantification of Margins and Uncertainties, QMU, appears to be working well in improving our understanding of nuclear weapons. It seems to me that QMU could be a valuable tool in assessing many civilian technologies. What is your view on that?

Answer: QMU has proven to be a powerful methodology for assessment of the stockpile. There certainly are complex problems in other areas where uncertainty quantification and some of the other tools of QMU can be applied. The same teams that developed these techniques for nuclear weapons are beginning to apply them to a broader array of technology and science challenges, such as climate modeling. This is just one of the many examples of the benefits of multi-program national laboratories working on a spectrum of problems of national importance; solutions developed on one area will be applied to other important problems in a healthy R&D environment.

46. PROTECTIVE FORCE

Question: there is an uncomfortable possibility that in 2012 we may be facing a situation in which the Protective Forces at three nuclear production plants go on strike simultaneously. What is your plan to deal with such a contingency?

Answer: The expiration dates for the respective Collective Bargaining Agreements (CBAs) are staggered such that three concurrent work stoppages at the geographically disparate DOE facilities would be extremely unlikely, and a strike is unlikely before such expiration because DOE/NNSA contractor CBAs have no-strike clauses. Although CBAs for three of the contractor protective forces (SRS, Pantex and Y-12) expire in 2012, the CBAs do not all expire in the same month in 2012. Rather, the CBA at SRS expires in April, the CBA at Pantex expires in June and the CBA at Y-12 expires in August. If the contractors at the respective sites are not able to reach agreement on a new CBA at the time the respective CBA expires, the contractor may negotiate extensions to the CBAs to minimize the impact on the Nuclear Security Enterprise as a whole.

Drawing on experience from the 2007 negotiations for each of these sites, the protective force contractor at SRS determined at the time that it had sufficient numbers of in-house qualified non-union personnel to manage a strike by the unionized work force. NNSA successfully managed the 44-day Pantex strike during April-May 2007 through the use of protective force supervisors, non-union protective force personnel from other DOE sites, and Office of Secure Transportation (OST) Federal Agents.

The need for protective force contractors to anticipate problems and work toward solutions to address potential bargaining issues prior to such an undesirable state is obviously the favorable path. Barring that, the following measures generally describe some of the options that could be considered in order to maintain security during a multi-site work stoppage by protective force personnel:

- Eliminate staffing of protective force posts and patrols that do not have direct bearing on, or contribute significantly to, protection system effectiveness for special nuclear material.
- Mobilize all non-union protective force-qualified personnel (i.e., protective force supervisors) and place them on posts/patrols as described above.
- Reduce or eliminate non-mission related protective force activities at DOE and NNSA sites with active CBAs, and deploy non-union protective force personnel from those sites to the affected locations to allow for the largest possible strike contingency force to be deployed across the affected facilities.
- Reduce or suspend nuclear material transport operations nationwide and deploy OST Federal Agents to the fixed sites to augment resident non-union protective forces.
- Reduce or suspend operations at the affected sites to enable consolidation and lock down of target material into the fewest and most readily defensible storage locations possible.

47. OVERSIGHT OF SAFETY AND SAFETY CONTROLS ON MOX

Question: The Government Accountability Office (GAO) has expressed concerns regarding the oversight of the MOX project, particularly safety and safety controls. Department of Energy headquarters oversight of the project, according to the GAO, needs to be strengthened. Are you taking actions to strengthen oversight?

Answer: Yes, the National Nuclear Security Administration and the Office of Health, Safety, and Security are taking actions to strengthen oversight of the MOX project. NNSA has conducted numerous reviews of the MOX facility safety systems including the design and fabrication of nuclear process systems, safety computers, process piping, the emergency diesel generator, ventilation systems along with the structural steel, steel foundations and concrete for the MOX facility structure. All of the recommendations and the comments resulting from these reviews have been incorporated and resolved.

HSS is in the process of implementing actions to improve nuclear safety oversight of nuclear facilities in response GAO recommendations. However, it is important to recognize that independent assessments at the MOX project are established in our oversight policies as a lesser priority than for many other facilities, such as the Waste Solidification Building, because in this case the Nuclear Regulatory Commission has the responsibility for regulatory oversight. HSS assessments conducted at the MOX project would be of the nature of internal corporate oversight/support.

48. PLUTONIUM FEEDSTOCK FOR THE MOX PLANT

Question: The construction of the Mixed-Oxide Fuel Fabrication Facility is well underway at the Savannah River Site. This facility will produce fuel for commercial nuclear reactors from surplus weapons-grade plutonium. The MOX plant requires feedstock in the form of plutonium oxide. There are concerns that an insufficient amount of feedstock will be available when MOX begins operations. Are you confident sufficient feedstock will be available when the MOX plant begins operations in 2016?

Answer: DOE's planned Pit Disassembly and Conversion Facility (PDCF) would begin operations after the start-up of the Mixed Oxide (MOX) Fuel Fabrication Facility. To fill the feedstock gap, DOE is disassembling surplus pits and using the Advanced Recovery and Integrated Extraction System (ARIES) at the Los Alamos National Laboratory to produce at least two metric tons of plutonium oxide for the MOX facility. DOE is also pursuing: (1) processing non-pit material suitable for MOX facility feedstock currently being managed by Office of Environmental Management at the Savannah River Site, (2) working with nuclear utilities interested in irradiating MOX fuel to adjust the quantity and timing of initial fuel deliveries, and (3) starting limited processing in a proposed project in K Area at the Savannah River Site to produce early feedstock for the MOX facility.

DOE continues to monitor the situation closely and is moving as quickly as possible, consistent with sound project management principles, to provide a production-scale capability to disassemble nuclear weapons pits for subsequent fabrication of the plutonium into mixed oxide fuel.

49.DIRECTION OF NUCLEAR RESEARCH AND DEVELOPMENT

Question: The Administration has made strong statements supporting nuclear power. The investments made in research and development provide a strong indication of where the Administration is headed in terms of the role nuclear power will play in the future. How did you determine the right balance between investing in nearer-term deployment, like small modular reactors, and longer-term advanced concepts?

Answer: The Department's investments are directly tied to our near-term and long-term goals for energy security, economic prosperity and environmental protection, such as reducing greenhouse gas emissions. Our specific investments in nuclear research and development support four main objectives that address challenges to expanding the use of nuclear power, which are: (1) improve the reliability, sustain the safety, and extend the life of current reactors; (2) develop improvements to make new reactors more affordable; (3) develop sustainable nuclear fuel cycles; and (4) understand and minimize the risks of nuclear proliferation and terrorism. We recently provided the *Nuclear Energy Research and Development Roadmap – Report to Congress, April 2010*, which describes these objectives, activities and milestones in detail.

Our investments in the near-term will produce meaningful results that can improve the safety and performance of the existing commercial nuclear power fleet and facilitate the development of evolutionary reactor technologies, such as Small Modular Reactors. We are also currently pursuing innovative advancements that can dramatically improve the economics, safety, proliferation resistance or waste management aspects of future commercial reactor and fuel cycle technologies in the long term.

50. INTERNATIONAL LEADERSHIP IN ADVANCED NUCLEAR CONCEPTS

Question: In terms of research and development, how is the United States positioned in terms of advanced nuclear concepts, such as Generation IV technologies?

Answer: The U.S. has considerable experience and technical expertise in several advanced reactor concepts and nuclear technologies. The Budget invests in research and development in a balanced portfolio of nuclear technologies and includes funding under RE-ENERGYSE to support nuclear scholarships and fellowships. Notably, the Budget also funds a new Nuclear Energy Enabling Technologies program designed to encourage the development of transformative, "outside-the box" solutions across the full range of nuclear energy technology issues. This effort will cover the full nuclear technology spectrum. This portfolio will help ensure that we maintain progress on key, cutting edge technology

Question: What needs to be done to strengthen the U.S. position?

Answer: The portfolio of activities included in the 2011 Budget will help strengthen our base of knowledge and expertise in a wide range of nuclear energy technology areas, including advanced concepts.

As industry builds new plants, the U.S. will continue to build our capabilities. The combination of cutting edge research and industry's build-out of new facilities can help spur breakthroughs that define technical leadership and provide young researchers the tools needed to establish expertise in their fields. Industry will also rebuild the capabilities, infrastructure and workforce it needs to design, fabricate and install the components, systems and structures. Also, we must continue to encourage and promote innovation. By harnessing the knowledge and creativity of America's national laboratories, industry and academia, we can assure future global leadership in advanced nuclear energy technologies.

51. SMALL MODULAR REACTORS

Question: The fiscal year 2011 request included \$39 million for Small Modular Reactors (SMR). Small, modular Light Water Reactors, based on proven technology, have the potential to provide carbon-free nuclear power while addressing financing, supply chain, construction, and grid-capacity challenges associated with larger reactors. What potential role do you see SMRs play in terms of their overall contribution to new nuclear construction in the next ten years?

Answer: Based on our discussions with SMR vendors, utilities, other end-users and the Department of Defense, DOE believes that there may be market potential for SMRs in the U.S. We also believe that there is a market for larger nuclear power plants, particularly in areas where electrical demand is sizable and the necessary infrastructure (*e.g.*, grid system, existing nuclear power plant site, security, water supply) for larger plants exists. Depending on the assumptions and the technology, SMRs may be more commercially viable in those areas of the country where electrical demand is lower, utilities need to replace aging fossil plants, or financing of larger nuclear plants is problematic.

Question: What role do you envision the Department playing in advancing SMRs – *e.g.*, cost-sharing research, licensing, and/or demonstrations?

Answer: DOE is scheduling an SMR Workshop on June 29-30, 2010, to solicit information from interested parties and stakeholders on SMR priorities, activities and projects to inform the development of DOE's SMR Program that will begin in FY 2011. As noted in the Budget, the Administration will evaluate potential priorities in the context of the appropriate Federal role to identify the most cost effective, efficient, and appropriate mechanisms to support further development. The SMR program is not a demonstration project. The program will support research on a range of issues related to advanced design concepts to support development of SMR technologies.

52. PLUTONIUM-238 PRODUCTION RE-START

Question: The National Aeronautics and Space Administration requested \$15 million for the Plutonium-238 (Pu-238) restart project that matches the \$15 million requested by the Department of Energy. The question is why should the Department of Energy be paying this large of a percentage when it is not the primary end user?

Answer: DOE is responsible for maintaining the national capability to support the development, production and safety of radioisotope power systems for national security and space exploration missions, as required. These systems require Pu-238. Although NASA is expected to be a primary user of Pu-238 produced in the near future, this capability will also be available to support future national security applications.

The proposed DOE-NASA funding allocation properly acknowledges the Department's mission to maintain a national capability for a range of Federal users and its responsibility to manage efforts related to the safe and secure production of special nuclear material. Considering DOE's role in this project, the fact that the production capability will be entirely DOE-owned and other factors, the Administration believes the proposed cost sharing arrangement between DOE and NASA is the most appropriate scenario.

53. RECOVERY ACT REPROGRAMING FOR RESIDENTIAL CONSUMPTION SURVEYS

Question: Mr. Secretary, in January the Department of Energy notified Congress that it would reprogram \$8 million of Recovery Act money to the Energy Information Administration to expand funding for its residential energy consumption survey.

Under what authority did the Department reprogram these Recovery Act funds? The Recovery Act allows the Department of Energy to reprogram some funds for the purposes of “management and oversight” of Recovery Act programs. How, exactly, does a nationwide energy consumption survey qualify as management and oversight, when the intent of the reprogramming authority was clearly to allow the Department to direct funds toward staffing and other resources needed to implement the Recovery Act programs?

Answer: The funds were transferred under section 403 of Division A of the American Recovery and Reinvestment Act of 2009 (Recovery Act), as amended. That section allows the Secretary to transfer funds from Recovery Act appropriations for “management and oversight activities.” (The Department has examined the relevant Appropriations Committee legislative reports and has not been able to locate any expression of congressional intent regarding section 403 to restrict the use of the transfer authority provided in that section to “staffing and other resources needed to implement the Recovery Act programs.”)

The Department determined that the increased scope of the 2009 Residential Energy Consumption Survey (RECS) was important to understanding and managing the effects of the large-scale influx of appropriated funds for energy efficiency programs in the Recovery Act. The expanded data collection will capture more households participating in government and utility energy efficiency programs, including but not limited to weatherization assistance. In addition, EIA will be able to collect energy expenditure data for the winters of 2008/2009 and 2009/2010. The enhanced baseline data from the tripled survey sample size will be compared with the results from the next quadrennial residential survey, currently scheduled to cover 2013 data, thus allowing the Department to better understand the energy consumption effects that this funding subsequently has on energy efficiency efforts nationwide. These data will provide much needed information which will be vital for performance measurement, effective management, and oversight of the funds by the Department, the Inspector General, the Administration and the Congress. Transparency is a key part of the Department’s implementation of the Recovery Act. EIA is committed to applying this principle to the 2009 RECS, as it does to its whole energy information program, so that it can be of assistance to all users of its data.

Question: As I understand it, this residential energy consumption survey began last month. To date, the Department indicates that about 40,000 homes had been weatherized by the end of 2009 with Recovery Act money. When last I checked, there were around 130 million households in the United States. How, Mr. Secretary, can this survey credibly be considered “oversight” of the weatherization program when only three hundredths of one percent of the households surveyed would have had anything to do with the weatherization program?

Answer: As noted in the previous answer, data collected on the 2009 residential survey will serve as baseline information which can subsequently be compared with data from the next

survey (for 2013) to measure the energy consumption impacts of the residential energy efficiency programs funded in the Recovery Act. The tripling of the sample size will allow for the collection and dissemination of State-specific data for 15 States instead of the usual four (California, Florida, New York, and Texas)--plus data for Census Regions--thus enhancing the usability of the data for program management and oversight purposes. The sample is carefully designed to provide for statistically-valid results, including data on households that have and have not received government assistance for energy efficiency improvements. It should also be noted that the RECS program staff consulted with a number of key stakeholders and data users with an interest in the design of the survey questionnaire, including several DOE laboratories and the Office of Energy Efficiency and Renewable Energy.

54. ENDING FOSSIL ENERGY SUBSIDIES

Question: The Administration announced an end to fossil energy subsidies. Ending them will encourage investment in renewable technologies, according to the Administration. The Department's oil and gas research and development budgets were terminated on these grounds. Yet, coal research and development was not considered a subsidy. Can you explain your logic?

Many of the recipients of the oil and natural gas research funding were academic institutions and laboratories. Why did the Administration determine cutting this research as consistent with cutting subsidies to the private sector?

Answer: Clean air is important to everyone and climate change will be a major environmental challenge for the 21st century. In September 2009, President Obama proposed and, with other G20 leaders, committed to "phase out and rationalize over the medium term inefficient fossil fuel subsidies while providing targeted support for the poorest. Inefficient fossil fuel subsidies encourage wasteful consumption, reduce our energy security, impede investment in clean energy sources and undermine efforts to deal with the threat of climate change." Fossil Energy coal research is focused on developing technologies to reduce greenhouse gas emissions to the atmosphere from power plants by increasing operating efficiencies and improving the cost and performance of carbon capture and storage technologies. We are developing a spectrum of technologies to evolve coal into a low-carbon energy source that is economically competitive in 2020 and beyond.

The decision for the Office of Fossil Energy to not request funding for oil and gas research and development is based on the nature of the research and development activities not the type of competitively selected awardees.

55. 10-YEAR DEPLOYMENT GOAL FOR CARBON CAPTURE AND STORAGE

Question: On February 3, the President directed that a government-wide strategy be developed in 180 days for fielding carbon sequestration technologies within ten years. The Department has requested approximately \$400 million for carbon sequestration research and development. Demonstrations project are supported by \$3.4 billion of Recovery Act funding. Is the fiscal year 2011 request sufficient to move the nation toward the President's goal?

What can we expect in the years ahead in terms of the Department's carbon capture and storage research agenda?

Answer: The approximately \$400 million requested for carbon capture and storage (CCS) related research and development will support advances in capture technologies, the efficiency of advanced power generation systems, and CO₂ storage technology. Research on a variety of post combustion capture technologies will help reduce the costs of post-combustion capture to the program's target of only a 35% increase in the cost of electricity compared to a system without CCS. The development of more efficient advanced power generation systems, along with the development of advanced pre-combustion technology, aims to meet the program's goal to bring down the cost of a CCS system for the pre-combustion capture systems such that there is only a 10% increase in the cost of electricity compared to a similar system without capture. Additionally, storage research is developing the technology needed for the safe and effective permanent storage of CO₂ in the subsurface. Lower cost capture and safe and effective storage both support the President's call for a "proposed plan to overcome the barriers to the widespread, cost-effective deployment of CCS within 10 years, with a goal of bringing 5 to 10 commercial demonstration projects online by 2016."

56. PRIORITIZING GOALS FOR LOAN GUARANTEE PROGRAM

Question: DOE has identified multiple goals for the LGP. For example, DOE's most recent budget request says that the program is important for promoting innovation in the energy sector, helping to develop the capacity to confront the challenges that climate change poses, jumpstarting the construction of new nuclear reactors, ensuring the affordability of energy, and bolstering the competitiveness of the United States in global energy markets. How is DOE prioritizing these ambitious goals and, as a practical matter, using them to select which projects to support?

Answer: Since issuing its first conditional commitment in March of 2009, as of April 1, 2010, the Loan Guarantee Program has closed one loan guarantee and issued conditional commitments in support of seven projects. Projects supported by the Loan Guarantee Program reach conditional commitment and ultimately financial close based on each project's ability to fulfill the requirements outlined in the Energy Policy Act of 2005, its Final Rule and the relevant solicitation.

Question: What differences are there between DOE's priorities for projects supported under the Recovery Act and those supported by the program as originally authorized?

Answer: There are several key differences between the original Title XVII legislation and the objectives of the Recovery Act. Title XVII—specifically section 1703—originally authorized DOE to guarantee loans for projects that use new or improved technologies and avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases. Projects under the Recovery Act are limited to , renewables, transmission, and leading edge biofuels, are required to begin construction by the end of FY 2011; and to pay wages at or above market rates. The appropriated subsidy and other changes in the Recovery Act lower barriers to entry. Additionally, sunset provisions require a rapid deployment of funds to meet Recovery Act objectives.

The LGPO accounts for the goals and objectives of the Recovery Act specifically in each of the solicitations released under the program. Under the FY2009 combined solicitation for 1703 and 1705, those projects qualifying under both programs are logically processed under the 1705 program to make available to the applicants the appropriated subsidy payments.

Question: How will you measure progress and ensure that the program is on track to achieve its goals?

Answer: The LGPO will measure progress through the performance measures that were included with the FY 2011 Budget.

57. DELAYS IN ADHERING TO PLANNED SCHEDULE

Question: According to the LGP's Program Specific Recovery Plan, which was developed during your tenure, DOE's Loan Guarantee Program planned to make a minimum of 21 conditional commitments for projects supported under the Recovery Act by the end of 2009. Instead, the department made a total of 4 conditional commitments, 2 of which were for projects that the Department had been reviewing since 2006. We understand that DOE has done somewhat better in issuing loan guarantees under the Advanced Technology Vehicles Manufacturing Program. What explains the LGP's difficulty in adhering to its plan? What steps are being taken to address the sources of delay in the LGP?

Secretary Chu: The Loan Guarantee program had substantial achievements in 2009 issuing four conditional commitments and closing the first loan guarantee in September. The Program Specific Recovery Plan was based on best estimates at the time, developed very early in the planning process.

58. STEPS TO USE ARRA FUNDING BEFORE EXPIRATION

Question: DOE's proposed budget states that the Department intends to obligate 100 percent of its Recovery Act funds by the end of fiscal year 2010. Given DOE's difficulty in issuing the number of conditional commitments it had planned, what steps are being taken to ensure that the LGP will issue enough loan guarantees to use the funding authority provided under the Recovery Act before the September 30, 2011 date, at which time this funding authority expires?

Answer: The Loan Guarantee Program has a robust pipeline of projects eligible for appropriated credit subsidy under the Recovery Act and able to meet the Recovery Act requirement to begin construction by September 30, 2011. In addition, the Loan Guarantee Program has two open solicitations and continues to receive applications from eligible projects.

59. PROGRAM CHANGES UNDER NEW EXECUTIVE DIRECTOR

Question: In February 2009, you announced an initiative to make DOE's process for issuing loan guarantees faster, simpler, and more accountable. In November, you named a new Executive Director to oversee both the loan guarantee program and the Advanced Technology Vehicles Manufacturing loan program and to accelerate the application review process for both programs. What specifically has changed since then? Please submit documentation of these changes for the record.

Answer: The Loan Guarantee Program is a high priority for the Department, and it is receiving the attention and resources needed to be successful. Reporting directly to me, the new Executive Director was brought on-board to streamline and accelerate the application review process, identify the best projects, evaluate them in a timely fashion, and negotiate good, financially sound deals on behalf of the American people. We have addressed a number of the internal challenges and continue to improve and refine our processes. For example, we have re-designed and streamlined the organization, creating sector-specific deal teams. An open solicitation under the Financial Institution Partnership Program focuses on conventional renewable energy generation. We shortened our intake and screening procedures, and are now in the process of automating and standardizing the application submission process. In 2009, we increased our staff, and as a result, program underwriting capacity and efficiency have increased. These efforts are now bearing fruit. Since November, we have made conditional commitment offers in support of five projects, and have a robust pipeline of other projects. We are in the process of redesigning our website.

60. INEQUITIES BETWEEN REVIEW PROCESSES FOR DIFFERENT TECHNOLOGIES

Question: Earlier this month, you were asked by our colleagues in the other body about differences in the way applicants are treated by the Loan Guarantee Program. According to the solicitations issued by the department, the application review process differs by the type of technology. For example, applicants with nuclear power generation projects received a ranking from DOE before submitting the full application fee, while applicants with coal-based and other types of projects did not. We also understand that applicants with some types of technologies were allowed to brief DOE and explain their projects after submitting their applications while others were not, potentially denying them the opportunity to clear up misunderstandings about their projects. On March 4, you said you would look into these apparent inequities. What have you found?

Answer: DOE strives to treat all applicants on an equitable basis. DOE understands that communication with applicants is critical as they seek to make business decisions. While the ultimate decision to issue a loan guarantee rests with the Department, DOE endeavors to provide early and thorough feedback to help all applicants make informed decisions regarding their application.

61. ESTIMATES FOR CREDIT SUBSIDY COSTS

Question: Given how substantial the credit subsidy fees can be for applicants—an average of about 12 percent of the loan guarantee amount, according to DOE planning documents, and potentially more for some applicants—when in the application process are you giving applicants estimates? For existing applicants, how long have they waited and how much money have they generally spent before receiving these estimates? How precise are these estimates? Please provide us with documentation about whether and when existing applicants have received estimates of their credit subsidy costs and what the ranges of these estimates have been.

Answer: Self-pay applicants can receive an estimated Credit Subsidy Cost, given as a range, early in the loan guarantee process. The Department has developed a process to provide estimates to applicants at key points in the application process. The intent of this process is to provide applicants with estimates of the likely cost so that they can use them for planning purposes. DOE produces early range estimates for self pay applicants under 1703

The length of the due diligence process depends on the completeness, robustness and simplicity of the project. During this period, companies pay all associated legal and contractor fees, which are comparable to costs assumed for equivalent work in the private sector, and vary widely across technology sectors.

62. 2011 REQUEST TO COVER CREDIT SUBSIDY COSTS FOR ENERGY EFFICIENCY
AND RENEWABLE ENERGY

Question: In the fiscal year 2011 budget proposal DOE requested \$500 million to cover credit subsidy costs for energy efficiency and renewable energy projects eligible under Section 1703. If appropriated, does DOE plan to use those funds to cover credit subsidy costs for projects that are currently under review or for projects that apply under a new solicitation? If the latter, how does DOE justify requiring certain projects, particularly energy efficiency projects, that applied earlier to incur substantial subsidy costs if they are chosen for loan guarantees that the government would cover for similar projects that applied later?

Answer: If Congress should approve the Department's 2011 budget request for \$500 million in appropriated credit subsidy to support important innovative energy efficiency and renewable energy projects not currently eligible for support under the Recovery Act, the Loan Guarantee Program will evaluate projects currently in the pipeline to determine their eligibility for this appropriated credit subsidy. This approach was taken after passage of the Recovery Act, and several projects were determined to be both innovative and ready for rapid deployment. The Loan Guarantee Program could also issue new solicitations targeted to energy efficiency projects. \$500 million in credit subsidy is estimated to support \$3 to \$5 billion in loan guarantees.

63. USEC APPLICATION

Question: In August 2009, after DOE asked USEC to withdraw its application, DOE and USEC agreed to delay the review of USEC's application for up to 6 months before making a final decision. To date, no decision has been announced about USEC, and Areva seems to be in a holding pattern. What is the reason for the delay in making a decision on these applications? Given that each applicant has requested the entire amount available under the solicitation, will DOE's decision to support one project result in a de facto decision about the amount available to the other? Does DOE have the potential to issue more than \$2 billion in loan guarantees for such projects, and if so, what is the source of its loan guarantee authority?

Answer: In response to a June 30, 2008 solicitation for federal loan guarantees supporting Front End Nuclear Facilities, the Department received two applications for federal loan guarantees to support two different front-end nuclear facility projects. In total, the two applicants requested DOE to provide loan guarantees in excess of the \$2 billion of available authority..

On March 25, 2010, the Department sent a reprogramming request to the appropriate Congressional Committees notifying them of DOE's intention to use up to \$2 billion of the FY 2007 Authority, made available to the Department under the Revised Continuing Appropriations Resolution, 2007, for front end nuclear fuel facilities. The balance of the FY 2007 Authority will remain available for loan guarantees for eligible project applicants under the 2006 Solicitation for fossil, energy efficiency and renewable energy systems projects that employ innovative technologies.

64. REQUIREMENTS FOR BIOFUELS APPLICANTS

Question: The biofuels industry has complained that, in order to receive a loan guarantee, DOE is requiring that biofuels projects obtain long-term agreements from buyers to purchase the fuel. While we understand that DOE has a duty to mitigate project risk, as the Renewable Fuels Association noted in a letter to Secretary Chu, “that is not how the U.S. transportation fuels market functions.” As a result, only subsidiaries of major oil refining companies are likely to be able to secure long-term off-take agreements, essentially precluding many companies from receiving a loan guarantee. Given that DOE has said that new cellulosic ethanol facilities will be essential to meet the new renewable fuel standard, what, if anything, is DOE doing to resolve industry concerns that the program is not adequately supporting the development of such technologies?

Answer: The Department of Energy Loan Guarantee Program was authorized by the Energy Policy Act of 2005 to issue loan guarantees to eligible projects that have a “reasonable prospect of repaying the principal and interest on their debt obligations.” While third-party supply and/or off-take agreements are not mandatory to satisfy the statutory requirement that the project have a reasonable prospect of repayment of the principle and interest of the guaranteed loan, they are factors which are taken into consideration. For projects that are not supported by third-party supply and/or off-take agreements, the projects need to establish that a viable market exists for the product produced by the projects. The Loan Guarantee Program is working closely with the Renewable Fuels Association to facilitate dialogue with the biofuels companies. As a result of this collaboration, on April 7, 2010, the Loan Guarantee Program held a roundtable discussion with members of the biomass community to discuss issues that the industry faces in obtaining a loan guarantee.

65. CREDIT SUBSIDY MODEL

Question: The credit subsidy model is the tool that DOE uses for estimating the subsidy cost for any given loan, that is, the amount the loan guarantee recipient must pay up front to be used in the event of default. For the nuclear loans, some calculations have put this cost at eight percent. The industry believes the rate should be in the range of one percent. Is the department and OMB evaluating the credit subsidy costs the same for nuclear loans as they are for all other loans?

Answer: DOE's Credit Subsidy Cost estimation methodology conforms to the requirements of the Federal Credit Reform Act of 1990. The LGPO conducts its review on a loan by loan basis and the specific credit subsidy score for each loan guarantee is based on project specific factors, including risk, contract terms, and other factors. There is no "one size fits all" score.

66. DEPARTMENT-WIDE PATH FORWARD

Question: The cyber security environment is a challenging one that is getting more so every day. Threats both domestically and abroad threaten the integrity of U.S. Government computer systems. The Department of Energy has a large national security mission operating alongside a variety of energy and clean-up missions. This adds to the challenge of developing and maintaining the integrity and security of the Department's computer systems. What have you accomplished to date and what major efforts are contained in the fiscal year 2011 request that will improve the Department's cyber security? How are these efforts being coordinated across program offices and with the National Nuclear Security Administration?

Answer: The Office of the Chief Information Officer (OCIO) is working on an effort to re-examine the DOE's Cyber Incident Response Capability (DOE-CIRC) to ensure that it provides the necessary services required by its customers and enhance its current operations. The OCIO has completed a number of operational cyber security initiatives related to incident detection and management and continues to provide ongoing cyber security support services to the Department, including NNSA. One such initiative is the Cooperative Protection Program (CPP), a network of sensors that provides coverage at over 80 sites in DOE, with about a dozen more planned during fiscal years 2010 and 2011. The CPP enables scanning at the network perimeter at DOE plants, laboratories, sites, and program offices to detect anomalous events and permits an enterprise-wide view of threats and vulnerabilities. It fosters an advanced situational awareness posture to alert other sites within DOE of events that have been detected elsewhere. OCIO has also begun implementation of a Cyber Threat Focused Operations (CTFO) team to provide DOE with a centralized capability to identify, track, categorize and mitigate the most serious cyber threats, namely, those likely to cause grave damage to DOE and national security. CTFO operates under the Department's Enterprise Incident Capability (EIC), performing deconfliction, situational awareness, and trending, correlation and visualization of specific cyber threats including targeted intrusions, nation-state cyber threats, and ongoing departmental cases. CTFO interfaces with the National Interagency Joint Task Forces and other similar groups in the National Capital Region to exchange threat information. Additionally, CTFO supports DOE and NNSA threat handlers and incident managers by providing data in weekly cyber security threat meetings that connect dozens of sites via secure telecommunications.

The FY 2011 budget request will enable the OCIO to continue to enhance its cyber security program with the continuation of the efforts outlined above, along with providing ongoing services and functions pursuant to the Federal Information Security Management Act. This includes planning and executing an annual cyber security training conference, attended by nearly 600 cyber security and IT professionals in DOE; funding specialized cyber security training for DOE and NNSA cyber security professionals; enabling annual and quarterly FISMA reporting and data analyses (which will develop into monthly reporting in FY 2011); and providing tools and services that facilitate cyber security certification and accreditation and support continuous monitoring requirements. It will enable the continued maintenance and enhancement of CPP, which will include the upgrade of approximately one third of the sensors to state-of-the-art technology that keeps pace with network speeds and the latest threat detection and analyses. DOE's FY 2011 budget request also supports continued enhancement of CTFO resources to provide better analytical capabilities to our threat analysts to keep up with detection and tracking

of increasingly capable adversaries who are also using ever more sophisticated tools and techniques.

67. ELECTRIC TRANSMISSION AND DISTRIBUTION SYSTEM CYBER SECURITY

Question: Cyber security has been an increasing concern for the nation's electricity transmission and distribution system, at a time when cyber attacks have increased worldwide and our power grid and homes are becoming increasingly network-connected. Last year, the President, with you in attendance, made clear that cyber security is a government-wide priority, and that was reflected in the increase in last year's budget request for electric grid cyber security research and development. This year's request, while still significantly above the 2009 level, cuts the activity to below last year's level.

What is the Department doing to safeguard the grid from cyber attacks as we move towards modernizing it?

Answer: To reduce the risk of energy disruptions due to cyber attack on control systems, the Department's Office of Electricity Delivery and Energy Reliability (OE) created the National SCADA Test Bed (NSTB) Program in 2003. By fostering partnerships between the government, the energy sector, and national laboratories, the program continues to develop, integrate, and sustain control systems security improvements through next-generation R&D, vulnerability assessments and mitigation, risk analysis, and industry outreach.

NSTB is a unique national resource that draws on the integrated expertise and resources of the Argonne, Idaho, Los Alamos, Oak Ridge, Pacific Northwest, and Sandia National Laboratories. This partnership combines state-of-the-art operational system testing facilities with expert research, development, analysis, and training to discover and address critical security vulnerabilities and threats the energy sector faces. Recognizing that collaboration with end users early on enhances project success, NSTB projects ask vendors, asset owners, and industry organizations to participate as advisors or research partners to ensure projects deliver applicable results.

In 2006, the Department (in collaboration with the Department of Homeland Security and Natural Resources Canada) joined forces with industry vendors, asset owners, and technology developers to establish a framework of goals and milestones to achieve a common vision: that in 10 years, control systems will be designed, installed, operated, and maintained to survive an intentional cyber assault with no loss of critical function. The resulting *Roadmap to Secure Control Systems in the Energy Sector* (January 2006) has been a guiding force for industry and government partnerships and projects. More than 21 public and private organizations have aligned their work in more than 60 projects to Roadmap goals, and we have made progress toward several milestones. The NSTB was one of the first organizations to align its R&D efforts with the Roadmap. The Department also helped establish the Energy Sector Control Systems Working Group—comprising 13 industry and government control systems experts—to oversee the Roadmap implementation and measure progress.

Recognizing that more work remains to reach the vision in a changing technology, threat, and regulatory environment, more than 80 stakeholders have come together to update the Roadmap's

goals and milestones for the next ten years. Under current plans the updated Roadmap be released in 2010.

To accelerate the development of next-generation control systems, DOE supports five industry-led, cost-shared projects selected through a competitive solicitation process. These projects work closely with NSTB labs and other private-sector partners to develop and commercialize tools and technologies that can make real and immediate impacts on energy sector cyber security.

Recognizing the importance and urgency of cybersecurity standards for the smart grid, in May 2009 the Department partnered with the UCA International Users Group (UCAIug), Consumers Energy, Florida Power & Light, and Southern California Edison and launched the Advanced Security Acceleration Project - Smart Grid (ASAP-SG) specifically to accelerate the development of cybersecurity standards for the smart grid. ASAP-SG is developing a set of security profiles, each containing a baseline set of security controls for a given smart grid application. These profiles can be used by utilities and vendors to improve the security of smart grid applications and implementations. They provide actionable guidance to utilities, vendors, and government entities on how to build cybersecurity into smart grid components in the development stage, and how to implement those safeguards when the components are integrated into the power grid. The ASAP-SG guidelines are vendor-neutral and are applicable to any smart grid architecture.

Question: If this is such a high priority, why does the 2011 request lower funding for cyber security research and development?

Answer: The funding reduction in FY 2011 reflects the successful completion of several industry-led projects and one-time funding for National Electric Sector Cyber Organization in FY 2010. The Department remains committed to addressing cyber security threats to ensure a secure, reliable, and modernized electricity grid, and the FY 2011 request supports a robust program that includes utilities, universities, academia, and vendors to enhance the cyber security of the nation's energy infrastructure.

Question: What is the current level of threat of cyber attacks to the electric power grid? As we take steps to modernize the grid and connect it to information networks, at what point will this threat escalate?

Answer: As an active member of the intelligence community, the Department continuously monitors, analyzes, and shares information on the capabilities and nature of the cyber threat. As a result, we believe we have a reasonably good understanding of the capabilities and nature of the cyber threat. That being said, it is clear "we do not know what we do not know" and there currently is no complete, integrated picture. The Department will continue to work with other U.S. government organizations and the private sector to develop a more complete picture.

68. SCIENTIFIC INTEGRITY AND POLICY DECISION-MAKING

Question: In the fiscal year 2010 appropriation bill, Congress directed that the Blue Ribbon Commission consider "all alternatives to nuclear waste disposal." We used this language because I am primarily concerned about the scientific integrity of the review. I want to make sure the Nation is on the best possible path for disposing of its nuclear waste.

The President issued a memo to his cabinet on March 9, 2009 on Scientific Integrity. In this memo, the President directs that, "Political officials should not suppress or alter scientific or technological findings and conclusions." Can you assure the Subcommittee that you intend to follow this direction with regard to the actions you are taking while the Blue Ribbon Commission conducts its review?

Answer: I can assure you that I intend to follow the President's direction, and I can assure you that the Blue Ribbon Commission's scientific and technical findings and advice will not be suppressed or altered by political officials.

69. BLUE RIBBON COMMISSION

Question: In the charter for Blue Ribbon Commission (BRC), one of its objectives is to evaluate "Options for permanent disposal of used fuel and/or high-level nuclear waste, including deep geologic disposal." As written, this should include the Yucca Mountain repository. The charter also makes several references to "such other matters as the Secretary deems appropriate." Has the BRC been directed to not consider Yucca Mountain? If so, by whom?

Answer: The Commission is not and was never intended to be a siting Commission. Rather, pursuant to the Charter, it is to conduct a comprehensive review of all potential policies for managing the back end of the nuclear fuel cycle and to provide advice, evaluate alternatives (which we would expect would include geologic repositories), and make recommendations for a new plan to address these issues. Yucca Mountain is not being considered by the BRC.

Question: If the BRC is not going to recommend any particular site for the repository, but is simply going to recommend different options for long-term storage and disposal - isn't that where we are today? Don't we already know what these options are?

Answer: While we may know of some possible options and alternatives, the Commission is chartered to conduct a comprehensive review of all potential policies for managing the back end of the nuclear fuel cycle and to provide advice, evaluate alternatives, and make recommendations for a new plan to address these issues. The Charter does not prescribe what form that plan should take. The Department awaits the outcome of the Commission's comprehensive evaluation, advice and recommendations on a new plan to address these important matters.

70. STAKEHOLDER REPRESENTATION ON THE BLUE RIBBON COMMISSION

Question: The members of the Blue Ribbon Commission (BRC) bring together an interesting variety of expertise and experience. However, we have a few questions about the representation. Which member or members of the BRC represent the interests of the Department of Energy's cleanup sites such as Hanford, Idaho, and Savannah River that are holding spent fuel and radioactive waste slated for disposal in the repository?

Which member or members of the BRC represent the interests of the decommissioned reactors in the United States?

Which member or members of the BRC represent the interests of the U.S. Navy and of the Department of Energy site currently storing all of the spent fuel from naval reactors?

Answer: The Secretary of Energy was directed by the President to establish the BRC for the purpose of conducting a comprehensive review of policies for how to best manage the back end of the nuclear fuel cycle, including all alternatives for the storage, processing, and disposal of civilian and defense used nuclear fuel, high-level waste, and materials derived from nuclear activities. In selecting members of the BRC, DOE considered the mission of the advisory committee, the cross-section of those affected or interested in the committee's recommendations, the types of perspectives that are required, the need for divergent points of view, and the geographic relevance to the development of the advisory committee's recommendations. DOE sought members with expertise in how to manage the back end of the nuclear fuel cycle and representatives of organizations that would be affected by the recommendations. The broad experience and expertise of the BRC members lead to a balanced advisory committee.

71. THE CHANGING REALITIES OF NUCLEAR WASTE MANAGEMENT

Question: In defending Yucca termination, you have cited the changing realities and science of waste management. The motion to withdraw the Yucca Mountain license application from the Nuclear Regulatory Commission states, "It is the Secretary of Energy's judgment that scientific and engineering knowledge on issues relevant to disposition of high-level waste and spent nuclear fuel has advanced dramatically over the 20 years" since Yucca Mountain was initiated. You have asserted how technologies and times have changed since the decision was made that Yucca would be the nation's deep geological repository. Please describe for the Committee the aspects of nuclear waste management that have changed since the selection of Yucca Mountain as the repository site. You have stated there are better ways to manage nuclear waste, and the Commission will surely report on this. But, not for another two years. Could you explain in more detail what some of those ways are?

Answer: Fortunately, over the past two decades scientists and engineers in our country and abroad have learned a great deal about effective strategies for managing the back end of the fuel cycle. In my judgment the scientific and engineering knowledge on issues relevant to disposition of high-level waste and spent nuclear fuel has advanced over the twenty years since the Yucca Mountain project was initiated. I believe future proposals for the disposition of such materials should thus be based on a comprehensive and careful evaluation of options supported by that knowledge, as well as other relevant factors, including the ability to secure broad public support, not on an approach that has not proven effective over several decades.

72. THE SCIENTIFIC BASIS OF YUCCA TERMINATION

Question: Since the Administration has moved to terminate the Yucca Mountain program, the Administration has substantiated the decision by citing a better understanding of the science behind a geologic repository.

One issue which the Department has included in its justification for termination is excessive water intrusion. Scientists at Sandia have previously concluded that the hydrologic conditions provided by Yucca's desert-like environment do in fact meet the million-year performance requirement, as well as other the stringent EPA and NRC standards. And, it's my understanding that DOE has even responded to previous NRC questions on this matter, and has done so satisfactorily. Furthermore, there was an international peer review which backed up these findings. Finally, in August 2008, you and many of your fellow lab directors from across the Nation signed onto a document called "A Sustainable Energy Future: The Essential Role of Nuclear Energy". One tenet is of particular interest to me, and I'd like to read it in its entirety:

"Employ an integrated approach to manage used nuclear fuel and high-level waste, including interim storage, licensing of the Yucca Mountain Repository as a long-term resource, and exploration of optimal future waste management options."

- That document I just cited was penned a mere 18 months ago. How is it that suddenly now the integrity of the scientific review of the past 20 years is being called into question?
- When you talk about the water intrusion issue, it would seem that you are in possession of evidence that would wholly contradict earlier studies completed by Sandia and the international peer review of the hydrologic conditions at Yucca Mountain. What body of research are you citing? Can you please furnish a summary of this work to the Committee?
- Decades of analysis have been conducted and documented by your peers, and validated by other independent, international peer review. Is it your scientific opinion that Yucca Mountain is unsafe?

Answer: Scientific and engineering knowledge on issues relevant to disposition of high-level waste and spent nuclear fuel has advanced over the 20 years since the Yucca Mountain project was initiated. And we believe we can find a better solution that achieves a broader national consensus. That is why we have convened the Blue Ribbon Commission on America's Nuclear Future; it will provide advice and make recommendations on alternatives for the storage, processing and disposal of civilian and defense used nuclear fuel and nuclear waste. The Commission plans to issue an interim report in 18 months and a final report within 24 months of its inception.

73. PRESERVING THE SCIENTIFIC KNOWLEDGE OF YUCCA MOUNTAIN

Question: Given the decades of study and over \$10 billion investment into Yucca, it is a priority to preserve the scientific knowledge involved in the project to inform the future solution that will likely include a waste repository. In a recent reprogramming notification, the Department planned to shift fiscal year 2010 funds from licensing to closure activities, including archiving and workforce transition. Can you assure the Subcommittee it is a priority to preserve all scientific knowledge involved in the work on Yucca Mountain? Are funds requested in fiscal year 2011 to preserve the scientific knowledge? If so, how much funding has been requested?

Answer: Yes, I can assure you that scientific knowledge will be preserved. Records generated by the Office of Civilian Radioactive Waste Management in the course of activities at Yucca Mountain are managed and archived in accordance with the requirements of the Federal Records Act and related regulations. Paper and electronic media records that have been currently archived are stored at several National Archives and Records Administration Federal Records Centers (FRC) under FRC regulations, as well as in a DOE-leased facility in Las Vegas. In addition to records on paper and electronic media, images of records are electronically maintained in our Records Information System and DOE's documentary material relevant to the Yucca Mountain licensing proceeding is electronically available on Licensing Support Network.

74. REDUNDANCY IN CLIMATE MODELING ACROSS THE GOVERNMENT

Question: The budget request for the Department of Energy's Office of Science includes expanded climate modeling efforts. I understand that various other federal agencies also fund climate modeling and observation programs, including the National Oceanic and Atmospheric Administration, the Environmental Protection Agency, the National Science Foundation, the National Aeronautics and Space Administration, several national laboratories, and federal other [*sic*] agencies.

What have you done to ensure that the Department of Energy's climate modeling efforts are not redundant with activities in other federal agencies? How do we know these activities are not redundant?

Answer: DOE climate modeling activities are coordinated with other federal agencies through the U.S. Global Change Research Program (USGCRP). The Department's representative is Dr. Anna Palmisano, director of the Biological and Environmental Research (BER) program. Through the USGCRP, the Department is a very active participant in the interagency process, working diligently with other agencies to coordinate climate research and develop effective approaches for answering critical scientific questions and minimizing redundancies. The Department is also active in interagency groups at the program manager level, working on modeling and simulation efforts with such other agencies as the National Oceanic and Atmospheric Administration (NOAA), the Environmental Protection Agency, the National Science Foundation (NSF), and the National Aeronautics and Space Administration (NASA). DOE modeling projects are seamlessly integrated with the rest of the DOE climate programs and leverage the high performance computing and computational resources of our Advanced Scientific Computing Research (ASCR) program. Joint funding with ASCR supports the SciDAC program, which focuses on computational science bottlenecks that need to be overcome to achieve sustained peak performance when undertaking climate simulation on high-performance computing platforms. SciDAC projects bring together interdisciplinary teams of climate scientists, mathematicians, computer scientists, and computational scientists to advance climate science in a collaborative environment.

Question: How can DOE's climate modeling programs productively collaborate with and complement the other federal efforts and what are you doing to make sure this happens?

Answer: There are several examples of interagency collaborations. Last month NSF and the Departments of Energy and Agriculture announced the launch of a joint research program to produce high-resolution models for predicting climate change and its resulting impacts. We have a long-standing activity of co-funding the Community Climate System Model (CCSM) project with NSF. Both our program managers and investigators are active members of the CCSM Steering Committee and CCSM working groups. Using the CCSM process, DOE investigators have markedly improved physical process representations in models, including atmospheric chemistry and physics, oceanic (including sea ice) physics, and biogeochemistry. For example, the next generation atmospheric model includes several DOE supported modules that include new aerosol and cloud representations, which are high priority targets of model improvement. We also have strong ties with both NOAA and NASA modeling programs. We recognize the

national importance of improving climate simulations, and strongly support this coordinated effort among the agencies.

Additionally, DOE seeks community input for its planning activities. To this end we have conducted several workshops to identify those high-priority science questions that the climate research community believes DOE should address. Reports from these workshops include *Science Challenges and Future Directions: Climate Change Integrated Assessment Research* (November 2008); *Scientific Grand Challenges, Challenges in Climate Change Science and the Role of Computing at the Extreme Scale* (November 2008); *ARM Climate Research Facility Workshop Report* (October 2008); and *Ecosystem Experiments, Understanding Climate Change Impacts on Ecosystems and Feedbacks to the Physical Climate* (April 2008).

75. RE-ENERGYSE AND EDUCATIONAL INITIATIVES ACROSS THE DEPARTMENT

Question: The budget request proposes \$50 million for RE-ENERGYSE, a program that would include kindergarten through graduate school education components and workforce training to build the country's clean energy workforce. Last year, this Committee expressed concern that the proposal for RE-ENERGYSE in the 2010 budget request failed to take into account the redundant activities embedded within offices in the Department of Energy and across all federal agencies. (S-3/S-4)

Mr. Secretary, have you identified all educational and workforce training activities spread throughout the Department of Energy in addition to RE-ENERGYSE?

Please provide for the record a crosscut of all educational and workforce training activities across the Department in the 2011 budget request

Answer: Yes, the offices of Science, Energy and NNSA have all conducted studies of the Department's educational and workforce training activities.

(\$ in thousands)			
Program Name	Sub-Agency	Program Type	FY11 Budget Rqst (in Thousand ds \$)
Academies Creating Teacher Scientists (DOE Acts)	Office of Science/WDTS	K-12 Programs	4,200
Computational Science Graduate Fellowship (CSGF) Program	Office of Science/ASCR	Graduate/Postgraduate Programs	6,000
SC Graduate Fellowship Program	Office of Science/WDTS	Graduate/Postgraduate Programs	15,000
Science Undergraduate Laboratory Internship	Office of Science/WDTS	Undergraduate Programs	4,150
ACS Summer School in Nuclear and Radiochemistry	Office of Science/BES, BER, NP	Undergraduate Programs	561
Albert Einstein Distinguished Educator Fellowship	Office of Science/WDTS	K-12 Programs	1,000
AMS Industry/Government Graduate Fellowship	Office of Science/BER	Graduate/Postgraduate Programs	25
Annual Meeting of Nobel Laureates and Young Scientists	Office of Science/BES, ASCR, BER, HEP, NP, FES, WDTS	Graduate/Postgraduate Programs	240
Argonne National Laboratory National School on Neutron and X-ray Scattering	Office of Science/BES	Graduate/Postgraduate Programs	216

ASCR - ORNL Research Alliance in Math and Science	Office of Science/ASCR	Undergraduate Programs	250
Atmospheric Research Measurement (ARM) K-12 Educational and Outreach Program	Office of Science/BER	K-12 Programs	250
Conference on Undergraduate Women in Physics	Office of Science/HEP & NP	Undergraduate Programs	18
Exotic Beam Physics Summer School	Office of Science/NP	Graduate/Postgraduate Programs	15
Fusion Energy Sciences Fellowship Program	Office of Science/FES	Graduate/Postgraduate Programs	600
Global Change Education Program	Office of Science/BER	Undergraduate Programs	-
Hopkins Microbiology Course	Office of Science/BER	Graduate/Postgraduate Programs	-
International Accelerator School for Linear Colliders	Office of Science/HEP	Graduate/Postgraduate Programs	51
Italian Student Exchange Program	Office of Science/HEP	Graduate/Postgraduate Programs	88
Los Alamos National Laboratory Neutron School	Office of Science/BES	Graduate/Postgraduate Programs	35
Marine Biological Laboratory Summer Course	Office of Science/BER	Graduate/Postgraduate Programs	-
Mineralogical Society and Geochem Society Short Courses	Office of Science/BES	Graduate/Postgraduate Programs	10

National Science Bowl	Office of Science/WDTS	K-12 Programs	2,100
Pre-Service Teachers (PST)	Office of Science/WDTS	K-12 Programs	450
QuarkNet	Office of Science/HEP	K-12 Programs	750
SLAC Summer Institute	Office of Science/HEP	Undergraduate Programs	10
Summer of Applied Geophysical Experience (SAGE)	Office of Science/BES & BER	Undergraduate Programs	65
United States (U.S.) Particle Accelerator School	Office of Science/HEP	Graduate/Postgraduate Programs	632
High Performance Computer Science and Applied Mathematics Graduate Fellowship (HPCSAM) Program	Office of Science/ASCR	Graduate/Postgraduate Programs	2,000
Pan American Advanced Studies Institutes (PASI)	Office of Science/BES	Graduate/Postgraduate Programs	200
Advancing Precollege Science and Mathematics Education	Office of Science/FES	K-12 Programs	220
Community Partnerships - Educator PD, student research internships	Office of Science/FES	K-12 Programs	245
Fusion Energy Sciences Postdoctoral Research Program	Office of Science/FES	Graduate/Postgraduate Programs	750
Fusion/Plasma Education	Office of Science/FES	K-12 Programs	155

National Undergraduate Fellowship Program in Plasma Physics and Fusion Energy Sciences (NUF)	Office of Science/FES	Undergraduate Programs	370
Plasma Physics Summer Institute and Contemporary Physics Education Project (CPEP)	Office of Science/FES	K-12 Programs	170
Minority Involvement in Nuclear Physics	Office of Science/NP	Graduate/Postgraduate Programs	100
Ultrafast X-ray Summer School	Office of Science/BES	Graduate/Postgraduate Programs	20
CARE California Alliance for Radiotracer Education	Office of Science/BER	Graduate/Postgraduate Programs	18
Hampton University Graduate Studies (HUGS)	Office of Science/NP	Graduate/Postgraduate Programs	45
Wonders of Physics Traveling Show	Office of Science/FES	K-12 Programs	61
American Physical Society/Division of Plasma Physics Distinguished Lecture Program	Office of Science/FES	Graduate/Postgraduate Programs	25
Faculty and Student Teams	Office of Science/WDTS	K-12 Programs	1,200
High School Engineering	Office of Science/WDTS	K-12 Programs	400
Lab Equipment Donation Program	Office of Science/WDTS	K-12 Programs	200
Community College Institute of Science and Technology (CCI)	Office of Science/WDTS	Graduate/Postgraduate Programs	600
Integrated University Program	NA-22	Graduate/Postgraduate Programs	15,000

Integrated University Program	Nuclear Energy	Outreach/ Financial assistance Programs	-
RE-ENERGYSE	Nuclear Energy	Outreach/ Financial assistance Programs	5,000
Higher Education	RE-ENERGYSE	Post Secondary Programs	35,000
Technical Training, Education and Outreach	RE-ENERGYSE	K-12 and Community College Programs	15,000
Methane Hydrate Research Fellowship	FE (NETL)	Graduate/Postgraduate Programs	450
Mickey Leland Energy Fellowships	FE	Undergraduate / Graduate Programs	700
Minority Mentoring and Internship Program (MMIP)	FE (NETL)	Undergraduate Programs	400
Minority University Research Assistantships (MURA)	FE (NETL)/ Office of the Under Secretary	Undergraduate Programs	800
Technical Career Internship program	FE	Undergraduate Programs	700
NETL Research Associate Programs	FE (NETL)	Undergraduate / Graduate Programs	4
NETL STEM Teacher Development	FE (NETL)	K-12	25
NETL K-12 Student Programs	FE (NETL)	k-12	25

76. OVERLAP BETWEEN RE-ENERGYSE AND OTHER FEDERAL ACTIVITIES

Question: Other federal agencies have had long-standing education and workforce initiatives, for example, to increase the number of students going into science, technology, engineering, and math through fellowships and scholarships—essentially the same model as RE-ENERGYSE.

Mr. Secretary, how does RE-ENERGYSE overlap with similar activities at other federal agencies, such as the National Science Foundation, Department of Education, and Department of Labor?

Please provide for the record specific areas of overlap between the RE-ENERGYSE proposal and other federal agencies, including agency names, program names, and current funding levels.

Answer: DOE will collaborate with the National Science Foundation (NSF) and other Federal agencies on the RE-ENERGYSE energy education initiative explicitly to leverage existing resources and expertise from these agencies. In addition to the DOE/NSF relationship, DOE is consulting and working closely with the Department of Education (ED), the Department of Labor (DOL), and the Office of Science Technology and Policy (OSTP) to achieve a strategic, and non-duplicative, government integrated energy education program.

As part of the Administration's agenda to grow, improve, and "scale up"² the Nation's Science, Technology, Engineering, and Math (STEM) education programs, RE-ENERGYSE will partner with NSF to take advantage of their deep knowledge and successful track record in administering science and technology focused education and training programs, including the Advanced Technological Education (ATE), Graduate Research Fellowship (GRF), and Integrative Graduate Education and Research Traineeship (IGERT) programs. For this reason, many of DOE's proposed RE-ENERGYSE programs closely resemble those run out of NSF in structure but will differ in content, by focusing exclusively on energy systems education; whereas NSF programs support a broad array of science and technology disciplines. In this way RE-ENERGYSE programs won't overlap NSF programs, but respond to very targeted gaps and needs in current energy education and training efforts.

Similarly, working with DOL, RE-ENERGYSE's community college technical training activity will compliment, rather than overlap with, DOL's "Green Innovation Fund" program. DOE recognizes that the future low-carbon energy economy workforce will require a wide variety of new skill sets and corresponding training opportunities. By working together, DOE and DOL will ensure that each program responds to a particular workforce training need without duplicating efforts. To this end, via an existing DOE/DOL/and ED MOU, DOE and DOL will

² "Preparing Our Children for the Future", Executive Office of the President and Department of Education joint press release, February 1, 2010: www.whitehouse.gov/sites/default/files/stem%2011%20final.pdf

consult one another while developing energy themed technical training and community college funding solicitations.

Although ED has yet to develop programs specifically focused on energy systems education, the two Departments will work closely to advance the shared goal of improving the Nation's STEM education, to which energy systems education is closely tied. ED requested \$450M in FY 2011 to grow and improve STEM education. Their Effective Teaching and Learning and Investing in Innovation programs will focus on deepening STEM education research and methods to assess and deliver STEM materials. Operating through the MOU, DOE will continue to consult and work with ED to share information while developing funding opportunities. The success of this relationship has already been shown by the Department's collaborative work on ED's upcoming "Educating for a Green Economy" Summit, as well as working to develop an energy efficiency/sustainability career pathway.

During the past year, DOE has also established strong relationships with the other education and technical training agencies and is committed to continuing these crucial partnerships to prepare the current and upcoming generation of energy systems professionals to enter the workforce. These efforts will be coordinated through an interagency approach to ensure that current programmatic strengths are maximized without duplicating efforts.

77. HOW WOULD RE-ENERGYSE WORK WITH OTHER AGENCIES

Question: In a time when we want every federal dollar to be spent well, I am particularly concerned about creating redundant activities and expertise across Department of Energy offices, and across federal agencies. Now, no one I know would claim that the DOE's core mission and expertise is education and workforce training. How would RE-ENERGYSE work with other agencies that already do education and workforce training as part of their core mission?

Can you explain the logic behind creating a new education and workforce development program in DOE, an agency whose expertise is research and development, when other agencies have been the experts in this area for decades?

How would RE-ENERGYSE use the expertise in other agencies for this type of program, rather than create duplicative expertise for administering activities such as fellowships and scholarships to university and post-doctoral students?

Answer: It is the intention of RE-ENERGYSE to leverage the administration and operation best practices already in place internal to DOE and through the National Science Foundation (NSF). DOE currently administers a variety of successful education programs throughout the DOE complex- from the Office of Science (SC), the National Nuclear and Security Administration (NNSA), and from the Energy Offices. To support current programs, robust administration and evaluation infrastructure and processes are already in place. RE-ENERGYSE will utilize the existing office operations of SC, Nuclear Energy (NE), and the Office of Energy Efficiency and Renewable Energy (EERE) to administer the newly proposed applied science education programs.

The partnership between the NSF and DOE is designed to combine our greatest resources: NSF's successful track record in administering research and education programs and DOE's subject matter expertise in energy systems. DOE RE-ENERGYSE proposes key activities that closely resemble many of NSF' education programs: Graduate Research Fellowships, Advanced Technological Education, Science Masters Program, and others expressly to take advantage of successful program models that are already in place.

78. REQUEST FOR AN ADDITIONAL ENERGY INNOVATION HUB

Question: The 2011 budget request includes \$34 million to establish a new energy innovation hub focusing on batteries and energy storage, which the Department proposes as a commitment of at least \$130 million over five years. We funded the first three energy innovation hubs in the fiscal year 2010, and these hubs are not very far into their research—in fact, the site, host organization, size, and shape of all three new hubs still haven't been decided. I don't yet have any evidence that these three new hubs will work and can attract the top talent, why are you asking for another hub?

Answer: The Energy Innovation Hubs are a key part of the Department's integrated research and development strategy to accelerate the progress of science and technology for the discovery and commercialization of energy breakthroughs. The Hubs address the most critical strategic R&D areas with a cross-disciplinary program spanning from research to development of technologies that can be quickly commercialized. However, the Hubs are not designed to tackle subsequent demonstration, deployment, and commercial scale-up. Their high level of concentrated investment and centralized, hands-on management model ensure a higher probability of accelerated success.

The schedule for soliciting, selecting, and standing-up a Hub is driven by the fact that these are major, merit-based competitions, which typically require 9–12 months to complete. While none of the Hubs has yet been awarded, the Department is requesting one additional Hub in its FY 2011 budget request. This fourth Hub will focus on Batteries and Energy Storage—an area that the Department believes is clearly ready for transformational advances if the latest science can be coupled with translational engineering and which would open large new markets for U.S. manufacturing and enhance competitiveness.

Question: In the 2010 appropriations act, this Committee directed the Department of Energy to deliver a report sixty days after enactment describing the Department's plan for implementing and measuring performance of the three new energy innovation hubs. To my knowledge, we still haven't received this report, and here we are 147 days after the law was enacted. What is the status of this report, and if you have not delivered us this report describing your plan for the first three hubs, how can you expect us to fund a fourth hub?

Answer. I would like to apologize for the delay in providing you with the requested Hubs implementation report. The report was provided to the Committee on April 9, 2010.

Question: We have heard the justification before that the hubs funded in the fiscal year 2010 are not really the first hubs at the Department, but that the Joint BioEnergy Institute (JBEI), for example, is proof that hubs will work. But it seems to me that JBEI is not a good example: JBEI studies a topic in a location where three national laboratories, two top universities, and a top research institution are all close by. This seems like a rare occasion where you can truly get all the top minds under one roof. How can we know if these hubs will see the same success and can even attract more than a few top researchers, until we, at the least, wait for them to materialize?

Answer: The Hub encourages co-location of researchers to facilitate close research integration. The vision for the “ideally under one roof” concept emphasizes the importance of research integration to the success of a Hub. To be successful, a Hub must achieve a high level of R&D integration and communication among its researchers, who will span multiple scientific and engineering disciplines. Forceful centralized scientific management is a key ingredient. Numerous historical examples have demonstrated that in order to keep researchers working effectively towards a common goal, an empowered and skillful scientist-manager must have the ability to make clear and timely decisions based on scientific and technical realities as they evolve in real-time.

While JBEI largely involves co-location of researchers under one roof, all three Bioenergy Research Centers have the forceful and active central management that is essential to rapid progress—and the significant scientific advances achieved by each of the three Centers in their first two years are testament to this leadership. The Department expects each Hub to have the same key elements to ensure its success: a clear lead institution with strong scientific leadership and central location for the Hub; to the extent that there is geographic distribution of the Hub participants, a clear commitment to the use of state-of-the-art technology and frequent virtual meetings to enable meaningful long distance collaboration; and, most importantly, a clear organization and management plan for achieving the collaborative and synergistic goals of a Hub and infusing a culture of empowered central research management throughout the Hub.

79. ENERGY EFFICIENT BUILDING SYSTEMS HUB AND ENERGY REGIONAL INNOVATION CLUSTER

Question: In the funding opportunity announcement for the Energy Efficient Building Systems hub, the Department proposes to partner with other federal agencies to locate the hub within a "regional innovation cluster", which I believe is a group of companies focusing on a single industry in one geographical region. As technology transfer-getting innovations out of these labs and into companies and consumer markets-has been particularly challenging for DOE for decades, this seems like an interesting idea. Can you explain how this regional innovation cluster partnership came about, how it will work, and how you think it will help?

How will the regional innovation cluster factor in to your selection process for the hub? Will a group of companies be co-sponsors of the applications? And will this approach favor regions that already have companies doing building efficiency work?

Answer: The Energy Research Innovation Cluster, or E-RIC concept is focused on developing networks of building-technology stakeholders in order to nurture and deliver solutions for energy-efficient buildings systems. To do this, the structure of the Hub and the encompassing cluster is designed to minimize or eliminate barriers that normally exist between early-stage research, applied research, commercialization, and deployment of new technologies. Working at the regional scale allows the E-RIC to reach a critical mass and unlock accelerated technology development and deployment in building systems. The results from this accelerated technology pipeline will ultimately have national and international benefits.

The Department will select the Hub applicants that best meet the technical merit evaluation criteria identified in the Funding Opportunity Announcement: Scientific and Technical Merit of the Project, Qualifications of Personnel and Adequacy of Resources, Management/Integration Plan, and Technology and Innovation Transfer Plan (available at http://www.energy.gov/hubs/documents/ERIC_FOA.pdf). The top tier Hub proposals will then be evaluated by the interagency review panel based on the regional innovation cluster (RIC) evaluation criteria: Demonstration of RIC Best Practices; Long-Term Economic Benefit; Commitment, Competency, and Track Record of E-RIC Personnel; Commitment to Inclusion; Commitment to Developing a Skilled Workforce; Demonstration of Environmental and Energy Security Objectives; Feasibility of the Project Budget and Adequacy of Facilities.

While the E-RIC will have a primarily regional focus, DOE explicitly allows the formation of strategic partnerships with entities outside the geographic region. It is anticipated that the projects will include existing companies as Hub members and cluster partners, and will create an environment in which small businesses and start-up companies can flourish.

80. MEASURING SUCCESS OF NEW RESEARCH AND DEVELOPMENT INITIATIVES

Question: One of the challenges we face as a Subcommittee is deciding which types of research and development models to fund. Unfortunately, we have no data pointing to the relative success of the old and the new models at DOE, including ARPA-E, energy frontier research centers, energy innovation hubs, and the traditional styles of work at the national labs and through the basic and applied R&D offices. Since the Department is just now establishing three new models—ARPA-E, EFRCs, and hubs—this seems like a critical time to think about how we'll measure the performance of each type of research model in 1, 2, 5, and 10 years from now.

How will you measure the success or failure of each of these new models?

Answer: Although the funding and management modalities are different for the new ARPA-E, EFRC, and Hub models, the principles of the review and performance measurement processes will be the same as those for other research and development activities supported by the traditional funding models for basic and applied research. For example, the Department's general guidelines for merit review for financial assistance are available at <http://www.management.energy.gov/documents/meritrev.pdf>. The Department has extensive experience at reviewing and managing large, multidisciplinary research activities, including laboratory programs, university centers, and large user facilities for operations and science productivity. Collectively, the codified guidelines and management experience will help establish the performance benchmarks and metrics to measure the progress and gauge the success or failure of each of the new models.

Question: What resources are you putting towards developing serious, intelligent, and deliberate ways to measure the long-term performance of these programs?

Answer: The Department has long experience reviewing and managing large, multidisciplinary research activities to assess the quality of the operations and the productivity of the science. Once awarded, each project is subject to project management and merit review tools to track and measure progress towards the approved benchmarks and program goals over the duration of the award.

For example, in the case of EFRCs, evaluations will be based on reviews by independent expert peers who will assess each Center's scientific productivity, impact, and management. In addition, annual progress reports will provide a synopsis of accomplishments and data on publications, collaborations, inventions and new technologies, databases produced, software created, and instrumentation developed. The Departmental program office managing each Hub will establish oversight and review practices for its Hub similar to those governing the other Hubs. To measure the success of ARPA-E and its investments, ARPA-E is establishing both near- and long-term metrics of success. In the near-term, it is critical to establish a strong foundation and hire top-notch individuals at all levels and positions within the organization. Through ARPA-E's innovative organizational structure, it is currently hiring program directors that span science, technology, and business and are given autonomy and resources to pursue high-risk technological projects and start and stop these projects based on performance and relevance. During the early years of an award, a few of the metrics that ARPA-E will track are follow-on

funding received by ARPA-E awardees, world-record technological performance, patents filed and licensed, the number of new companies and industries formed, jobs created by new and existing industries affected by ARPA-E's innovation. Longer term, ARPA-E will look beyond the local performance of the performers and examine their investments in terms of their national economic impact on U.S. industries. A few of these metrics would include domestic and global sales, the influence on the U.S. market share and technological lead, and the number of innovative ecosystems that have been built. Furthermore, ARPA-E will measure the effects on the environment and track the reduction in greenhouse gas emissions and oil imports.

81. FIX THE EXISTING PROGRAMS RATHER THAN ADDING ON NEW ONES

Question: Mr. Secretary, much of the discussion in the last year about research and development programs at the Department has been about new programs we're starting, rather than about doing the hard work to fix the existing programs we have in place where in fact most of the funding still goes. In your opinion, what is not working in the existing basic and applied R&D programs and the national labs if our goal is to create innovations and get them out into the market place, and what are you doing to fix these problems?

Answer: The Office of the Under Secretary of Energy has several initiatives underway that can help the applied R&D programs improve strategic planning and management and better target resources to promote innovation. An initiative that focuses on R&D excellence is a joint effort with the Office of the Under Secretary for Science as we look for better integration of the basic energy discoveries and their pathways to application. The stepping stone for R&D excellence initiative is topic prioritization in the programs and its connection to budget justification. Under this initiative, topic selection and planning processes are to address the most effective ways of ensuring a continued input from the stakeholders (including industry, national labs and academia) and the review of the programs and funding applications (via peer review) that will leverage input from the accomplished and distinguished members of the technical community. Strategic planning for technological path assessment will allow for multiple scenario exploration to achieve the President's CO₂ reduction goals. The execution of the program priorities will be looking to the justifiable alignment of funding opportunities with the strategic goals and relevant technology benchmarks relative to the sector they are addressing. For this to be accomplished we are working on recruiting and retaining the best federal program managers; we will also look to leverage the technical talent from outside the federal government who are willing to serve on short rotations in our programs. To support decision-making, we are working with the CFO to improve IT systems to get real time data on funding, program performance, recipients, project lifecycle, and other elements in an interactive dashboard to provide managers and senior leadership with key information. To help get innovations faster into the marketplace we have increased award sizes for Phase I and Phase II grants under the Small Business Innovation Research Programs and placed renewed emphasis on this program.

82. STRATEGIC PLANNING

Question: In a tightening budget climate, strategic planning becomes increasingly important. Difficult decisions need to be made about resource allocation. Strategic planning that clearly defines the Department's objectives supports resource allocation decisions. What is the status of your strategic plan?

Answer: The Department's senior leadership has drafted a strategic plan outline which establishes the Department's Strategic Goals, Objectives and Initiatives. This draft outline is being vetted with the Secretary of Energy and Under Secretaries and will be made available shortly as the Department begins to structure its FY 2012 budget and SES performance plans.

Question: Which organizations in the Department are leading the effort?

Answer: The Secretary of Energy is leading this effort along with the Deputy Secretary and the three Under Secretaries of Energy, Science and Nuclear Security. The process is being coordinated by the Chief Financial Officer.

83. FIVE-YEAR BUDGETING

Question: Mr. Secretary, five-year budgeting would provide an opportunity for in-depth program oversight. Without five-year budgeting, the budget formulation process has a less predictable structure with unnecessary battles over budget resources repeating year to year. The National Nuclear Security Administration already implements five year budgeting in the form of its Outyear Funding Profile. Do you have plans to implement five-year budget planning across the Department?

Answer: I believe that considering five year budget implications provides useful guidance for internal formulation and planning and the Department is making significant strides in that direction.

A more in-depth internal consideration of multi-year budget implications will offer the Department many advantages including enhancing transparency and improving long-term planning. We are currently establishing a Department-wide budget formulation and execution system that will be better able to build and track five year budget plans.

84. PLANNING, PROGRAMMING, BUDGETING AND EVALUATION

Question: A Planning, Programming, Budgeting and Evaluation process links resource decisions to a deliberative planning process for the Department. In short, it strengthens budget justifications. Last year, the Department stated it would implement a limited Planning, Programming, Budgeting and Evaluation (PPBE) process in fiscal year 2011 and a full PPBE process in fiscal year 2012. Is this still the case? What is the status of this effort?

Secretary Chu: I am fully committed to the wise use of the Department's resources. Since becoming Secretary, I have focused significant attention on ensuring the American Recovery and Reinvestment Act (ARRA) funds are spent appropriately and quickly. I have also directed my Chief Financial Officer (CFO) to make significant improvements in the base budget process leveraging many of the best practices from ARRA funds tracking. The CFO has made a number of improvements. Key examples including: 1) a financial transparency initiative to improve budget formulation through funds execution and 2) an Office of Cost Analysis lead effort, recently established within the Office of the CFO to improve tracking of multi-year projects in the Department's budgeting system. While we are in the early stages of implementing a truly integrated Planning, Programming, Budgeting, and Evaluation (PPBE) process, I believe the Department has made significant progress in all four of these areas:

- **Planning:** The foundation of an effective budget process is a Strategic Plan based on the President's vision of restoring U.S. scientific leadership; developing a clean economy; lowering greenhouse gas emissions; and reducing nuclear dangers. The plan will clearly articulate the goals of the Department and provides clear prioritization of these goals to the Energy, Science and National Security Programs. I have taken the time to develop this plan and am pleased to report that I now have a final draft that accomplishes these goals which is being used to inform the FY 2012 budget formulation.
- **Programming:** The Departmental-level policy guidance was issued to the Programs in the CFO Program Resources Memorandum (PRM) to inform their budget development. I have also taken steps to improve the Department's ability to address significant issues in the budget development. The CFO has worked with the respective Under Secretaries to stand up issue teams to conduct analysis and develop program options that will be reviewed by the Deputy's Resource Board (DRB) to be considered for the FY2012 budget.
- **Budgeting:** The Department is taking steps to improve the way it budgets. Improvements include closer connection with the strategic plan and consideration of current funds available and life-cycle costs when assessing requests for new funding. This will allow me, in consultation with senior management, to make better informed FY 2012 program and budget decisions. The CFO has also made notable IT system investments in the Budget Execution Formulation Module (BEFM) to improve integration across the budget systems.
- **Evaluation:** The Department's CFO is building on improvements in evaluating the use of ARRA funds to inform the way the Department assess the use of base funding. The CFO

has established quarterly execution reviews to provide DOE senior leadership tools to address underperforming programs. In the near future, these reviews will be used to inform future budget requests and reprogramming requests to other Departmental needs and priorities.

In sum, the Department has made substantial progress in how we manage the nation's energy resources.

85. BATTERIES AND ENERGY STORAGE REDUNDANCIES

Question: Mr. Secretary, the Department proposes in this budget an energy innovation hub to study batteries and energy storage. At the same time, ARPA-E has plans to fund batteries and energy storage research and development, the Office of Electricity Delivery and Energy Reliability more than doubles its energy storage R&D, and the Office of Energy Efficient and Renewable Energy is funding additional work on the same topic.

In a time of tight fiscal constraints, why do we have so many redundancies across the Department?

How have you arrived at the relative amount of funding that each of these offices and initiatives receives?

This is in fact not just about batteries and energy storage. This seems representative of a bigger problem at the Department: across all of the program offices, and the different research and development models like ARPA-E, EFRCs, and the hubs, there may be significant redundancies in research without the benefit of collaboration between the different research groups and award recipients. How are you ensuring that there isn't duplication and redundancies across the various offices and research models, and how are you ensuring that there is collaboration and communication between these different groups if there is purposeful duplication?

Answer: On the energy storage questions, the Department does not have redundancies, but rather complementarities. Energy storage consists of many different technologies for many different applications. Each program office supports projects consistent with its mission and the stage of technology development. Funding levels for each program are developed to be consistent with each program's long-term goals and the goals of the Department. For example, the Office of Energy Efficiency and Renewable Energy Vehicle Technologies Program aims to reduce the production cost of high power 25kW batteries for use in passenger vehicles to \$500 by the end of 2010. To achieve this goal, the lithium ion battery technology being pursued has relatively long storage times and low power. The Office of Electricity Delivery and Reliability is funding research and demonstrations on energy storage systems that can help with electricity system load regulation, ramping, or peak shaving, which have various energy storage duration and power requirements. Depending on the application, appropriate technologies may include, for example, flywheels, super capacitors, sodium sulfur batteries, or compressed air.

The Department has formed an Energy Storage Principals Working Group consists of relevant Departmental senior leadership. A staff level working group meets more frequently to coordinate day-to-day activities. The program offices share detailed project listings and participate in review of each other's new and ongoing projects. They also share information on upcoming Funding Opportunity Announcements and support joint workshops to identify gaps and barriers.

On the question about potential duplication among various funding mechanisms, the Department has launched a concerted trio of R&D efforts to accelerate the normal progress of science and

technology for energy research. It is important to point out the differences and coordination between EFRCs, Hubs, and ARPA-E:

- EFRCs focus on small teams exploring basic science issues.
- Hubs will ideally be located under one roof and will bring together a diverse team of researchers spanning basic and applied. Their work will have a common goal, but will require addressing multiple challenges in a coordinated and focused way. The Hubs are modeled after the Office of Science Bioenergy Research Centers.
- ARPA-E is modeled after DARPA, i.e. it will invest in high-risk/high-payoff time-bound projects focused on combining various science and engineering discoveries and inventions into energy technologies with potentially commercial impact.

The feedback loop, coordination and leveraging between EFRCs, Hubs and ARPA-E is critical. The scientific discoveries and inventions made in EFRCs and Hubs could lead to ARPA-E technologies with significant commercial impact. A historical example of this is the invention of the transistor leading to integrated circuits – this translation required both science and engineering of devices and manufacturing. Furthermore, it is important to note that during this translation, one may encounter major technical barriers, which will require going back to science to solve them. Hence, EFRCs and Hubs could leverage off of ARPA-E as well. As mentioned above, the Hubs are designed to ideally be located under one roof. However, if the Hub encounters a technical challenge that the Hub team cannot address, ARPA-E could engage teams from the rest of the nation to help address the challenge and enable the Hub to make progress.

86. TRANSFORMATION OF THE ENERGY SECTOR THROUGH LONG-TERM, HIGH-RISK INVESTMENTS

Question: Mr. Secretary, one of the roles of government is to make the long-term investments that the private sector wouldn't make, and to take the calculated risks on revolutionary innovations that private industry, with its emphasis on short-term profit, is unlikely to take. In the case of energy, these high-risk and long-term investments are in fact quite essential to creating the innovations that can transform our nation to use cleaner, more secure, and more independent sources of energy. How does this budget request make those long-term, high-risk, transformational investments?

Answer: The Department supports long-term, high-risk investments in scientific research and technology development that are essential if we are to transform the way we produce and use energy. The long-term, high-risk, transformative investments requested in the FY 2011 budget take many forms and build upon our core programs.

Scientific research has a number of important roles in a high-tech economy: integrating knowledge about the natural world into robust descriptions useable for engineering applications; developing measurement tools and techniques; training a technically talented workforce; solving problems that arise in the design, manufacture, or operations of complex technologies; and—what is most interesting to scientists themselves—the discovery of new phenomena. The Department's core research programs are an essential basis for long-term energy technology innovation. The Energy Frontier Research Centers and systems biology research on plants and microbes are examples in this category, as the goal is to advance a broad range of scientific knowledge relevant to energy technologies.

Applied and engineering research is optimized to different ends: the translation of scientific knowledge into improved technological concepts and the design, manufacture, and operations of complex technologies that deliver a desired function in an economically viable fashion. Steady incremental progress is often the norm, and industry's ability to exploit new advances agilely is built upon a broad accumulated stock of knowledge. The pressing nature of our energy and climate challenges, however, requires that we place significant emphasis on identifying that subset of opportunities where energy technology innovation could be accelerated and target high-risk transformational investments towards long-term as well as mid-term efforts. To drive this kind of innovation, I have launched the Energy Innovation Hubs and ARPA-E.

The Energy Innovation Hubs are concentrated, directed resources marshaled to support multidisciplinary, goal-oriented research. At \$24 million per year, they are managed by top teams of scientists and engineers with the resources and authority to move quickly in response to new developments. We use the Hubs where we believe a problem is ripe for the side-by-side integration of discovery-oriented scientific research with translational engineering research so that opportunities for commercialization can be seized as early in the development life cycle as possible. For this reason, research supported through a Hub is ideally conducted under one roof. The Joint BioEnergy Institute (JBEI) in Emeryville, CA, one of three DOE Bioenergy Research Centers, is a prototypical example of a Hub. The Department has requested funding in FY 2011 to continue the three Energy Innovation Hubs introduced in FY 2010 focused on developing fuels that can be produced directly from sunlight, improving energy efficient building systems

design, and using modeling and simulation tools to create a virtual model of an operating advanced nuclear reactor—as well as to initiate a fourth Hub to focus on batteries and energy storage. The request for the new Hub is \$34 million, which includes one-time funding of \$10 million for start-up needs, excluding new construction.

ARPA-E is discovery-oriented, but this program is on the hunt for new technologies rather than new scientific knowledge. From the concept feasibility stage to the product development stage, a large gap exists today where many good ideas perish because the concepts cannot be translated into technologies. When these technologies are disruptive and could make today's approaches obsolete, this translation of ideas to technology is too risky both for the private sector and the applied science offices in DOE. ARPA-E's role is to identify and fund research projects that will overcome the long-term and high-risk technological barriers that are preventing a promising and potentially transformational technological innovation from reaching the stage where private investment will take over and turn the technology into a marketable product. Furthermore, ARPA-E's goal is to reduce technological risks at various stages of developing disruptive technologies and to invest in translating such ideas and concepts into these technologies and helping to make them market ready. ARPA-E will invest in multiple disruptive technological approaches to reach the same goal (e.g., high energy density, low-cost batteries for plug-in hybrid vehicles), and then allow the private sector to choose the winning technology based on what is best for business. The FY 2011 budget request includes \$300 million for ARPA-E.

87. KEEPING AMERICAN COMPETITIVE IN THE GLOBAL ENERGY RACE

Question: We have heard plenty of talk in the last year about how countries like China are catching up or taking the lead in energy innovation, manufacturing, and market share for new energy technologies. When I think about American innovation and American jobs 5, 10, or 20 years in the future, I worry about positioning America as a leader to make sure that the jobs in tomorrow's energy sector will be here and not overseas. How does this budget request and the activities at the Department foster the breakthroughs and innovations that we need to keep innovation and manufacturing jobs here in the United States?

Answer: Our FY 2011 budget request of \$28.4 billion invests in basic and applied research and puts us on the path to doubling funding for science, a key presidential priority. To lead in innovation, we are launching Hubs, EFRCs, and ARPA-E to accelerate the normal progress of science and technology for energy research. EFRCs will fund small groups of researchers focused on breakthroughs in science. ARPA-E will fund transformative breakthroughs in technology. Hubs will fund large, multi-disciplinary, highly collaborative teams of scientist and engineers working over a longer time frame to achieve a specific high priority goal.

On manufacturing, our 2011 Budget proposes a new Manufacturing Energy Systems(MES) program within the EERE Industrial Technologies Program. This program is focused on enhancing the competitiveness of America's manufacturers through the rapid innovation of new products and processes to significantly reduce manufacturing energy intensity and carbon emissions. We are also requesting \$55 million to start the RE-ENERGYSE initiative to help educate the next generation of scientists and engineers.

88. CHINESE COMPETITION AND COOPERATION

Question: Secretary Chu has stated several times that China is moving forward quickly and aggressively to advance its clean-tech industry, and that we must act to hold our leadership in the emerging clean energy industries.

How much funding does the Department include in the fiscal year 2011 budget request for cooperative applied R&D programs with China? In what programs and for what purposes are these collaborations included?

We've seen recently an increasing number of American companies partnering with Chinese firms and institutions on energy projects, and more Chinese companies engaging in energy projects in the United States. What advantages, in your opinion, does China offer the United States to attract clean tech investments, and what advantages does the U.S. have?

Answer: Three Program Offices at the Department have cooperative programs with China. Details of these cooperative programs are given below:

Office of Energy Efficiency and Renewable Energy

Approximately \$10 million will be allocated from the International line in Program Support to support the following research and development activities:

- Joint research and development through the U.S.-China Clean Energy Research Center, focusing on electric vehicles and building energy efficiency, with funding to be matched by China and by consortium partners; \$5M
- Implementation of the U.S.-China Renewable Energy Partnership, including renewable resource assessments and cooperation on grid integration, standards, testing, and certification; \$2M
- Implementation of the U.S.-China Ten Year Energy and Environment Cooperation Framework, including cooperation on building codes, appliance and materials standards, testing, and labeling; \$1M
- Cooperation on industrial energy efficiency, including plant assessment, access to financing (e.g., helping industrial facility managers explore various methods of financing retrofits, including through energy service companies), and training and outreach materials; \$1M and
- Cooperation on transportation technologies, including biofuel research and development and electric drive vehicle deployment. \$1M

Office of Fossil Energy

Approximately \$2.5 million will be allocated to support the carbon capture and sequestration (CCS) portion of the U.S.-China Clean Energy Research Center with the following focuses:

- Capture technology, with an emphasis on post-combustion CO₂ capture;
- Storage, use and transport, including: geologic storage capacity estimates, identification and assessment of sources and sinks of CO₂, and techniques for monitoring, verifying, and accounting;
- Integrating plants with CCS, focusing on efficiency and costs; and

- Risk assessment and simulation, including risk assessment methodologies, simulations of CO₂ behavior during storage, and plant simulations.

Office of Science

Approximately \$8 million will be allocated to support the following bilateral activities:

- High Energy Physics: Research and Development of reactor neutrino detector in Daya Bay, China;
- Biological and Environmental Research: Research at the Atmospheric Radiation Measurement Climate Research Facility, and mobile facility deployment in China; and
- Fusion Energy Sciences: Research on the Experimental Advanced Superconducting Tokamak (EAST) reactor in Hefei, China.

Through multilateral collaboration, with a requested budget of \$80 million, the Office of Science is also cooperating with China on the International Thermonuclear Experimental Reactor (ITER) in the area of Fusion Energy Sciences.

Office of Nuclear Energy

China is collaborating with the United States and other countries on research and development of Very High Temperature Reactor systems via the Generation IV International Forum. China is also constructing a gas-cooled pebble bed modular reactor that is substantially similar to one of the designs being considered for the Next Generation Nuclear Plant. China has offered to provide information on their gas-cooled reactor experience through the Generation IV International Forum activities.

For clean technology investors, China is attractive for four primary reasons: 1) a growing domestic market, 2) lower costs, 3) policy incentives (e.g., low interest loans, subsidies, etc.), and 4) faster implementation of large-scale projects. The advantages to investors in the United States are: 1) protected and dynamic environment for innovation, 2) strong R&D infrastructure, 3) mature clean energy technology market, and 4) transparent laws and regulations.

89. OVERSIGHT OF NUCLEAR OPERATIONS

Question: In September 2009, public hearings were held at the headquarters of the Defense Nuclear Facilities Safety Board (DNFSB) on the Department's Implementation Plan of "Recommendation 2004-1, Oversight of Complex, High-Hazard Nuclear Operations." A number of the Department's officials testified at these hearings. DNFSB has noted that a number of the commitments contained in the Department's plan are incomplete. What is the status of your efforts to fulfill these commitments?

Answer: The Department has completed 41 of 48 identified commitments and actions in the Department's implementation plan (revision 2, approved by the Secretary of Energy, October 12, 2006). Significant actions completed include: (1) establishment of Central Technical Officers and support staff; (2) revision of policy directives on the conduct of oversight; (3) implementation of upgrades to the operating experience program; (4) implementation of improvements in recruiting, developing, and retaining DOE federal technical personnel; (5) issuance of updated Quality Assurance Plans and Integrated Safety Management system descriptions for DOE field and headquarters organizations; and (6) establishment of site plans for improving hazardous work planning and feedback and improvement activities. Of the seven actions that remain, two are related to development and issuance of additional guidance for conducting DOE line oversight; two are related to implementing a process for nuclear safety research; two are related to effectiveness of completed activities; and one is related to periodic status briefings. Additional guidance for DOE line oversight is pending review and revision of the existing DOE oversight policy and order, which is ongoing and expected to be completed this year. The Department continues to gain experience with the approach adopted for nuclear safety research that relies on line programs to develop and manage research projects. Effectiveness reviews have been partially conducted but cannot be completed until all plan actions are complete. Periodic status reports to the Board are expected to continue until the Department's implementation plan is complete.

Question: Have roles and responsibilities been clearly delineated on the safety of nuclear operations?

Answer: The Department's roles and responsibilities for safety of nuclear operations have long been established in the Department's Manual 411.1-1C, *Safety Management Functions, Responsibilities, and Authorities Manual*, originally established in 1994 and issued as a DOE directive in 1997. Related to 2004-1 implementation, the Department issued a supplemental directive: DOE Order 410.1, *Central Technical Authority Responsibilities Regarding Nuclear Safety Requirements*, issued August 2007. Also, as part of the 2004-1 implementation, the Department implemented revised protocols for delegation of authorities related to safety responsibilities.

90. NUCLEAR SAFETY RISK ASSESSMENTS

Question: The Department has accepted a Defense Nuclear Facilities Safety Board (DNFSB) recommendation to improve its risk management tools for nuclear safety. Yet, you did not commit to developing a quantitative risk assessment policy. Quantitative risk assessments are a necessary component of a robust Departmental policy on nuclear safety. Why are you not implementing the complete recommendation by the DNFSB? What is your overall plan for improving risk assessments in nuclear safety?

Answer: In accepting the Board's recommendation on quantitative risk assessment, the Department recognized that there are opportunities to clarify DOE's expectations regarding the use of quantitative risk assessment in nuclear safety and possibly improve application of the tool at DOE defense nuclear facilities to better inform nuclear safety decisions.

The Department has an existing Nuclear Safety Policy that addresses risk assessment and risk goals. DOE has committed to revising the Nuclear Safety Policy to address the Department's expectations regarding the use of quantitative risk assessment in nuclear safety. Because quantitative risk assessment is only one tool used in DOE's nuclear safety assurance process, the Department believes that addressing it in the Nuclear Safety Policy is the appropriate course of action. The Department also has committed to completing a study in CY 2010 to determine if additional guidance, standards or other actions are warranted to improve use of this tool in DOE nuclear safety-related decisions.

In addition, to enhance the consistency and quality of quantitative risk assessments used to inform its nuclear safety decisions, DOE has:

- established a risk assessment experts working group to provide technical support and peer review services to DOE line elements responsible for reviewing or conducting quantitative risk assessment, and
- developed and is continuing to develop additional risk assessment training for DOE line elements.

The Department's current hazard-based regulatory approach to nuclear safety decisions is providing protection of the public, workers and environment. The plans for implementing the Board's recommendation are focused on how quantitative risk assessment may be better used to provide insights that might improve DOE's approach to ensuring nuclear safety.

91. STREAMLINING THE OFFICE OF HEALTH, SAFETY AND SECURITY

Question: The efforts to streamline and strengthen the Office of Health, Safety (HSS), and Security are generally supported. The efforts aim to reduce and/or consolidate orders and directives, make reasonable reductions in inspections by Federal employees from headquarters and DOE field offices, and identify efficiencies in how to enforce health, safety, and security policies. Discussions of streamlining, however, do raise concerns about how you are proceeding with these changes. How can you assure the Subcommittee that this is a reasonable tradeoff to make, or a reasonable risk to take?

Answer: The goal of the Office of Health, Safety and Security's (HSS) reform efforts is to improve the efficiency of our operations while continuing to ensure that the Department maintains the highest standards of safety and security at our DOE sites. In reviewing DOE's safety and security directives, we will maintain an appropriately robust set of requirements based on well-established regulatory standards and retain Departmental requirements as necessary to address hazards and activities that are unique to DOE operations. The directives reform will eliminate requirements that are outdated, overlapping, redundant, and unclear, or are of little value in protecting workers, the public, the environment, and national security. The requirements necessary to protect workers, the public, and nuclear materials will be retained.

Question: What evidence can you provide to the Subcommittee that shows that contractor self-reporting of HSS violations will be more accurate, or at least no less accurate, than Federal inspections and oversight?

Answer: With respect to oversight and enforcement, we are refocusing our inspection, assessment, and investigation activities based on a better understanding of risk and performance to specifically target the areas of greatest risk. We will continue to conduct routine independent oversight of higher-hazard facilities and activities. For example, by the end of the calendar year, HSS plans to conduct six independent safeguards and security assessments at DOE and NNSA nuclear facilities, seven security inspections of Field Intelligence Elements and Special Access Programs, six classified information security system inspections, and ten nuclear safety inspections. For lower-risk activities and assets, HSS will conduct independent evaluations when there is evidence of poor or significantly degraded performance or when a contractor has experienced a significant adverse event or accident. Shifting oversight resources previously devoted to evaluating lower-risk operations will increase the resources available to assist line managers in solving difficult problems that have remained unresolved by layers of past oversight.

Question: Over the years, this Subcommittee has seen countless health, safety, and security problems within the DOE complex, and the contractors are rarely held accountable in a serious way. How are you reforming the HSS enforcement mechanism, and how will you hold contractors more accountable for their HSS performance?

Answer: HSS will also continue to execute its Congressionally-mandated enforcement programs based on risk and performance. HSS is working to better define what conditions or events warrant enforcement action and make increased use of the full range of enforcement

outcomes that are available as means to influence contractor behavior. For contractors that exhibit significant but isolated cases of noncompliance, the Office of Enforcement will continue to use the “carrot and stick” approach that provides mitigation and discretion for contractor self-identification and reporting of the noncompliances, and the depth and breadth of the contractor’s investigation and corrective actions. For cases of significant and recurring noncompliances, the Office of Enforcement will continue its practice of escalating penalties using the per-day penalty provisions of the regulations, and closely monitor contractor performance until fully compliant programs are attained. In many cases (except for worker safety and health where it is prohibited), civil penalties are also accompanied by contract fee reductions as a means to hold contractors accountable for inadequate safety or security performance.

The Office of Enforcement will also continue to perform regulatory assistance reviews. These reviews assess whether contractors have established proactive programs to self-identify, critically evaluate, promptly report, and effectively correct noncompliances to prevent recurrence. Contractors that do not demonstrate these attributes are less likely to receive enforcement discretion or civil penalty mitigation.

92. SEISMIC DESIGN OF NUCLEAR FACILITIES

Question: The Defense Nuclear Facilities Safety Board (DNFSB), as well as the Department's own Inspector General, found the Department does not fully consider seismic risks in its design of nuclear facilities. An example is the delays caused at Hanford's Waste Treatment Plant to address the DNFSB concerns. What corrective actions have been taken?

Answer: The Department is committed to ensuring that our facilities are designed, built and operated safely. Over the past several years, DOE has taken major steps in ensuring that safety is fully integrated into the design process

In March of 2008, the Department issued DOE Standard (DOE-STD)-1189, *Integration of Safety into the Design Process*. The Standard establishes a rigorous safety review process that is integrated into all phases of facility design and includes specific requirements for assessing and addressing seismic-related concerns. In November 2008, the Department revised its project management order (DOE Order (O) 413.3A chg.1, *Program and Project Management for the Acquisition of Capital Assets*) to require the use of DOE-STD-1189 for the design and construction or major modification of Hazard Category 1, 2, and 3 nuclear facilities, or projects. DOE is making conforming changes to other DOE directives, such as DOE O 420.1B, *Facility Safety*, to ensure effective integration of safety into the design process for all new nuclear facilities and projects. The DOE-STD-1189 will help ensure the appropriate selection of seismic design criteria for new projects and facilities. For projects in the final design stage or in construction, the standard will be used to guide the format and content for preparation of nuclear safety authorization basis documents.

With respect to Hanford's Waste Treatment Plant (WTP), the Office of Environmental Management completed additional seismic-related studies (a deep-hole boring confirmation program) in 2007 and used that information to confirm the amount of conservatism in assumptions utilized to underpin revised seismic design criteria established in 2005 in response to DNFSB concerns with the original seismic design criteria primarily related to uncertainty in the understanding of the WTP site subsurface soil characteristics. As the Department's January 2010 Inspector General report observed, this effort resulted in significant costs increases and an associated schedule delay. At other projects, the Office of Environmental Management brought in independent experts to review the seismic hazards and the approach the Department's contractors have taken to design for that hazard.

To ensure that the Department is fully addressing seismic risks systematically, the Chief of Nuclear Safety, in conjunction with the Office of Environmental Management, established a Seismic Lessons-Learned Panel in 2007. The Panel provides expert advice to DOE to help ensure that the seismic design of nuclear facilities is conducted appropriately, consistent with mission and safety goals of the Department. In addition, a Seismic Design Expectations Report has been incorporated into the Office of Environmental Management Standard Review Plan (SRP). The SRP is employed during construction project reviews, and the Seismic Design Expectations Report will allow reviewers to verify that seismic hazard characterization and design are performed in accord with best practices.

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