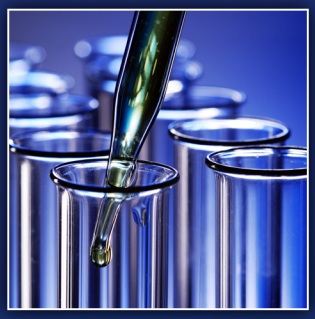
DOE/CF-0067

U.S. DEPARTMENT OF ENERGY

STRATEGIC PLAN

MAY 2011



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STRATEGIC PLAN

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Mission and Goals

The mission of the Department of Energy is to ensure America's security and prosperity by addressing its energy, environmental, and nuclear challenges through transformative science and technology solutions.

Goal 1: Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in clean energy technologies.

Goal 2: Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity with clear leadership in strategic areas.

Goal 3: Enhance nuclear security through defense, nonproliferation, and environmental efforts.

Goal 4: Establish an operational and adaptable framework that combines the best wisdom of all Department stakeholders to maximize mission success.

The Department's mission and strategic goals reflect the President's directives for clean energy, science, and national security.

Department of Energy Management Principles

1. Our mission is vital and urgent.
2. Science and technology lie at the heart of our mission.
3. We will treat our people as our greatest asset.
4. We will pursue our mission in a manner that is safe, secure, legally and ethically sound, and fiscally responsible.
5. We will manage risk in fulfilling our mission.
6. We will apply validated standards and rigorous peer review.
7. We will succeed only through teamwork and continuous improvement.

Deputy Secretary of Energy Daniel B. Poneman serves as the Department's Chief Operations Officer under the Government Performance and Results Modernization Act of 2010.

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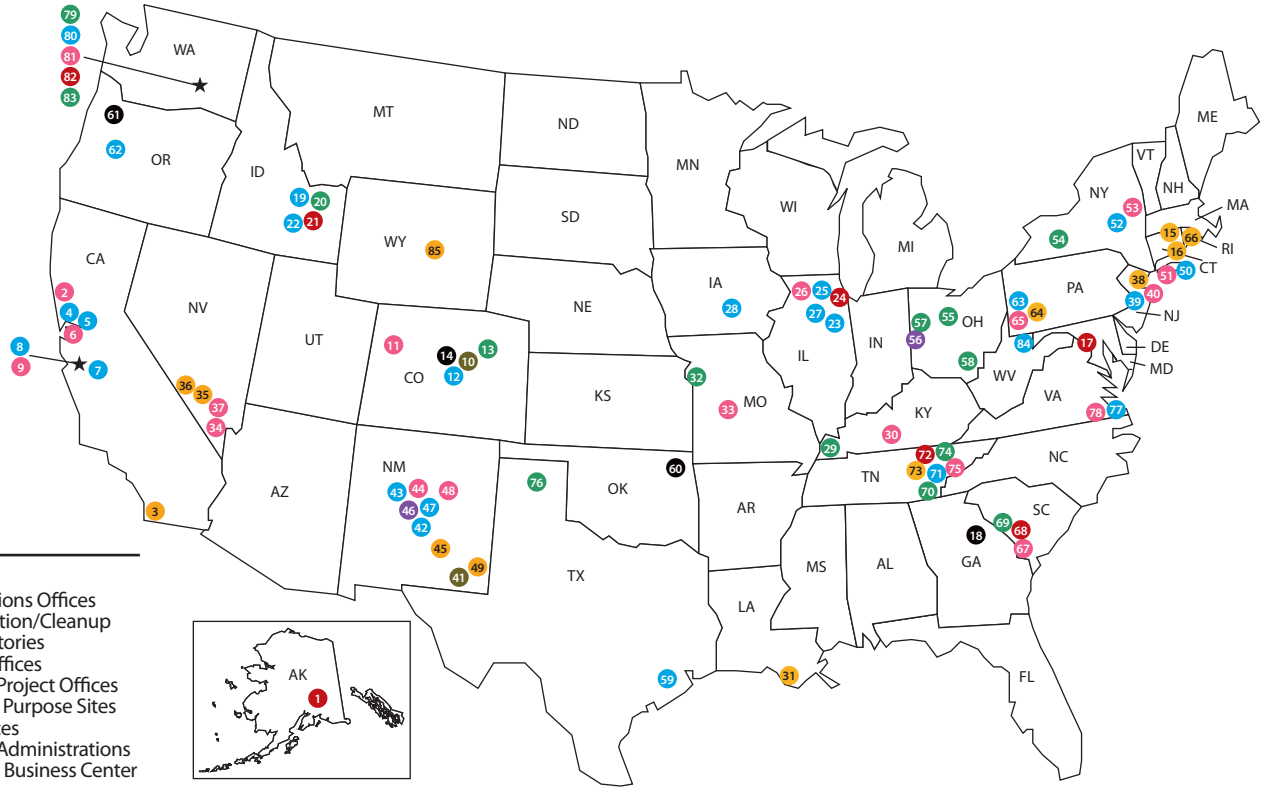
Major Laboratories and Field Facilities



Legend
- Operations Offices
- Production/Cleanup
- Laboratories
- Field Offices
- Site or Project Offices
- Special Purpose Sites or Offices
- Power Administrations
- Service Business Center

Alaska
1. Arctic Energy Office

California
2. Berkeley Site Office
3. Energy Technology Engineering Center
4. Lawrence Berkeley National Laboratory
5. Lawrence Livermore National Laboratory
6. Livermore Site Office
7. Sandia National Laboratories
8. SLAC National Accelerator Laboratory
9. SLAC Site Office

Colorado
10. Golden Field Office
11. Grand Junction Office
12. National Renewable Energy Laboratory
13. Rocky Flats Closure Project
14. Western Area Power Administration

Connecticut
15, 16. Northeast Home Heating Oil Reserves

District of Columbia
17. Washington D.C. Headquarters

Georgia
18. Southeastern Power Administration

Idaho
19, 20. Idaho National Laboratory
21. Idaho Operations Office
22. Radiological Environmental Sciences Laboratory

Illinois
23. Argonne National Laboratory
24. Chicago Office
25. Fermi National Accelerator Laboratory
26. Fermi Site Office
27. New Brunswick Laboratory

Iowa
28. Ames Laboratory

Kentucky
29. Paducah Gaseous Diffusion Plant
30. Portsmouth/Paducah Project Office

Louisiana
31. Strategic Petroleum Reserve

Missouri
32. Kansas City Plant
33. Kansas City Site Office

Nevada
34. Nevada Site Office
35. Nevada National Security Site
36. Yucca Mountain
37. Office of Civilian Radioactive Waste Management

New Jersey
38. Northeast Home Heating Oil Reserve
39. Princeton Plasma Physics Laboratory
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New Mexico
41. Carlsbad Field Office
42. Inhalation Toxicology Research Institute
43. Los Alamos National Laboratory
44. Los Alamos Site Office
45. National Training Center
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47. Sandia National Laboratories
48. Sandia Site Office
49. Waste Isolation Pilot Plant

New York
50. Brookhaven National Laboratory
51. Brookhaven Site Office
52. Knolls Atomic Power Laboratory
53. Schenectady Naval Reactors Office
54. West Valley Demonstration Project

Ohio
55. Columbus Environmental Management Project
56. EM Consolidated Business Center
57. Miamisburg Closure Project
58. Portsmouth Gaseous Diffusion Plant

Oklahoma
60. Southwestern Power Administration

Oregon
61. Bonneville Power Administration
62. National Energy Technology Laboratory – Albany

Pennsylvania
63. Bettis Atomic Power Laboratory
64. National Energy Technology Laboratory – Pittsburgh
65. Naval Reactors Laboratory Field Office

Rhode Island
66. Northeast Home Heating Oil Reserve

South Carolina
67. Savannah River National Laboratory
68. Savannah River Operations Office
69. Savannah River Site Office

Tennessee
70. East Tennessee Technology Park
71. Oak Ridge National Laboratory
72. Oak Ridge Site Office
73. Office of Scientific and Technical Information
74. Y-12 Plant
75. Y-12 Site Office

Texas
76. Pantex Plant and Site Office
59. National Energy Technology Lab – Sugar Land

Virginia
77. Thomas Jefferson National Accelerator Facility
78. Thomas Jefferson Site Office

Washington
79. Hanford
80. Pacific Northwest National Laboratory
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83. Office of River Protection

West Virginia
84. National Energy Technology Laboratory – Morgantown

Wyoming
85. Naval Petroleum Reserve No. 3 – Casper

Message from the Secretary of Energy

Secretary of Energy Steven Chu.

All Americans seek a better quality of life, prosperity, and strengthened national security. Also deep in our national DNA is the desire to provide our children and grandchildren with greater opportunities than we received from our parents. In today's rapidly changing world, none of our aspirations can be taken for granted. The Department of Energy has the ability and obligation to play an increasingly central role in realizing these aspirations.

The Department of Energy plays an important and unique role in the U.S. science and technology community. The Department's missions and programs are designed to bring the best scientific minds and capabilities to bear on important problems. It is an integrator, bringing together diverse scientists and engineers from national laboratories, academia, and the private sector in multidisciplinary teams, striving to find solutions to the most complex and pressing challenges. This Strategic Plan lays out the Department's leadership role in transforming the energy economy through investments in research, development of new technologies, and deployment of innovative approaches.

There is great urgency in the Department's work today. An increasingly complex, global environment has brought into sharp focus the relationships between energy security, climate change, and national security objectives—all against a backdrop of concerns about U.S. economic competitiveness. The Department's engine of innovation must now be directed at that nexus, accelerating progress toward solutions with renewed purpose and vigor.

In addition to advancing science and technology relevant to energy, the environment, and security, the Department of Energy is the government's largest financial supporter of the physical sciences, managing world-class basic research programs and supporting unique user facilities in a variety of disciplines. These activities underpin the mission areas through the discoveries they produce, the people they attract and train, and the instruments and methods they develop.

This Strategic Plan is designed to take best advantage of the capabilities of the Department to drive solutions across energy, environmental, climate, and security challenges. It draws upon the Department's ability to take a systems view of large, complex problems; build multidisciplinary teams; and drive science and engineering innovation. Success in this strategy will catalyze the transformation of the nation's energy system, build a sustainable and competitive clean energy economy, increase nuclear security worldwide, and maintain U.S. global leadership in science and engineering. These goals are important first steps toward the Department's vision of a prosperous, sustainable, secure future for generations to come.

Some of America's top scientists are working on solving complex scientific challenges at the Department's national laboratories.

SCIENCE AND TECHNOLOGY FOR ECONOMIC COMPETITIVENESS

Innovation will drive our economic prosperity in an increasingly competitive world. Although the United States still leads the world in computers, communications, biotechnology, aerospace, and other technology industries, we are being challenged in all of these areas. The competition is closing in rapidly—the United States has become a net importer of high technology products, and our leadership in future technology revolutions is not guaranteed. It is imperative that we reverse the loss of U.S. manufacturing jobs, particularly in high technology manufacturing, and maintain a wide set of opportunities for our citizens by rebuilding manufacturing capabilities.

A cornerstone of technology leadership and its accompanying jobs is a vibrant science and technology enterprise. Although the United States still has the world's greatest research institutions—in no small part due to the Department's efforts—this leadership is at risk. We must remain focused on effectively nurturing our research enterprise.

In addition to this core activity, the Department needs to cultivate the entire technology innovation chain, from enabling discoveries to research, development, demonstration, and deployment (RDD&D). While our most beneficial role is the support of the earlier stages of this chain, there are several stages in which the best innovative "seedlings" can wither and die before the private sector embraces a new technology. This is especially true in certain energy sectors that currently do not have a strong innovation culture or where markets have not yet adjusted to changing conditions. To ensure our nation's future prosperity, the Department must identify and nurture promising technologies, even though some may falter for a variety of reasons unrelated to technical capability. In later stages of innovation, we must leverage our resources with those of the private sector to move promising technologies from the laboratory to the marketplace.

OUR ENERGY AND ENVIRONMENTAL LEGACY

There is compelling evidence that carbon-dioxide emissions from human activities are adversely affecting the climate. Any path close to "business as usual" will imperil future generations with dangerous and unacceptable economic, social, and environmental risks. The conventional use of fossil fuels is a major source of these emissions. In particular, our excessive dependence on oil is taking us down an increasingly costly, insecure, and environmentally dangerous path. As part of prudent risk management, our responsibility to future generations is to eliminate most of our carbon emissions and transition to a sustainable energy future. An ancient Native American saying reminds us of this duty:

> "Treat the earth well. It was not given to you by your parents, but is loaned to you by your children."

Together with a sustainable environmental legacy, we want to bequeath to the next generation the likelihood of future prosperity. While it has been said "It is difficult to make predictions, especially about the future," strategic plans are best made with a focus on likely outcomes. Developed and developing countries in Europe and Asia are positioning themselves for a future of higher oil prices and constrained carbon emissions.[1] Most notably, China is aggressively developing clean energy technologies, promoting energy efficiency, and diversifying its energy supplies.

American leadership in the clean energy revolution is essential to future economic competitiveness. Regrettably, the United States has lost its lead in many of the energy technologies that we developed. Electricity transmission and distributions systems were pioneered by Thomas Edison, George Westinghouse, and Nikola Tesla, but today Europeans are the leading manufacturers. China, also seeking to compete in this market, hopes to export expertise gained from installing the world's highest voltage alternating current and direct current lines. America built the first nuclear reactor as part of the Manhattan Project in the 1940s, but the major commercial suppliers today are headquartered in France, Japan, Russia, and Korea. China has broken ground on more than 20 new nuclear reactors (approximately half of all Gen III+ reactors under construction) and will construct two nuclear reactor foundries. Similar reports of lost advantages apply to photovoltaics, advanced wind turbines, and fuel-efficient automobiles. With the right government policies and effective RDD&D programs, the United States can lead the clean energy revolution.

The transition to a secure, low-carbon energy future requires nothing less than a new industrial revolution. Economics and climate science demand a rapid transition, yet transformations of energy systems have historically taken decades. We must act aggressively "with the fierce urgency of now" and greatly reduce the time from invention to deployment with significant market penetration. To guarantee U.S. leadership in the transition to a sustainable energy future, we need to increasingly engage in all stages of energy innovation to optimally harvest the scientific, technological, and economic bounty for our future generations. For example, by exploiting unique Department capabilities in instrumentation and numerical simulation, we can reduce time-consuming and costly development steps as a technology moves from the laboratory to pilot- to full-scale demonstration.

The Department is working toward 80% clean energy by 2035.

NUCLEAR SECURITY

The Department and its predecessor organizations were founded upon scientific research in accelerator and nuclear physics that began with E. O. Lawrence in the 1930s. Subsequently, that expertise played a critical role in our national defense during World War II and the Cold War. While the threat of a nuclear Armageddon among superpowers diminished as the Cold War ended and the Soviet Union

[1]The *Annual Energy Outlook 2011* projects the average real price of light crude oil will rise from $78 a barrel in 2010 to nearly $125 a barrel (real 2009$) in 2035. 2011. U.S. Energy Information Administration. Available at: http://www.eia.doe.gov/forecasts/aeo/MT_liquidfuels.cfm. The full *Annual Energy Outlook* report is available at http://www.eia.doe.gov/forecasts/aeo/index.cfm.

disintegrated, the threat of nuclear proliferation and terrorism is growing. The Department has a central role in minimizing these dangers. We must minimize the risk of proliferation and detect and counter proliferation threats if and when they occur. As the number of nuclear weapons in our own stockpile shrinks, it is our task to improve their surety and maintain their reliability without nuclear testing. Our aging nuclear security infrastructure will be modernized to support the stockpile and perform other vital nuclear security work, including nonproliferation, counterterrorism, emergency management, and naval nuclear propulsion.

Our nuclear responsibilities also include the development of safe storage and final disposition of used nuclear fuel, as well as the cleanup of our Cold War legacy. The Department supports the President's call to work with other nations to build "a new framework for civil nuclear cooperation" so that countries can access peaceful power without increasing the risks of proliferation. There is a huge potential to engage the expertise of U.S. industry and our national laboratories and universities in the challenges of better using the energy of nuclear fuel; enhancing proliferation resistance; and reducing the volume, the toxicity, and the lifetime of waste streams.

Waste disposal operations at the Waste Isolation Pilot Plant in Carlsbad, New Mexico.

GETTING FROM WHERE WE ARE TO WHERE WE WANT TO BE

The Department is a vast organization whose significant resources must be coordinated to meet the challenges outlined in this Strategic Plan. In that spirit, we have worked hard to overcome barriers that degrade our performance—by launching efforts to cut across stove-piped programs; encouraging people to think beyond the mandate of their own organizations to embrace the whole enterprise; challenging them to reform established habits and procedures; and reassuring them that prudent risk-taking will be rewarded, even when our efforts fall short of our hopes. In recent years, the Department has made good progress in these areas, but there remains opportunities for further improvement. To accelerate and improve the execution of Department missions, we must first identify where we are and where we want to be.

A number of opportunities have been identified to improve our organization and management, including the following areas:

- Increased transparency across the DOE enterprise.
- Technical assessment and peer review.
- Project and contract management.
- More aggressive recruitment of top-quality program managers with extensive subject matter expertise.

- Continued integration of safety and security as an integral part of line management responsibilities. Independent oversight provides a means to verify whether line management is fulfilling their responsibilities.
- Improved mechanisms to solicit and incorporate the expertise of management and scientists in our national laboratories.

As part of this reform agenda, we need to establish feedback mechanisms that will ensure identified problems are addressed and solved in a timely manner.

The development of a strategic plan is one mechanism to encourage different stakeholders to look across scientific disciplines and organizational structures. However, a strategic plan does not guarantee consultation or collaboration. Similarly, plans developed by upper management without the participation and enthusiastic endorsement of our career program officers and national laboratory leaders and scientists will not succeed. All stakeholders have to be convinced that the investment of time to learn what others are doing within the organization is worth the effort. The most successful organizations have developed a culture in which people are willing to move out of their comfort zones, see value in being challenged by others, and are able to share authority. In formulating our Strategic Plan, I have asked the Department the following questions:

- Is our current portfolio of investments consistent with our overarching goals?
- How can we better tap the best technical and managerial expertise throughout the Department, national laboratories, and research universities to identify and constantly renew the most promising opportunities in our investment strategies?
- What can we do to increase the scientific nimbleness of our programs without sacrificing institutional stability?
- What enduring mechanisms can we establish that will break down barriers to maximize the transfer of information and integration of programs across the Department?

Perhaps the most important part of the development of a strategic plan is the creation of a successful framework for future planning. In formulating a strategic plan, we need to guard against premature down-selection of specific paths or the creation of a narrow list of priorities that do not allow or encourage bottom up "skunk-works" developments. On the other hand, we need to seek and consistently pursue bold strategies that will help ensure U.S. prosperity and security.

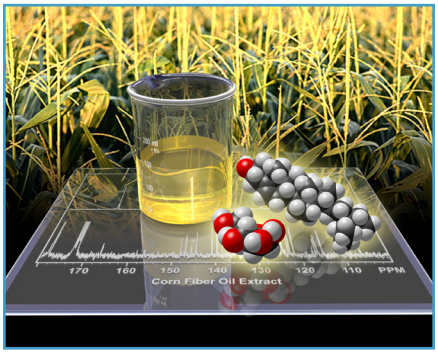
Together, we can meet our responsibility to the generations to come.

Secretary Steven Chu

Who We Are

OUR PEOPLE

The Department's workforce is our greatest asset. The core is the more than 15,000 federal employees at headquarters and across the country. Our highly qualified personnel dedicate their expertise—ranging from engineering to accounting, public policy to climate science, and physics to law—to the urgent missions of the Department with a fierce sense of deep devotion to public service. Our staff's skill in project and contract management delivers the Department's mission while remaining dedicated to the taxpayer through sound guidance and effective supervision. We are also committed to expanding the diversity of our employees and contractors, recognizing that the vibrancy of the Department's culture depends on the varied backgrounds of its personnel. The Department can succeed in addressing the greatest challenges of our times because of the quality and dedication of our employees. The Department is committed to enhancing its employees' wellbeing as they serve the nation.



Researchers at Pacific Northwest National Laboratory are working to develop an economic process for the separation of corn fiber into its core building blocks.

NATIONAL LABORATORIES

National laboratories are signature assets of the Department. As Federally Funded Research and Development Centers,[1] laboratories provide unique technical capabilities to the government that cannot be met as effectively by existing in-house or contractor resources. This status can give the laboratories greater flexibility than most government organizations in operations, and in attracting and retaining a diverse and highly skilled technical workforce across a wide range of disciplines. The national laboratories are the Department's strong long-term partners, supporting the diverse research and development needs our missions demand.

Multiprogram laboratories pursue a full spectrum of capabilities, from discovery and mission-driven research through technology development. Thus, these laboratories are nimble and adaptable in the face of changing national problems and priorities. This rich, intellectual environment promotes excellence by enabling a healthy competition of ideas. The contractors who operate these laboratories are evaluated on how well the laboratories—as institutions—serve the long-term mission needs of the Department.

The strengths and unique character of national laboratories and our supporting sites have also made them assets for other government agencies. National laboratories make crucial contributions to the U.S. intelligence community and the Departments of Defense and Homeland Security. These missions contribute directly to saving human lives and protecting national security in real time.

USER FACILITIES

The Department has a core competency in the design, development, construction, and operation of unique world-class user facilities that benefit the entire U.S.

[1]The National Energy Technology Laboratory, a federal laboratory, is the sole exception. Other national laboratories are managed by contractors.

research community. The facilities' capabilities are driven by the Department's mission needs and are created through the Department's competencies. These accelerators, colliders, light sources, lasers, neutron sources, materials fabrication and characterization facilities, renewable energy test facilities, and gene sequencing facilities are used annually by more than 26,000 users from academia, industry, national laboratories, and other government agencies. The Department is also home to some of the world's most powerful scientific computers and leads the world in simulation capabilities that couple computer modeling with experimental validation.

Virtually all of these facilities operate under a model of cooperative stewardship with other federal agencies such as the National Science Foundation, the National Institutes of Health, and the Department of Defense.

The Department's Spallation Neutron Source, located in Oak Ridge, Tennessee, is the world's most powerful pulsed spallation neutron source.

THE BROADER SCIENTIFIC COMMUNITY

The Department plays a critical role in ensuring the intellectual vitality of the U.S. technical enterprise by sponsoring research at 540 colleges and universities and supporting approximately 5,800 faculty and postdoctoral fellows and 3,600 graduate students. This broad range of science, technology, and engineering activities is an essential complement to national laboratory efforts and helps drive innovation and sustain U.S. leadership in many disciplines. It also creates a training pipeline of scientists and engineers, one of the most important results of the Department's research and development. Equally important, a vibrant capacity in the sciences enables the United States to exploit discoveries occurring anywhere in the world.

A PARTNER WITH THE PRIVATE SECTOR

Many of the Department's activities are designed to work with the private sector to achieve our energy, environmental and competitiveness goals.

Applied science and engineering disciplines solve energy problems. Because we guide scientific concepts from basic research through technology development—and in a small set of cases, through to pilot- and full-scale facilities—the Department is uniquely capable of leveraging scientific discovery into technical innovation. Translation to the private sector is accomplished in part through extensive interactions between the national laboratories and the private sector.

Environmental cleanup contractors are crucial partners in the Department's ongoing efforts to clean up the environmental contamination resulting from nuclear weapons development, production, and government-sponsored nuclear energy research. The Office of Environmental Management employs more than 30,000 contractors, including scientists, engineers, and hazardous waste technicians, for nuclear cleanup activities at 18 sites in 11 states.

Power marketing administrations (Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration, and Western Area Power Administration) are Department agencies subject to Secretarial supervision and control. The authority vested in the Secretary with respect to the power

marketing administrations has been delegated to the Deputy Secretary. The power marketing administrations were created to sell and transmit power generated from federal water projects and have since grown to service significant parts of the country. These administrations offer experience in power generation and transmission activities, and can demonstrate and deploy new technologies and capabilities into the electric grid. They also provide opportunities for transmitting and integrating renewably generated electricity into their electric systems.

Grant and financing mechanisms allow the Department to catalyze market adoption of maturing technologies from Small Business Innovation Research (SBIR) grants, designed to promote private development of technical innovations and the commercialization of scientific instrumentation, to loan guarantees that enable initial market penetration and facilitate commercial-scale deployment of innovative energy technologies.

The Energy Information Administration (EIA) is the nation's premier source of independent statistical information about energy production and use. The EIA collects, analyzes, and disseminates impartial energy information in support of sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment.

The **Strategic Petroleum Reserve** provides an emergency stockpile of petroleum to protect the United States against petroleum supply disruptions by domestic and international events.

THE EXPERTS IN DEFENSE AND CIVILIAN NUCLEAR TECHNOLOGIES

The Department plays an important role across the full spectrum of nuclear science and technology, from weapons design and production to nuclear power and isotope production. Through the National Nuclear Security Administration (NNSA), the Department is responsible for the management and security of the nation's nuclear weapons, nuclear nonproliferation, and naval reactor programs. This collection of expertise and capabilities is embodied in the nuclear security complex—NNSA's three weapons laboratories, the Pantex Plant, the Kansas City Plant, the Y 12 National Security Complex, the Savannah River Site, and the Nevada National Security Site—that form the core of an integrated design, manufacture, and test capability for maintaining the nation's nuclear deterrence. These assets, along with the civilian national laboratories and academia, position the Department uniquely in addressing problems at the nexus of energy, climate, and security, including nonproliferation, naval nuclear propulsion, management of the nuclear fuel cycle, nuclear counter-terrorism, nuclear and radiological emergency response, and arms control. The Departments of Defense and Homeland Security, the intelligence community, the electric utility sector, and the medical community are all customers for these capabilities. The Department also supports research in nuclear science and technology that advances this discipline of science and trains the next-generation nuclear workforce.

Transform Our Energy Systems

Goal: Catalyze the timely, material, and efficient transformation of the nation's energy system and secure U.S. leadership in clean energy technologies.

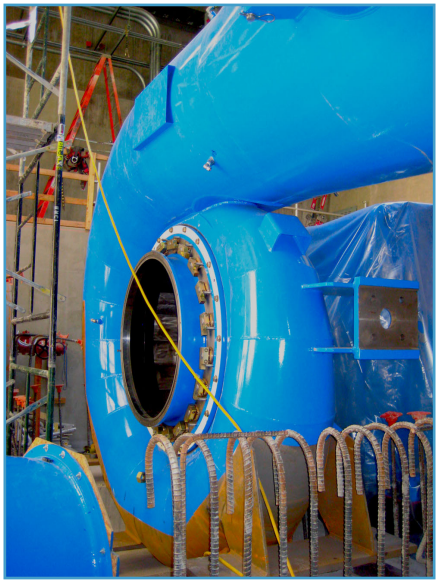
> (1) "the United States faces an increasing shortage of nonrenewable energy resources;
>
> (2) this energy shortage and our increasing dependence on foreign energy supplies present a serious threat to the national security of the United States and to the health, safety and welfare of its citizens;
>
> (3) a strong national energy program is needed to meet the present and future energy needs of the Nation consistent with overall national economic, environmental and social goals;
>
> (4) responsibility for energy policy, regulation, and research, development and demonstration is fragmented in many departments and agencies and thus does not allow for the comprehensive, centralized focus necessary for effective coordination of energy supply and conservation programs; and
>
> (5) formulation and implementation of a national energy program require the integration of major Federal energy functions into a single department in the executive branch."
>
> - Findings in the *Department of Energy Organization Act*, 1977

These findings in the *Department of Energy Organization Act*, a 34-year-old text defining the Department's role in energy, remain broadly applicable today. Reducing dependence on oil and reducing greenhouse gases are two major challenges in today's U.S. energy systems. These challenges are daunting. From 1977 to 2010, the gap between total annual U.S. imports and export of crude oil increased by more than 933 million barrels (nearly 39%).[1] Although there has been progress on local environmental concerns, the global threat of elevated greenhouse gas concentrations is now widely recognized, and related effects are better understood. The Department is committed to advancing solutions to these dangerous climatic trends. While access to affordable and reliable energy has been the cornerstone of America's economic growth, the nation's physical and social systems that produce, store, transmit, and use energy remain deficient in several important dimensions. Driven by environmental, economic, and social impacts, President Obama has set the following specific targets:

- Reduce energy-related greenhouse gas emissions by 17% by 2020 and 83% by 2050, from a 2005 baseline.

[1]International Petroleum (Oil) Imports and Exports. 2010. U.S. Energy Information Administration. Available at http://www.eia.doe.gov/emeu/international/oiltrade.html.

- By 2035, 80% of America's electricity will come from clean energy sources.[1]
- Put 1 million electric vehicles on U.S. roads by 2015.[1]



Los Alamos County, New Mexico, completed the Abiquiu Hydropower Project - the first hydropower project funded by the Recovery Act to be completed nationwide. The project provides clean energy to Los Alamos National Laboratory.

Currently more than 80% of total U.S. primary energy[2] and more than 95% of U.S. transportation fuel comes from fossil resources;[3] these percentages are expected to change little over the next 25 years under a business-as-usual scenario.[2,4] While U.S. energy consumption and carbon-dioxide emissions are also expected to increase significantly in this scenario, global energy consumption will rise more than twice as quickly due to growing population and increasing development in non-Organisation for Economic Co-operation and Development (OECD) countries.[5] Likewise, water is integral to many energy technologies, and related water demands could be amplified in the future if climate change alters regional water cycles. Our energy technology R&D activities should be cognizant of this interdependence.

This context frames the challenge before us: to achieve our long-term energy and environmental goals, we must change our current energy paradigm through concerted effort across public and private sectors. Although the scale of this challenge dictates that the necessary transformation of our energy systems will not be completed soon, efforts to facilitate an ongoing energy transformation will improve national security, the balance of trade, and demonstrate U.S. leadership on global challenges.

This document is not a national energy plan[6] but rather a strategy focused on the capabilities and authorities of the Department, and grounded in simple assumptions regarding the path to meet our national goals. Petroleum use will be decreased by raising fuel economy standards, gradual electrification of the vehicle fleet, and increasing production of advanced biofuels. Greenhouse gas emissions will be reduced through improved efficiency, accelerated deployment of low-carbon energy generation technologies (including conventional renewable, nuclear, and carbon capture and storage), modernization of the electric grid, and public policy.

The Department has substantial assets it can bring to bear as appropriate, including basic scientific discovery, invention, applied research, full-scale technology demonstrations, deployment financing, policy analysis, and information and education resources. U.S. energy infrastructure is primarily owned and operated by the private sector, and will continue to be dominated by conventional energy

[1]Clean energy is defined in the context of the Clean Energy Standard as renewables, nuclear, combined-cycle gas, and fossil energy with carbon capture and storage. *Fact Sheet: The State of the Union: President Obama's Plan to Win the Future*. 2011. Available at http://www.whitehouse.gov/the-press-office/2011/01/25/fact-sheet-state-union-president-obamas-plan-win-future.
[2]*Annual Energy Outlook 2010 with Projections to 2035*, Figure 1 data. 2010. U.S. Energy Information Administration. Available at http://www.eia.gov/oiaf/archive/aeo10/pdf/0383(2010).pdf.
[3]*December 2010 Monthly Energy Review*, Table 2.5. 2010. U.S. Energy Information Administration. Available at http://www.eia.gov/FTPROOT/multifuel/mer/00351012.pdf.
[4]*EIA Annual Energy Outlook 2011 Early Release*, Table A2. 2011. U.S. Energy Information Administration.
[5]*International Energy Outlook 2010*. 2010. U.S. Energy Information Administration. Available at http://www.eia.doe.gov/oiaf/ieo/.
[6]The DOE Quadrennial Technology Review (http://energy.gov/qtr/) will be a first step in developing a national energy plan. Other agencies will have to be involved with a national plan.

resources, even as we embark on its transformation. Thus, it is the private sector that will have to make the largest share of the investments needed to deploy clean energy technologies at scale. Our strategy will be to prioritize our resources rigorously and highly leverage the assets at our disposal. Significant authorities relevant to energy production and use reside outside the Department with such agencies as the U.S. Environmental Protection Agency and the Departments of Transportation, Commerce, Interior, and Agriculture. Accordingly, the Department must leverage its efforts and work in concert with policies and regulations established by other agencies and state and local governments to ensure safe, secure, and environmentally benign energy for our country throughout this transformation.

The Department invests in clean energy RDD&D for technologies like solar and wind.

The American Recovery and Reinvestment Act: Laying the Foundation for a Clean Energy Economy

The *American Recovery and Reinvestment Act* (ARRA) channeled an unprecedented amount of funds through the Department in record time. ARRA funding and an increased fiscal year 2009 appropriation, together representing an 187% increase over the prior year, stress-tested every part of our organization—from program managers to procurement and legal staff. The Recovery Act provided the opportunity for new, extensive projects. In energy, projects include tax credits spurring innovation across the energy industry, construction of a significant portion of the world's capacity to manufacture advanced vehicle technology batteries, and energy efficiency grants available to every state, county, and large city. These projects are driving economic growth now, while laying the foundation for our long-term prosperity through a clean energy economy.

In the last first 18 months after ARRA's passage, the Department of Energy has accomplished many things, including the following:

- Making the grant application review process more rigorous, including recruiting participation from the nation's best engineering and scientific professionals, and carrying out over 30,000 reviews of applications in a 1-year time frame.
- Funding over 8,000 projects that are laying the foundation to a new, clean energy economy: renewable energy deployment, energy efficiency, advanced vehicles and fuels, grid modernization, science and innovation, environmental cleanup, and carbon capture and storage.
- Leveraging the Department's $35.2 billion in Recovery Act appropriations and $7.5 billion in U.S. Treasury tax incentive programs with private capital funds that will support over $100 billion in clean energy projects.
- Expanding and accelerating the research mission of our national laboratories with $3 billion.
- Supporting small businesses around the country with over $8.2 billion in grants, contracts, loan guarantees, and tax credits. Several of these companies have already gone public.
- Creating and saving over 40,000–50,000 full-time jobs each quarter.

DEPLOY THE TECHNOLOGIES WE HAVE

Drive Energy Efficiency to Reduce Demand Growth

Improvements in energy efficiency are among the most cost-effective and immediate steps toward our national energy goals. However, economy-wide efficiency can be achieved only through aggregated improvement of individual buildings, facilities, vehicles, and equipment.

Switching 15 traditional incandescent bulbs to compact fluorescent lamps can save $50 per year on energy bills.

The Department has a unique role in defining end-use standards for appliances and other electronic devices and informs the vehicle fuel economy standards set by the Department of Transportation.[1] We will strive for global leadership in both the underlying technical rigor and the impact of efficiency standards. The Department will achieve the following:

1. Enforce the standards we have in place.
2. Review minimum appliance efficiency standards at least every 5 years.
3. Develop standards and processes to address the entire spectrum of energy intensities for a given product class, not just the least (or most) efficient limits.
4. Leverage precompetitive research and development to understand the potential and limits for new technologies to improve building, appliance, vehicle, and industrial efficiency while providing economic benefits.

The Department will develop efficiency standards and test procedures to address at least 75% of the energy used in the building sector. In addition to appliance standards, the Department will use a variety of other mechanisms to achieve significant savings in the 40% of U.S. energy that is consumed in buildings and the 30% used in industry. The Department will advance new approaches for improving the efficiency of our nation's homes, buildings, and facilities.

Improvements in conventional vehicle efficiency can significantly affect the 30% of U.S. energy used for transportation. The Department will partner with industry to discover and promote adoption of materials, aerodynamics, engines and power train technologies that improve vehicle efficiency and will inform regulatory bodies across the government of opportunities for increased fuel economy. The Department will work to help meet the President's goal to deploy 1 million electric vehicles by 2015.

[1] *Department of Transportation National Highway Traffic Safety Administration – Average Fuel Economy Standards Passenger Cars and Light Trucks Model Year 2011.* 2011. Department of Transportation. Available at http://www.nhtsa.gov/DOT/NHTSA/Rulemaking/Rules/Associated%20Files/CAFE_Updated_Final_Rule_MY2011.pdf

Targeted Outcomes:

- DOE and the U.S. Department of Housing and Urban Development will work together to enable the cost-effective energy retrofits of a total of 1.1 million housing units by the end of fiscal year (FY) 2013. DOE programs will contribute to retrofits of an estimated 1 million housing units (High Priority Performance Goal).[2]
- Facilitate the transition to a more energy-efficient economy by establishing or updating efficiency standards and best practices, including at least six appliance standards annually and establishing an American National Standards Institute -accredited commercial and industrial energy-efficiency certification process by 2015.

Demonstrate and Deploy Clean Energy Technologies

The United States has the opportunity to lead the world in a new industrial revolution to manufacture the clean energy technologies we need and create the jobs of the future. To ensure America's competitiveness in this century and achieve our energy goals, we must develop and deploy clean energy technologies in our nation.

Adoption of innovative technologies by both consumers and industry is necessary to make meaningful progress on our energy challenges. Today—in the absence of stable, comprehensive energy policies that reflect the true costs of traditional energy technologies—the private sector is not adopting clean energy technologies rapidly enough to achieve our national energy goals. The Department can advance this process by reducing risk for early adopters of the most promising technologies.

The Department will address two primary issues to unlock financing: 1) low unsubsidized returns for renewable energy compared to traditional sources; and 2) heightened risk, both technology and policy, associated with innovative clean energy technologies.

In the near term, the Department's loan programs play a critical role in catalyzing investment in clean energy. Loan guarantees lower the cost of capital for companies, allowing them to develop clean energy projects that would otherwise not be financially feasible. The Department's due diligence review promotes private financing of sound technologies.

Converted Ford Escape PHEV charging from a photovoltaic system as part of a National Renewable Energy Laboratory electric-vehicle grid-integration project.

[1]To ensure the Department can evaluate success in implementing the aspirations of this Strategic Plan, each goal includes a number of specific performance measures called "Targeted Outcomes." Unless noted otherwise in the text, all Targeted Outcome dates refer to the calendar year.

[2]DOE's High Priority Performance Goals (HPPGs)—developed in response to a Presidential directive—provide direct value to the public and/or reflect key agency missions; the HPPGs present performance outcomes that can be evaluated and are also quantifiable and measureable. The seven current DOE HPPG goals represent Departmental areas that reflect significant yet achievable challenges requiring cross-DOE resources and focus to accomplish. More information is available at http://www.whitehouse.gov/sites/default/files/omb/budget/fy2011/assets/management.pdf.

Moving forward, we will use integrated planning, budgeting, and administration to harmonize the Department's clean energy efforts across stages of the development cycle, from basic and applied research through pilot and demonstration projects. The Department will use its Loan Guarantee Program to accelerate the domestic commercial deployment of innovative and advanced clean energy technologies to scale.

Targeted Outcomes:

- Double renewable energy generation (excluding conventional hydropower and biopower) by 2012 (High Priority Performance Goal).
- Support battery manufacturing capacity for 500,000 plug-in hybrid electric vehicles a year by 2015 (High Priority Performance Goal).
- Complete a comprehensive assessment—by September 2012—of materials degradation issues for light-water reactor plants operating beyond 60 years.

New technologies are being introduced to the electric grid.

Modernize the Electric Grid

Today's electric grid needs to be more efficient, reliable, and secure. A modern, smarter electric grid may save consumers money, help our economy run more efficiently, allow rapid growth in renewable energy sources, and enhance energy reliability. However, new technology will only be deployed if utilities, including public power distributors, gain confidence in the associated integrated system performance. The Department will therefore promote well-instrumented microgrids for understanding the performance of new technologies in real-life settings, where industry and researchers alike will access these capabilities via open, peer-reviewed competition. Similarly, the Department will work with utilities and system operators to understand and characterize new technologies and operating strategies within the bulk power system and facilitate the transition to a cleaner electricity sector.

Grid assets can be used efficiently only when the system and its components are well understood. Recent system sensor deployments are providing greater insight than ever into the operation of the electric grid, and the Department will partner with industry to ensure the knowledge gained is widely disseminated and incorporated into industry standard models, tools, and devices. We will develop technologies and operational methods that can better integrate variable, renewable energy sources with fossil fueled sources, including automated synchronization and control of conventional systems and renewable energy sources. Similarly, the introduction of storage and other technologies, as well as improved operational methods, will enable more flexible and efficient control of the electric grid. The Department will facilitate the demonstration and deployment of storage technologies for applications ranging from frequency regulation to bulk-energy management.

The introduction of technologies into the grid, together with the transition to an actively controlled distribution network, significantly expands the challenges to grid security. The Department will monitor new threats and work with industry and other federal agencies to create security and communication standards while facilitating hardening infrastructure to ensure continued reliability of the energy infrastructure.

Targeted Outcomes:

- Enable better understanding and control of our electric grid by installing more than 1000 synchrophasor measurement units by 2013.
- Deploy more than 26 million smart meters in American homes and businesses by 2013.
- Reduce utility-scale energy storage costs 30% by 2015.

Enable Prudent Development of Our Natural Resources

The one-year anniversary of the Macondo well blowout is a reminder of the environmental risks associated with exploring for and producing oil and natural gas. As the nation transitions to the clean energy economy of the future, we must also ensure that we effectively mitigate the risks of our current energy portfolio.

The oil and gas industry will continue to meet our economy's immediate needs by pushing into increasingly difficult frontiers, including deepwater operations offshore and unconventional gas onshore. The Department will ensure that the federal government's understanding of the risks associated with these operations keeps pace. This will be accomplished through scientific assessment of the risks, potential impacts, and adequacy of current response and mitigation technologies.

The Department is uniquely suited to address this research challenge. The Department brings expertise and experience in geospatial engineering and modeling, fluid flow in porous media, underground containment in engineered natural systems, mechanical/structural stress analysis, complex fluid flow simulations, and other relevant research areas.

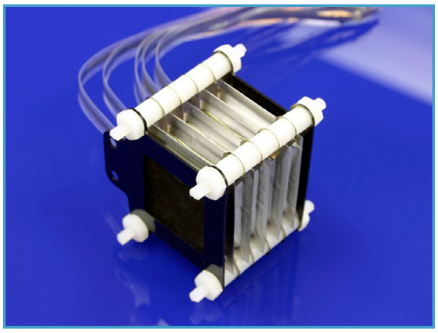
DISCOVER THE NEW SOLUTIONS WE NEED

The Department has an unrivaled capability for technological innovation, and the urgency to dramatically reduce greenhouse gas emissions by 2050 has set a relentless clock for our response. Because significant market penetration in the energy supply sector can take 20 years or more, the Department will focus on technologies that can confidently be predicted to enter commercial application at a minimum of 1 quadrillion British thermal units (quad) annually by 2030 (about 1% of current U.S. primary energy). We will pursue technologies that can have the greatest impact on national energy goals within this time horizon, avoiding technologies of limited applicability or resource. We will employ innovative funding mechanisms where appropriate to drive down the time from conception to commercialization. Additionally, because innovation is essential to meeting our goals, we will dedicate 10% of our energy technology portfolio to inventing new platforms with the potential to be technically and economically competitive.

Algae is considered one of the promising feedstocks for biofuels by the Department because of its high energy content and yield, rapid growth and ability to thrive in seawater or wastewater. Oil from algae can be refined into gasoline, biodiesel or jet fuel.

Accelerate Energy Innovation through Precompetitive Research and Development

We will conduct timely, relevant research and development programs that can demonstrably impact the energy system. Because the Department neither manufactures nor sells commercial-scale energy technologies, our best impact is in the generation and use of broadly applicable analytical tools, validated engineering design rules, and data from test beds to help generate, assess, and mature novel energy technologies. This work must be done in close collaboration with the private sector, which is the agent of technology deployment. Important new strategy elements are included in the following subsections.



The Advanced Research Projects Agency-Energy is funding research and development of PolyPlus's lithium-air battery that could enable an electric car to travel 500 miles on a single charge. Source: PolyPlus Battery Company.

New Research Structures. The Department has traditionally pursued technology innovation through focused programs addressing known gaps in understanding and technology performance. To enable commercialization of new energy technologies at the pace required by national goals, we will pursue research that blurs the boundaries between science, engineering, and technology development but maintains a focus on research and development where the federal role is strongest. We will be more goal-oriented and multidisciplinary; we will work to better couple basic and applied work; and we will encourage academia-laboratory-industry partnerships.

We will also promote technology development that addresses market needs. Improving industry's early insight into technology development can accelerate its deployment, and improving researchers' understanding of industrial needs and constraints can lead to more effective innovation.

We have developed a portfolio of new research efforts, including Energy Frontier Research Centers, Energy Innovation Hubs, Advanced Research Projects Agency-Energy (ARPA-E), and Manufacturing Energy System Partnerships to provide integration across disciplinary boundaries as well as across multiple phases of RDD&D.

Geoscientists at Lawrence Berkeley National Laboratory sample hot springs for geochemical and isotopic data to identify fluid sources, water-rock reactions and fluid flow paths and rates associated with the Long Valley Caldera, California, geothermal system. Geothermal can provide a baseload source of power.

- We will use **Energy Frontier Research Centers** where 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.
- We will use **Energy Innovation Hubs** to focus research and development efforts on problems ready for side-by-side integration of discovery-oriented scientific research with translational engineering research so that opportunities for commercialization are recognized as early in the development life cycle as possible.
- We will use **ARPA-E**, a new funding organization within the Department, to search for new technologies rather than the creation of new scientific knowledge or the incremental improvement of existing technologies.
- We will use **Manufacturing Energy System Partnerships** to perform concurrent technology development and manufacturing systems design to reduce the cost and time for commercial-scale deployment of new, low-carbon energy systems.

Energy Systems Simulation. We will facilitate the transfer of our computer simulation capability to industry with the goal of accelerating energy technology innovation by improving designs, compressing the design cycle and easing transitions to scale, thereby enhancing U.S. economic competitiveness. Applications could include combustion technologies, carbon capture, fission reactors, grid operation and optimization, and underground fluid transport and storage. The Department will create open software tools where none exist and will work with industry to advance the capability of standard toolsets.

Targeted Outcomes:

- ARPA-E will catalyze by FY 2012 the development of transformative and potentially disruptive energy technologies; drive the transition of high-impact energy innovations toward market adoption; contribute to the advancement of U.S. leadership and global competitiveness in energy innovation; and build itself as an innovative, highly effective, and sustainable organization.
- Reduce upfront risk and cost associated with geologic technologies, including carbon sequestration and geothermal energy systems, by validating at least two new innovative exploration techniques for geologic reservoirs by 2014.
- Validate high-fidelity simulations of internal combustion engines, fission, and conventional power plants in commercial use by 2015, thereby integrating high-performance computer simulation into the industrial energy sector. Demonstrate advanced inspection techniques for irradiated fuel at the Irradiated Materials Characterization Laboratory.
- Develop by 2020 innovative solutions for highway transportation electric drive components (e.g., battery energy storage, electric motors, and electric power management) that enable cost-effective use of electric vehicles, significantly reducing oil use and greenhouse gas emissions.

Facilitate Technology Transfer to Industry

Moving laboratory inventions into the commercial sector where products can be scaled and deployed for public use and benefit is essential if new energy technologies are to have a real impact. To promote commercialization, the Department will partner with the private sector and other federal agencies to move technologies from proof-of-concept to full-scale deployment.

We will expand contracting vehicles between industry and national laboratories, and lower transaction costs for those willing to develop and deploy the early-state innovations arising in the laboratories. The Department will seek to develop innovative contractor-led technology transfer mechanisms that can be deployed within the current framework and will also increasingly seek to partner in the support of small businesses and high-growth companies that can create jobs in the clean energy sector.

ENERGY STORAGE: FROM DISCOVERY TO COMMERCIALIZATION

The Office of Science sponsored basic research at the Massachusetts Institute of Technology over a decade ago that led to the discovery of a new nanostructured cathode material for battery applications. Based on this discovery, the faculty member started a company, A123 Systems in Watertown, Massachusetts, to commercialize this new battery technology. Development was further supported by a Department Small Business Innovation Research grant starting in 2002, and by a grant from the Office of Energy Efficiency and Renewable Energy starting in 2006. Today, A123 Systems' batteries have reached the commercial marketplace in power tools, hybrid and plug-in hybrid electric vehicles, and electric grid-related applications.

We will encourage the private sector to translate our research and development outputs to market through SBIR, Small Business Technology Transfer (STTR), ARPA-E, Cooperative Research and Development Agreements, and loan guarantees. The newly initiated SBIR Phase III Xlerator Program provides up to 3 years of Phase III funding to the most promising clean energy technologies and companies that are on the threshold of high-growth job creation.

Targeted Outcomes:

- Encourage industry to translate our research and development outputs to market through new contractual vehicles that lower transaction costs and address commercialization barriers.

Establish Technology Test Beds and Demonstrations

The commercialization, broad diffusion, and regulatory approval of a new energy technology requires high confidence in its performance. Industry, regulators, and policy makers must have high confidence in issues ranging from technology performance to environmental impact, as operational uncertainty increases early adopter risk, slows market penetration, and presents environmental risks. A successful characterization of a new technology at scale can reduce these risks and speed adoption.

The Department has allocated Recovery Act funds to more than 25 projects that capture carbon dioxide emissions from industrial sources such as chemical plants, refineries, and manufacturing facilities, and sequester carbon dioxide into underground formations.

The Department will continue to develop the capability to evaluate and characterize the performance of energy technologies in operational environments so that system-level performance, benefits, challenges, and environmental risks can be well understood prior to commercialization and deployment. The Department will make these testbed and demonstration capabilities available to researchers and industry alike, with resources allocated through open, peer-reviewed competition. Where appropriate, we will pursue—in collaboration with industry— a limited number of demonstration projects with the greatest potential to catalyze wide-scale adoption.

Targeted Outcomes:

- Complete at least two new national technology user facilities by 2015.
- Complete small modular reactors design certification by 2016.
- Develop cellulosic ethanol technologies by 2012 that can facilitate mature production costs less than $2.00/gallon.
- Bring at least 5 commercial-scale carbon capture and storage (CCS) demonstrations online by 2016.
- Use research and development results of laboratory through pilot-scale tests to show, through engineering and systems analyses studies, 90% CO_2 capture of advanced post-combustion and pre-combustion capture technologies with potential for no more than a 35% increase in the levelized cost of electricity for post-combustion and no more than a 10% increase in the levelized cost of electricity for pre-combustion when compared to a reference power plant.

Leverage Partnerships to Expand Our Impact

State and Local Governments, Utilities, and Retailers. State and local governments, utilities, and retailers who interact directly and regularly with consumers are key enablers of the deployment of new energy technologies. Partnerships and constructive competition and benchmarking across jurisdictions can be important tools for overcoming informational, permitting, financing, and other types of barriers that impede the deployment of cost-effective clean energy and efficiency technologies. The Department has long-standing programs that provide grants to state and local governments for deployment of energy efficiency and renewable energy technologies, including technical assistance on policy issues. The Department will continue to support state policies to address climate and energy challenges and seek to replicate best practices from state experience at the national level.

International. Because the greatest energy challenges are global in nature, the Department will foster international partnerships to advance our common goals for developing and deploying clean energy technologies and addressing climate change, energy security, and energy scarcity. The Department's strategy for developing these partnerships focuses on engaging other major economies and participating in broader regional platforms for cooperation. Thus, the Department works with the Department of State, as delegated and where appropriate, to lead activities such as the Clean Energy Ministerial and participate in bilateral and multilateral agreements such as the U.S.-China Clean Energy Research Center and the Energy and Climate Partnership of the Americas.

Secretary Chu and Administrator Zhang Guobao of China discuss potential collaboration opportunities.

Technologies must be deployed globally if they are to materially impact consumption and emissions. U.S. leadership through the Department can help promote clean energy technologies around the world. Other countries can have greater demand, pace, risk and/or tolerance in energy innovation. International partnerships could offer more diverse projects to increase learning rates, promote the global adoption of clean energy technologies, and perhaps ease foreign market entry for U.S. firms. However, intellectual property and competitiveness issues will be carefully managed.

Interagency Engagement. In addition to authorities assigned to the Department, more than a dozen federal agencies have significant authorities relevant to the development and deployment of innovative energy technologies. Standards, siting, and permitting are just a few of the many energy issues that involve multiple agencies. Supporting a whole-of-government approach to Administration policy objectives, the Department will actively consult and coordinate with other agencies, leveraging additional capacity and reducing redundancy. For example, data from the testing and validation of innovative energy efficiency and renewable energy technologies by the Department of Defense can directly inform DOE-applied technology programs. Whenever possible and appropriate, DOE will work with the Department of Defense to demonstrate innovative technologies, including on military installations, thus accelerating the development of energy solutions for defense and nondefense applications. DOE will continue coordinating with the Department of Interior, U.S.

Department of Housing and Urban Development, Department of Commerce, U.S. Department of State, U.S. Environmental Protection Agency, U.S. Department of Agriculture, and other agencies as appropriate to develop and implement integrated federal energy policies and programs.

Educational Institutions. The Department has long-standing programs that provide grants and contracts to educational institutions for research and development, infrastructure support, training, scholarships, and internships. Partnerships with educational institutions encourage more students to explore careers in the Science, Technology, Engineering, and Mathematics (STEM) fields. Specifically, support of minority serving institutions fuels the pipeline of future scientists and engineers in energy-related fields. Minority-serving institutions—which include historically Black colleges and universities, Tribal colleges and universities, and Hispanic-serving institutions—primarily serve underrepresented minority populations and are a valuable and unique resource to the Department's mission. Supporting these educational institutions will create a diverse workforce, spurring innovation in the clean energy sector.

LEAD THE NATIONAL CONVERSATION ON ENERGY

Given the scale, longevity, and incumbency of energy systems, energy policy can be the most effective tool for promoting our energy goals. Energy policy development is a collaborative process among many stakeholders in the executive and legislative branches of the federal government. The Department plays a unique role in ensuring the processes of informing, shaping, and supporting energy and related environmental policies are underpinned by sound techno-economic principles and analyses. The Department will strive to remain a highly trusted authority for informing energy policy decisions.

National Solar Thermal Test Facility at Sandia National Laboratories provides experimental engineering data for the design, construction, and operation of unique components and systems in proposed solar thermal electrical plants planned for large-scale power generation.

Provide Sound Information on Energy Systems and Their Evolution

The Department must marshal its extensive knowledge of energy technologies, energy infrastructure, energy markets, and consumer behavior to provide unimpeachable analyses that inform policy makers, program management, and the private sector. We will support objective, thorough technology assessments, including analyses of technology diffusion and adoption paths that avoid technology advocacy.

The Department also has strong capabilities in climate modeling, large-scale ecological field experiments, atmospheric radiation measurements, and simulation methodologies that promise to improve the accuracy and precision of climate predictions. A particular focus will be on projecting regional impacts to better inform policymakers and communities planning for the future. The Department will also inform policy for future international accords by engaging its technical base, in cooperation with other government agencies and nations, in developing and validating methodologies to monitor greenhouse gas emissions at local, regional, and national scales.

Promote Energy Literacy

National energy goals will be achieved only through economy-wide energy transformation. The Department will use its technical expertise and analytic capabilities in a transparent and unbiased manner to inform decisions in government policy-making, the marketplace, and households. Because today's young generation are tomorrow's world leaders, we will champion outreach through competitions, project-based learning, interactive gaming, and social media. By using today's technologies to inspire the country's most aspirational and imaginative citizens, we will create the momentum necessary to meet our energy goals.

The Department will actively participate in the development and implementation of a coordinated national energy education or "energy literacy" effort. A modest understanding of energy sources, generation, use and conservation strategies will enable informed decisions on topics from home energy use to international energy policy. The Department will leverage relationships with academic institutions, other federal agencies, industry, organizations, and other stakeholders to improve awareness and understanding of energy issues.

Targeted Outcomes:

- Identify by 2012 the most promising educational opportunities to improve domestic energy literacy.
- Provide online energy literacy content by 2013 for the National Training and Education Resource platform.

Make the Federal Government a Leader in Sustainability

The Department is uniquely positioned to lead by example in transforming domestic energy use. Integrating sustainability throughout the Department is an essential aspect of implementing Executive Order 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*,[1] and Executive Order 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*,[2] as well as related statutes, and meeting or exceeding all required energy management and environmental goals. As stated in the *U.S. Department of Energy Strategic Sustainability Performance Plan* (SSP),[3] the Department will reduce greenhouse gas emissions from onsite combustion of fossil fuel, fugitive emissions, and purchased power by 28% and reduce emissions from outside sources—such as business travel and employee commuting—by 13% by 2020. We will strive to exceed these goals at our own facilities by incorporating sustainability into all corporate management decisions, continually improving our

Cool roofs—as shown here on the DOE Headquarters building—use lighter-colored roofing surfaces or special coatings to reflect more of the sun's heat, helping to improve building efficiency, reduce cooling costs, and offset carbon emissions.

[1] *Federal Leadership in Environmental, Energy, and Economic Performance.* 2009. Executive Order 13514, Office of the President. Available at http://www.whitehouse.gov/assets/documents/2009fedleader_eo_rel.pdf.
[2] Strengthening Federal Environmental, Energy, and Transportation Management. 2007. Executive Order 13423, Office of the President. Available at http://edocket.access.gpo.gov/2007/pdf/07-374.pdf.
[3] *U.S. Department of Energy Strategic Sustainability Performance Plan – Discovering Sustainable Solutions to Power and Secure America's Future - Report to the White House Council on Environmental Quality and Office of Management and Budget, September 2010.* Available at http://www.energy.gov/media/DOE_Sustainability_Plan_2010.PDF.

operations and existing infrastructure to maximize efficient use of energy and natural resources, and ensuring, whenever built, new facilities are highly energy efficient. The Department will partner with other federal agencies to influence energy consumption and sustainability across the government, accelerating the diffusion of energy expertise and technologies to achieve the goals of the Executive Orders and the "greening" of the federal government.

Targeted Outcome:

- Maintain the Department's path in reducing greenhouse gas emissions by 28% by 2020 from a 2008 baseline and assist other federal agencies in achieving their reduction targets.

The Science and Engineering Enterprise

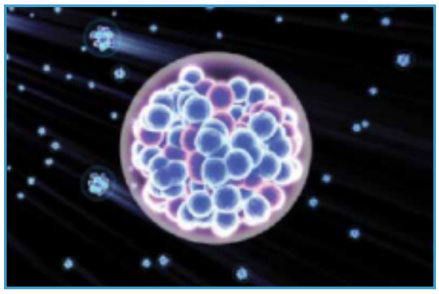
Goal: Maintain a vibrant U.S. effort in science and engineering as a cornerstone of our economic prosperity, with clear leadership in strategic areas.

The Department supports basic research into the smallest constituents of matter; the most fleeting subatomic, atomic, and chemical transitions; and the structure and properties of materials and biological systems. We are the largest federal funder of physical sciences.[1] Our research extends understanding of nature; enables new technologies that support the Department's energy, environment, and security missions; and improves the quality of life of all Americans. Scientific discovery feeds technology development and, conversely, technology advances enable scientists to pursue an ever more challenging set of questions. The Department will strive to maintain leadership in fields where this feedback is particularly strong, including materials science research, bio-energy research, and high-performance computing.

The Department's science program is unique among federal research agencies in the extent to which it enables discoveries and innovation through investments in the design, construction, and operations of unique, world-leading facilities and research tools for discovery. Its technical enterprise will not remain vital without a continual upgrading and full exploitation of the experimental and computational tools that advance discoveries. These tools for discovery in science often push technology development earlier and harder than almost any other activity. The Department has core technology research competencies in nuclear systems, security, and reliability systems, accelerator and detector technologies, light sources and associated instrumentation, high-speed diagnostics, and pulsed power systems. The Department's research also play an important role in a high-technology economy through the skilled technical workforce that work and train in these diverse activities.

EXTEND OUR KNOWLEDGE OF THE NATURAL WORLD

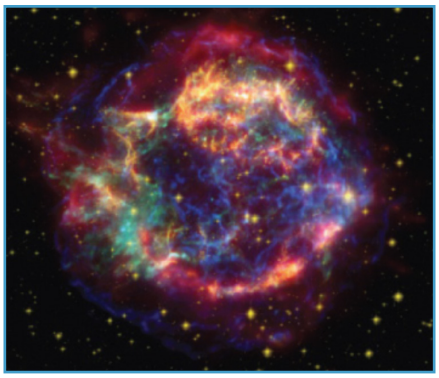
The Department's basic research programs address fundamental questions in the physical sciences and produce novel hardware and theoretical and analytical tools with applications well beyond the specific science. Furthermore, this discovery-oriented research produces highly trained researchers who apply their research skills to more immediate problems. The Department invests resources so that the U.S. research community can maintain meaningful, and in some instances, world-leading research capabilities.



An international team of scientists from the U.S. and Russia discovered element 117, the newest super heavy element.

Subatomic Physics. The Department is the primary government sponsor of research in particle and nuclear physics. These fields also steward isotope research and development and accelerator technology development, two activities with demonstrable societal impact. The quest for knowledge at the extreme scales of energy and space reveals the basic building blocks of the universe. This research will

[1] *Federal Funds for Research and Development: Fiscal Years 2007–09.* 2010. NSF 10-305, Table 22, National Science Foundation. Available at http://www.nsf.gov/statistics/nsf10305/.



Using tools like the National Superconducting Cyclotron Laboratory at Michigan State University, nuclear physicists at Argonne Tandem Linac Accelerator System at Argonne National Laboratory and the Holifield Radioactive Ion Beam Facility at Oak Ridge National Laboratory are deciphering the processes by which supernova explosions create elements.

continue to illuminate questions about the unification of the forces of nature, the structure of black holes, the origins of the universe, the structure of nuclei, and the nature of dark energy and matter.

Targeted Outcomes:

- Complete construction of nuclear physics facilities by the end of the decade at Jefferson Laboratory and Michigan State University to test quantum chromodynamics, the theory of nuclear forces, and produce exotic nuclei of relevance in astrophysical processes.
- Perform a series of experiments through 2020 in the intensity, energy and cosmological frontiers to illuminate questions about the unification of the forces of nature, the structure of black holes, and the origins of the universe.

Chemical and Materials Research. At the atomic and molecular scales, the Department pursues world-class research in fundamental properties of materials and chemistry that explores the origins of macroscopic behaviors and their fundamental connections to atomic, molecular, and electronic structures. At the core of the Department's chemical and materials sciences programs is the quest for the deterministic design and discovery of new materials and chemical assemblies with novel structures, functions, and properties. To accomplish this goal, the portfolio stresses the need to probe, understand, and control the interactions of phonons, photons, electrons, and ions with matter to direct and control energy flow over multiple time and length scales.

Growing capabilities to synthesize and characterize materials and chemical processes are converging with advances in simulation (theory, modeling, and computation) to create new opportunities for materials and chemistry by design. Our synchrotron sources, free-electron and ultra-fast lasers, electron microscopy, and neutron sources expand our ability to "see" and understand materials and their properties to ever smaller length and time scales, while improved theory and modeling is moving to increasingly larger systems of atoms and longer time scales.

The Department has developed world-leading capabilities to produce and probe materials at temperature and pressure extremes. Static and dynamic compression techniques, coupled with ultrafast diagnostic techniques, have given us insight into conditions comparable to those observed in a variety of astrophysical systems such as the cores of the giant planets or exploding supernovae. Accurate properties of materials in these extreme environments, previously only inferred from observations, will help to improve theory and modeling of these and other exotic objects in the universe.

Targeted Outcomes:

- Explore the construction and use of X-ray free electron lasers and the next generation of synchrotron light sources.
- Develop and explore a broad spectrum of new materials that have novel properties, such as catalysis, electrothermal behavior, radiation resistance, or strength, or otherwise contribute to the advancement of energy technologies by 2020.

Climate Science. The Department supports basic and policy-relevant research underpinning a predictive, systems-level understanding of climate. The carbon cycle and the rich interplay of soils and microbes with the atmosphere are particular areas of expertise. These activities combine field experiments, global data collection, and simulations. The Department will continue to pursue predictive climate models at the regional spatial scale and decadal time scale as part of the U.S. Global Change Research Program and through the international science community. We will also incorporate forecasts of global energy use and anthropogenic greenhouse gas emissions into climate modeling to provide a better sense of how the energy system, the economy, and the environment will interact. Climate science capabilities will inform wind and solar modeling and system management.

Targeted Outcome:

- Determine the major sources of uncertainty in our understanding of the coupled climate system by 2015.

Synchrotron Light Sources

One of the Department's most important contributions to the nation's research and development portfolio is its support of major scientific facilities. These large-scale facilities are indispensable tools of 21st century science.

As with most discovery science, facilities have often developed via unexpected avenues. For example, synchrotron light—the light emitted by an electrical charge following a curved trajectory—was originally viewed as an undesirable byproduct of particle accelerators built to probe the fundamental laws of physics. However, by the 1970s, the Department began to support the construction of large accelerators built entirely to produce and use synchrotron light. These advanced light sources are among the world's most powerful tools for research in a broad range of fields, including chemistry, advanced materials science, biology, medicine, and nanoscience, to name only a few. Three of the last six Nobel Prizes in chemistry were awarded for research using Department-supported synchrotron radiation light sources.

Rendering of the National Synchrotron Light Source II, currently under construction at Brookhaven National Laboratory. The facility is a new state-of-the-art medium energy storage ring designed to deliver world leading brightness and flux.

The fundamental tenet of materials research is that structure determines function. The practical corollary that converts materials research from an intellectual exercise into a foundation of our modern technology-driven economy is that structure can be manipulated to construct materials with specific desired behaviors. To this end, synchrotron radiation has transformed the role of X-rays as a mainline tool for probing the atomic and electronic structure of materials and their surfaces.

With the recent commissioning of the Linac Coherent Light Source at SLAC National Accelerator Laboratory and the construction of the National Synchrotron Light Source II at Brookhaven National Laboratory, the Department continues to support U.S. leadership in this research technology. This technology is one of the most critical—for both maintaining America's competitive edge and producing the fundamental breakthroughs needed to address our pressing challenges in energy and climate.

DELIVER NEW TECHNOLOGIES TO ADVANCE OUR MISSION

Technical innovation is produced when new and fundamental knowledge is combined with in-depth technical understanding of applied systems to create new capabilities. Engineering, the practice of science under constraints and performance requirements, can therefore be most innovative when coupled directly with scientific discovery. Given the urgency of our energy and security missions, we must enhance our capacity for technical innovation through a tight coupling of science and technology efforts across the Department.

With strategic investments, the Department will foster the development of new technologies to make major contributions to our energy, environment, and security missions. These investments will enable the Department to focus its resources on forefront research optimized for timeliness, relevance, and impact.

Materials in Energy and Security-Related Systems. Almost any energy-related system built today depends on materials with unique properties—whether those properties be strength, weight, energy content, electronic or optical properties, or resistance to high temperatures and radiation. This is also true of novel detection systems for national security applications such as screening for nuclear materials or remote-sensing applications. Airplanes, automobiles, and other transportation vehicles depend on new materials that are lightweight and high strength, to achieve high-energy efficiency and increased safety. Next-generation wind systems will depend on similar materials to achieve high strength with lighter weight for improved lifetimes, system reliability, and reduced operating costs. Similarly, electronics used in energy systems depend on the processing of materials at nanometer scales and materials that possess as yet unavailable properties, including improved band-gap properties, improved junction materials, and tailored thermal properties—all at lower cost. Examples from other technology areas of the types of advances needed in energy systems include introduction into the modern telecommunications system of new materials based on glass optical fiber with transparency not imagined 40 years ago; use of superconducting materials that have enabled fabrication of magnets that are widely used today in imaging applications and accelerators; and development of alternatives to rare earth materials.

Basic science research translates into applied energy solutions.

The Department will continue to support broad-based research directed toward discovering new materials, and with the use of laboratory facilities such as the synchrotron centers, laser facilities, neutron scattering facilities, and the nanoscience laboratories, characterize the properties of these materials for applications such as catalysts, batteries, materials resistant to high temperatures and radiation, composite materials, and electronic devices. The Department will consider the role of rare earth materials in production of energy technologies.

Bioenergy. The Department will continue to develop biotechnology solutions for energy, the environment, and carbon sequestration, with particular emphasis on cost-effective technologies for next-generation production of biofuels.

The Department will support research in the discovery, design, and synthesis of biomimetic and bioinspired functional approaches and energy-conversion processes based on principles and biological concepts. The emphasis is the creation of robust, scalable, energy-relevant processes and systems that work with the extraordinary effectiveness of processes from the biological world. Areas of particular focus include the following:

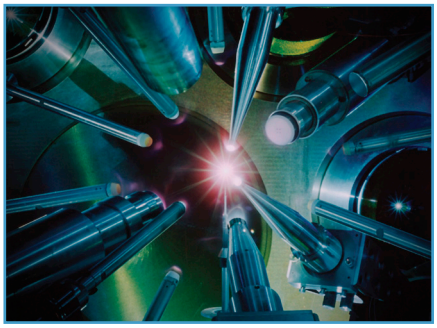
- Understand, control, and build complex hierarchical structures by imitating nature's self- and directed-assembly approaches.
- Design and synthesize environmentally adaptive, self-healing multicomponent systems that demonstrate energy conversion and storage capabilities found in nature.
- Create functional systems with collective properties not achievable by simply summing the individual components.
- Create biomimetic and/or bioinspired routes for the synthesis of energy-relevant materials.
- Develop science-driven tools and techniques for the characterization of biomolecular and soft materials.

Genomics-based systems biology research, agronomic strategies, and fundamental understanding of biological and chemical deconstruction of biomass are particularly important elements of these activities. Research supported in this area will have impacts beyond bioenergy, underpinning technologies such as batteries and fuel cells, catalysis, hydrogen generation and storage, and membranes for advanced separation.

Targeted Outcome:

- Apply systems biology approaches by 2015 to create viable biofuels processes and greatly increase the understanding of microbes in carbon-dioxide climate balance.

Fusion Energy. Because fusion may have applicability to our energy mission in the long term, the Department will continue to pursue a program of fusion science, technology, and energy research aimed at developing the scientific and technological foundations needed to make a fusion energy source. Progress over the last decades in this effort lies at our ability to pursue the next frontier of exploring burning plasmas, with ITER and the National Ignition Facility being the key research facilities. The Department is well positioned to exploit advances in high-energy density science, core expertise in pulsed power, laser and accelerator technology, and the demonstration of laboratory ignition at the National Ignition Facility to advance technology relevant to inertial fusion energy.



The international inertial confinement fusion community uses the OMEGA laser at the University of Rochester's Laboratory for Laser Energetics to conduct experiments and test target designs and diagnostics.

Targeted Outcomes:

- Execute U.S. responsibilities for construction of the ITER project, consistent with sound project management principles.

- Exploit the National Ignition Facility by 2012 in a credible National Ignition Campaign and establish an open-science user program.

The Jaguar supercomputer, located at the Oak Ridge National Laboratory Leadership Computing Facility, can perform 700 trillion calculations per second and is the world's most capable scientific computing resource.

Lead Computational Sciences and High-Performance Computing

Simulation has emerged as a critical tool for science and engineering. It enables the exploration of complex phenomena that are impossible to study in a laboratory (such as the formation of galaxies or the global climate), and enables engineers to build a virtual prototype of a complex system and test its performance before physical construction.

Beginning with the Manhattan Project in the 1940s, the Department and its predecessor organizations have developed and exploited the fastest computers of the day for simulations. In particular, over the past 15 years stockpile stewardship activities have combined computer modeling with laboratory experiments and historical test data to achieve unprecedented understanding and predictive capability for complex systems. In parallel, the Department has promoted the application of the world's most capable computers to unclassified science and engineering problems, in part through the development of open-community simulation codes.

The Department will continue to invest in the applied mathematics, computer science, and networking tools necessary to build upon this core competency in scientific simulation. The Department will perform research required to develop exascale computing platforms and associated software environments in support of energy, science, and security missions. The Department will continue to advance the frontiers of energy-efficient computing and supercomputing to enable greater computational capacity with lower energy needs.

Targeted Outcome:

- Continue to develop and deploy high-performance computing hardware and software systems through exascale platforms.

SUSTAIN A WORLD-LEADING TECHNICAL WORKFORCE

Excellent scientists, technologists, and engineers are the creative engine of the Department. The Department and its national laboratories must cooperate to create conditions that allow today's researchers to be as productive as possible, as well as to ensure an adequate supply of tomorrow's researchers. Investments will help develop the next generation of scientists and engineers to support Department missions, administer its programs, and conduct the research that will realize the nation's science and innovation agenda. These investments will enrich the diversity of the STEM pipeline so that it is more inclusive of women, minorities, and persons with disabilities while mentoring the next generation of scientists, technologists, and engineers.

To conduct discovery and mission-driven research, Department laboratories must attract and retain a critical mass of the most talented researchers. In discovery areas, access to unique facilities and a focus on research are powerful attractions, while in the applied areas, multidisciplinary team science and the importance and urgency of the mission are also important. Stability (but not stasis) of funding and the quality of colleagues also play a role. The Department will be relentless in ensuring the laboratories attract and retain a high quality, diverse workforce.

The Department will continue to support students and educators through undergraduate and graduate support, postdoctoral fellowships, laboratory internships, teacher-mentor programs, and national middle- and high-school science competitions. Continued emphasis will be placed on ensuring an adequate pipeline of scientists and engineers in critical skills areas essential to supporting the Department's missions. The Department will help create educational and training programs involving energy literacy and energy efficiency. Expanded use of advanced learning and training technologies will enable high-quality, interactive education and training materials to be rapidly created and disseminated, and improve the Department's response to immediate and longer-term job training needs.

The Department improves energy education through advanced learning and training technologies.

Targeted Outcome:

- Provide support by 2015 to graduate students in a manner designed to address skill gaps identified by senior Departmental leadership in the Department's scientific and technical workforce.

Secure Our Nation

Goal: Enhance nuclear security through defense, nonproliferation, and environmental efforts.

"So, today, I state clearly and with conviction America's commitment to seek the peace and security of a world without nuclear weapons. ... [M]ake no mistake: As long as these [nuclear] weapons exist, the United States will maintain a safe, secure, and effective arsenal to deter any adversary, and guarantee that defense to our allies."

– President Obama, Prague, Czech Republic, April 5, 2009

In his Prague speech[1] in April 2009, President Obama described a world at a crossroads. The Cold War is over but thousands of nuclear weapons remain. The risk of a nuclear attack by terrorists or proliferant nations has increased, even as the threat of global nuclear war has gone down. The growing global demand for energy—coupled with increasing concerns about climate change—has accelerated deployment of nuclear power plants, increasing proliferation risks.

The President presented a path forward to reduce nuclear danger while enabling access to peaceful nuclear power for all nations that respect the international nonproliferation regime. This comprehensive agenda was described in the 2010 *Nuclear Posture Review Report* (NPR),[2] prepared by the Department of Defense, in consultation with the Department of Energy and the Department of State. The NPR set out five key objectives for our nuclear weapons policies and posture:

1. Preventing nuclear proliferation and nuclear terrorism;
2. Reducing the role of U.S. nuclear weapons in U.S. national security strategy;
3. Maintaining strategic deterrence and stability at lower nuclear force levels;
4. Strengthening regional deterrence and reassuring U.S. allies and partners; and
5. Sustaining a safe, secure, and effective nuclear arsenal.

The Department—primarily through the National Nuclear Security Administration—is central to (1) preventing proliferation and nuclear terrorism and (5) sustaining a safe, secure, and effective nuclear arsenal. We have added responsibility for cleaning up the environmental legacy of the Cold War's nuclear weapons complex. Through engagement with the International Atomic Energy Agency and directly with other international and interagency partners, the Department has a leading role in nonproliferation and cooperative threat-reduction programs. This expertise positions the Department ideally to help shape policy surrounding future deployment of nuclear power globally. Just as the Department is the trusted authority on the safety, security, and effectiveness of the U.S. nuclear weapons stockpile, it can apply science, technology, and engineering to ensure future nuclear power systems can be deployed safely and securely with appropriate mitigation of risks from terrorism and proliferation.

National laboratories bring their own expertise in support of the full range of nuclear security work including nonproliferation, fuel cycles, nuclear forensics,

[1]Remarks by President Barack Obama in Prague, Czech Republic. 2009. Available at http://www.whitehouse.gov/the_press_office/Remarks-By-President-Barack-Obama-In-Prague-As-Delivered/.
[2]*Nuclear Posture Review Report*. 2010. Department of Defense. Available at http://www.defense.gov/npr/docs/2010%20nuclear%20posture%20review%20report.pdf.

nuclear counter-terrorism, nuclear and radiological emergency management, intelligence analysis, and treaty monitoring and verification. Investments in these science, technology, and engineering capabilities were cited in the NPR as a means to reduce our reliance on large inventories of nondeployed warheads, and to deal with technical surprise, thereby allowing additional reductions in the U.S. nuclear stockpile and supporting the long-term path to zero.

SUPPORT THE U.S. NUCLEAR STOCKPILE AND FUTURE MILITARY NEEDS

Since 1992, the ongoing Stockpile Stewardship and Management Program has enabled annual certification that the U.S. stockpile remains safe and reliable without further nuclear testing. While the stockpile is being reduced to levels outlined in the New Strategic Arms Reduction Treaty (START) Agreement, as supported by Nuclear Posture Review analysis, the Stockpile Stewardship and Management Program and the capabilities and expertise it has developed and sustained remain essential to ensure the safety, security, and effectiveness of the nuclear deterrent.

Targeted Outcomes:

- Complete annual assessments of the stockpile to ensure it is safe, secure, and effective (High Priority Performance Goal).
- Deliver by 2020 a physics-based capability to enable assessment of weapon performance with quantified uncertainties.
- Complete by 2022 the dismantlement of all weapons systems retired prior to 2009.
- Recapitalize and modernize by 2022 plutonium and highly enriched uranium capabilities.

Maintain a Safe, Secure, and Effective U.S. Nuclear Stockpile

The annual assessment process and life-extension programs are both important components of a successful Stockpile Stewardship and Management Program. To meet national nuclear security goals, we must exercise the full spectrum of capabilities—from concept through design studies, to engineering prototypes and production, and finally to maintenance and dismantlement. Important life-extension activities are beginning on the B61 bomb and the W78 warhead to replace aging warhead components and to assess options for enhanced safety and security in these systems. Novel surveillance technologies, designed to provide more and higher-fidelity data while sampling a smaller number of weapons each year, are being deployed to better assess the current state of the stockpile. Stockpile Stewardship and Management Program tools will continue to be developed and applied to support these activities, as well as the annual assessment process.

The B61 bomb is the oldest nuclear weapon in the our nation's active stockpile.

NNSA workers train to dismantle a nuclear weapon.

Stockpile Stewardship

The United States stopped underground nuclear testing in 1992, ending the practice used as the ultimate demonstration of the safety, security, and effectiveness of the nuclear weapons stockpile. The replacement approach for warhead certification and assessment was called science-based stockpile stewardship. Its premise was that a foundation of comprehensive understanding of the science, technology, and engineering phenomena in these most complex of weapons would serve to assure the nuclear deterrent for the enduring future. This new approach would require the development of a new generation of high-performance computer software and hardware well beyond those available, and a suite of experimental capabilities to investigate the extreme states of matter encountered in nuclear weapon operation, previously only accessible in underground tests and in astrophysical objects such as the cores of giant planets and supernovae.

Today, stockpile stewardship has demonstrated this goal is achievable. The numerical simulations are now becoming predictive, incorporating more detailed scientific understanding of critical physical phenomena. These simulations use sophisticated models and algorithms that are validated through extensive analysis of data from surveillance, the underground nuclear testing archive, and new experiments. Unique facilities provide higher fidelity measurements of fundamental materials properties and nuclear reactions while exercising the nuclear security enterprise skills needed to maintain and manage the stockpile.

In the future, a new generation of nuclear weapons designers skilled on modern tools and techniques will have been trained and mentored by experienced designers to ensure the knowledge gained over six decades of nuclear testing is incorporated into this sustainable stockpile stewardship mission. Continued improvement in the science, technology, and engineering understanding and predictive capabilities has enabled a deeper understanding of nuclear weapons performance than was previously possible, and provides assurance the stockpile can remain safe, secure, and effective without new underground nuclear testing.

Strengthen the Science, Technology, and Engineering Base

The Department must maintain its unique capabilities in nuclear weapons design, science, and production. In addition, we must maintain other science, technology, and engineering capabilities needed to support the nuclear weapons program. The reduction of nuclear weapon stockpiles does not diminish the need for these capabilities. Rather, their importance may increase as the nuclear-testing era recedes, and we pursue further stockpile reductions. Sustaining this expertise will require significant emphasis on recruiting and training a new generation of weapon scientists and engineers, and ensuring the knowledge and experience gained over 60 years of actual weapon development and testing is passed to this new generation. Experimental and computational capabilities and facilities must be developed and applied to enhance knowledge of nuclear weapons performance and life cycles, and to train and hone the next generation weapons workforce and specialists. Revitalizing this science, technology, and engineering workforce is an essential component of a successful Stockpile Stewardship and Management Program.

Recapitalize the Nuclear Infrastructure and Deterrent Capability

The production, surveillance, and dismantlement of stockpile weapons requires specialized infrastructure capable of handling hazardous and nuclear materials. The safety, security, and environmental demands of nuclear security require modernization of Cold War-era facilities, and in some cases, transformed capabilities. In particular, facilities for uranium and plutonium production and handling are now more than 50 years old and must be replaced to meet modern safety, security, and environmental standards.

Dismantle Excess Nuclear Weapons to Meet National Objectives

The U.S. commitment to reduce the size of the stockpile is expressed in the *Nuclear Posture Review* and treaty objectives. Meeting this commitment requires an effective weapon dismantlement program that completes this important work in a timely manner with appropriate attention to safety and security concerns. Dismantling excess weapons is important, tangible evidence of U.S. commitment to move toward a world free of nuclear weapons.

REDUCE GLOBAL NUCLEAR DANGERS

The Department will accelerate and broaden its longstanding nonproliferation efforts and will support arms control objectives to achieve the President's nuclear security agenda goals, embodied in the *National Security Strategy*[1] and *Nuclear Posture Review*. Increasing demands for clean, carbon-free energy are accelerating the deployment of nuclear power plants worldwide, which could spur pursuit of indigenous nuclear fuel enrichment and reprocessing capabilities by other countries. Increased numbers of fuel cycle facilities, unsecured nuclear materials, and illicit nuclear trafficking combine to make the prevention of nuclear terrorism and proliferation an urgent priority. Effective and credible international nuclear safeguards and export controls are important tools to counter proliferation threats. International agreements currently under consideration will place significant demands on monitoring and verification to provide the necessary confidence that all parties are complying with their treaty obligations. The Department will build on its long history of engagement with international partners to promote transparent weapons of mass destruction reductions and effective verification through the development of technical capabilities and policy options.

Members of the NNSA Radiological Assistance Program conduct training exercises in Alaska.

Enhance Nonproliferation Efforts and the Security of Nuclear Materials

The President's objective to combat nuclear proliferation presents numerous challenges. It will require an active nuclear and radiological material security

[1]*National Security Strategy*. 2010. Office of the President. Available at http://www.whitehouse.gov/sites/default/files/rss_viewer/national_security_strategy.pdf.

NNSA workers load casks of highly enriched uranium nuclear fuel for shipment out of Romania.

dialogue and cooperation with key domestic and international partners, where the Department will take a leading role. Enhanced tools for the detection of nuclear material movement and production will be needed to help reduce proliferation risks. Russian and U.S. commitments to dispose of surplus weapon-grade plutonium to ensure it cannot be used again for nuclear weapons requires a safe, secure, transparent, and effective disposal process.

Targeted Outcomes:

- The National Nuclear Security Administration will support the President's goal of securing vulnerable nuclear materials worldwide; target is end of 2013 (High Priority Performance Goal).
- Complete, by the end of 2013, demonstrations of next-generation technologies and methods to detect movement of special nuclear material for new treaty monitoring tools to ensure the obligations of foreign governments are being met.

Support the President's Arms Control and Nonproliferation Agendas

International treaty regimes are an important component of reducing nuclear danger, with the ultimate aim of zero nuclear weapons worldwide. The success of the New START Treaty, the Comprehensive Nuclear-Test Ban Treaty, the Treaty on the Non-Proliferation of Nuclear Weapons, and the Fissile Material Cutoff Treaty depend on technology to detect noncompliance and to hold international partners accountable. The Department's expertise and long experience with nuclear technologies is essential to providing the reliable and robust monitoring and verification systems required.

The NNSA deployed workers and equipment—Consequence Management Response Teams and Aerial Measuring Systems—to Japan in response to the March 2011 earthquake, tsunami, and nuclear reactor incident.

APPLY OUR CAPABILITIES FOR OTHER CRITICAL NATIONAL SECURITY MISSIONS

The Department—because of its extensive science and technology capabilities and nuclear expertise—has long provided support to national security missions in defense, homeland security, and intelligence. We will provide the scientific and technical knowledge to enable national security agencies to understand and counter dangers arising from foreign nuclear weapons programs, the spread of nuclear capabilities to additional countries, and the potential exploitation of nuclear materials by terrorists. As part of this effort, we will provide nuclear and radiological emergency response capabilities, assess foreign nuclear weapons development programs, analyze the life cycle of fissile materials, develop nuclear propulsion systems for the Navy, and address an array of technologies to enhance transportation security. The Department will continue to work with its federal, state, and local partners to ensure these important missions are continuously supported and that the nation can understand and effectively address strategic threats worldwide.

Strategic Partnerships to Address Broad National Security Requirements

The Department of Energy, Department of Defense, Department of Homeland Security, and the Director of National Intelligence will partner in an interagency forum to ensure the science, technology, and engineering capabilities of the Department's national laboratories are developed and sustained to meet the strategic needs and priorities of the broader national security community. This then enables other agencies to use the expertise and capabilities resident in the Department's laboratories via Work for Others, Memoranda of Understanding, or other mechanisms.

NNSA's Second Line of Defense Megaports Initiative installation of portal monitors at Antwerp in Belgium to detect illicit trafficking of nuclear and radiological material.

Analysis of Foreign Nuclear Weapons Programs and Novel Technologies

The unique knowledge gained in nuclear weapons design developed to support the U.S. stockpile plays a critical role in the nation's ability to understand strategic threats worldwide. The Department must support the development of capabilities and expertise to apply this knowledge broadly to the intelligence community and national security policymakers for the analysis of foreign weapons programs, and to assess the potential of emerging nuclear threats.

Counter the Threat of Nuclear Terrorism

Nonproliferation efforts play a key role in discouraging additional countries from acquiring nuclear weapons capabilities and stopping terrorist groups from acquiring nuclear weapons or the materials to build them. However, the need to be prepared to respond to the threat of nuclear terrorism remains, including maintaining emergency response capabilities that draw heavily upon the Department's expertise in nuclear weapons design and engineering. In the event of discovery or use of a nuclear or radiological device or materials, advanced capabilities for nuclear forensics will be required to identify the source of the nuclear material.

Design and Develop Integrated Navy Nuclear Propulsion Systems

The Department provides the design, development and operational support required to provide militarily effective nuclear propulsion plants and ensure their safe, reliable, and long-lived operation. The Department is responsible for the reactor plant design and development for the Ohio-class ballistic missile submarine replacement, which will include new technology to enable lower-cost construction while enhancing plant safety and survivability and reducing life cycle costs. It will also refuel its land-based reactor plant prototype in support of essential research and development efforts, and work toward the recapitalization of the program's 50-year-old used nuclear fuel infrastructure to ensure the flexibility needed to adjust to future mission demands.

The USS New Mexico submarine. The NNSA provides nuclear propulsion related research, development, operational support, and enriched uranium for the U.S. nuclear submarine fleet.

Targeted Outcomes:

- Provide the United States Navy with an A1B reactor plant by 2015 for next-generation aircraft carrier that increases core energy, provides nearly three times the electric plant generating capability, and requires half the number of reactor department sailors as compared to today's aircraft carriers.
- Provide the United States Navy by 2026 with a reactor plant that will extend core lifetime for the next-generation ballistic missile submarine.

SUPPORT RESPONSIBLE CIVILIAN NUCLEAR POWER DEVELOPMENT AND FUEL CYCLE MANAGEMENT

Worldwide deployment of civilian nuclear power is important to simultaneously satisfy both the increasing demand for energy and the need to limit greenhouse gas emissions. However, we must also carefully consider the impacts of deployment.

Support the Development of a New International Framework for Nuclear Cooperation

President Obama has called for the development of a new framework for international nuclear energy cooperation to reduce incentives for countries to pursue their own fuel-cycle facilities. This new framework may include a variety of features, such as international fuel banks, multilateral fuel service assurances, storage facilities, and repositories for used fuel. The Department will help establish this framework, taking into account the findings and recommendations once they are issued by the Blue Ribbon Commission on America's Nuclear Future. In doing so, we re-affirm the Department's commitment to the responsible disposition of used nuclear fuel and high-level waste.

Targeted Outcome:

- Use multilateral forums to promote nuclear fuel leasing.

Strengthen International Safeguards and Export Controls to Support Safe and Secure Deployment of Nuclear Power Globally

Safety and security concerns surrounding civilian nuclear power must be successfully addressed in the United States and globally. By taking a leading position in helping to craft the international nuclear technology "rules-of-the-road" and providing a sound technology base for their implementation and enforcement, the Department can facilitate a safe and environmentally acceptable source of energy while reducing greenhouse gas emissions and maintaining public confidence. The Department will also conduct research and development in search of fuel-cycle technologies that improve resource utilization while reducing the risk of proliferation.

COMPLETE ENVIRONMENTAL REMEDIATION OF OUR LEGACY AND ACTIVE SITES

The Department has the monumental task of cleaning up the environmental legacy from five decades of nuclear weapons development and government-sponsored nuclear energy research. We have been successfully mitigating the technically challenging risks and have made substantial progress in nearly every area of nuclear waste cleanup, including stabilizing and consolidating special nuclear material and safely storing tons of used nuclear fuel. We have continued to build momentum in disposing of solid radioactive wastes, remediating contaminated soil and water, and deactivating and decommissioning radioactively contaminated facilities, with each succeeding year building on the last.

Our strategy is to work aggressively to reduce the footprint of our contaminated sites while bringing to bear the Department's formidable research and development assets to develop and deploy transformational technologies that will both accelerate and lower the cost of dispositioning our highest curie materials that present high risk to public health and the environment. Disposition of this material remains our biggest challenge, as there are few precedents and fewer existing technologies and processes available to solve them. For these unique challenges, advancing our technology efforts is essential to finding new and better solutions.

Protect Human Health and the Environment

When the Environmental Management Program was established in 1989, there were 110 sites requiring cleanup in 35 states (including the Commonwealth of Puerto Rico), resulting in a legacy footprint of 3125 square miles. Today, there are 18 sites requiring cleanup in 10 states, resulting in a footprint of 900 square miles. Our strategy is to build on this success and complete cleanup activities that reduce the legacy footprint while maximizing the reduction of environmental, safety, and health risks in a safe, secure, compliant, and cost-effective manner.

An aerial view of the F-Area at the Hanford Site in Washington State shows a wide range of waste sites during mid-cleanup activities.

Transuranic waste and low-level waste disposal, soil and groundwater remediation, and deactivation and decommissioning—cleanup activities for which we have demonstrated high performance using proven technologies within a well-defined regulatory framework—will enable the near-term site completions and reduce our legacy footprint further.

Ultimately, completion of such cleanup activities reduces the surveillance and maintenance costs associated with managing large tracks of land, while having the potential to furthering other priorities of the Department.

Targeted Outcome:

- Reduce Cold War legacy waste site footprint by 40% (to 540 square miles) by 2011 (High Priority Performance Goal) and by 90% (approximately 90 square miles) by 2015.

Nicknamed "fast glass," a more efficient formula for vitrifying radioactive waste, was developed by a team of researchers at Pacific Northwest National Laboratory and the Savannah River Technology Center.

Maximize Success of Construction and Operations Outcomes

Large, one-of-a-kind construction projects, designed to treat highly radioactive waste from decades of legacy operations, are key assets needed to fulfill the cleanup mission. With the projected cost of projects more than $14 billion (total cost for the Hanford Site, Savannah River Site, and Idaho treatment plants), the successful completion of Environmental Management construction projects within the current baseline costs and schedules is crucial. We have embarked on an effort to improve safety and quality performance toward a goal of zero accidents and defects, and to increase accountability for contract management and project management performance through application of best practices.

For a subset of our integrated soil and groundwater remediation activities, current processes and treatments are not viable. These more complex remediation activities offer opportunities for using enhanced technology as well as streamlining treatments. The use of advanced modeling and simulation tools offers solutions that would not be otherwise possible. As early as next year, we will recognize the rewards of these new modeling and simulation tools.

Targeted Outcomes:

- Develop and apply advanced modeling and simulation tools in 2011 to accelerate progress on Environmental Management technical challenges.
- Develop novel methods for addressing high-level waste that can accelerate progress and reduce costs of this multidecadal program, with a 2012 target date for the first demonstration.

A Technical Roadmap to Address Radioactive Liquid Tank Waste

Radioactive liquid tank waste is our most significant environmental, safety, and health threat. The Department and its predecessor agencies generated radioactive liquid waste as a by-product of the production of nuclear weapons. The 239 underground tanks hold about 88 million gallons of highly radioactive waste from the legacy of the Cold War. It is also the largest cost element in the cleanup program. Through the use of the Environmental Management Engineering and Technology Roadmap, we will leverage our national laboratories' capabilities to provide technical solutions where none exist, improved solutions that enhance safety and operating efficiency, or technical alternatives that reduce cost, schedule, or performance risks. These technologies involve advanced concepts in waste disposal, modular tank waste treatment, and next-generation melters for waste vitrification. Deployment of new technologies will reduce the life cycle and accelerate completion.

Ensure a Long-Term Solution to the Cold War's Environmental Legacy

Technical or economic limitations, or worker health and safety considerations, prevent many facilities and Cold War sites from being remediated for unrestricted use. Long-term surveillance, monitoring, and maintenance at some sites will be required for hundreds or even thousands of years. To ensure the long-term protection of human health and the environment, we will take corrective action to modify engineered disposal cells, treat contaminated groundwater, and sustain institutional controls. The Department's actions will be focused on maintaining compliance as a priority, and lowering risk and the cost of maintenance activities where possible. The Department will also work with local communities and regulators to optimize the use of land and related assets.

Management and Operational Excellence

Goal: Establish an operational and adaptable framework that combines the best wisdom of all Department stakeholders to maximize mission success.

This Strategic Plan establishes our vision for transformational clean energy, science, and security solutions that are significant, timely, and cost effective. Success in this enterprise will require a sustained commitment to management excellence from headquarters, to every site office and service center, to every laboratory and production facility based on Secretary Chu's guiding management principles listed on page v.

We translate our management principles into action by focusing on operational and technical excellence. Achievement of our goals will require each of us to clearly understand our own—and one another's—respective roles and responsibilities. We must develop the most highly qualified, capable, and flexible federal workforce. We will improve the rigor of our research and development management so that we support only those activities that have the greatest potential and likelihood for impact; make decisions fully informed by rigorous peer review; and effectively disseminate the results of the activities we support. We will work relentlessly to improve project management and exercise our regulatory authorities in a manner that is strategic and efficient. Additionally, our management principles call us to implement a performance-based culture that clearly links work to agency goals, holds employees accountable for meeting our mission, and appropriately rewards employees for their efforts. It will require careful use of public resources, and faithful compliance with the highest ethical and legal standards. This will require increased transparency of financial and operational data systems, vigilant protection of safety and security, and effective information technology and cyber-security systems. This is our management excellence agenda.

Following a recommendation by the National Academy of Public Administration, we are driving our management excellence agenda under the auspices of an Operations Management Council consisting of the leadership of the mission and mission-support organizations that are chaired by the Associate Deputy Secretary.

ACHIEVE OPERATIONAL AND TECHNICAL EXCELLENCE

The $35.2 billion entrusted to the Department through the ARRA in FY 2009 showed that we can reinvent our business processes. We have learned much about our business practices—what we are capable of, where we were, and where we want to be. We proved that we can excel only through teamwork and continuous improvement. Based in part upon our ARRA experience, we have identified a number of opportunities for improvement and have begun processes to realize them in the following areas.

The American Recovery and Reinvestment Act: A Benchmark for Departmental Operations

The Recovery Act's urgency required an exceptional level of collaboration across Departmental programs and functions. Novel organizational efforts allowed us to succeed in both speed and quality, ramping up activities while minimizing risk to taxpayers.

Operations and processes: Task-oriented teams staffed up from across multiple programs and adopted process reforms to enhance collaboration across programs and functions, created shared accountability, provided a forum to break down barriers to implementation, and facilitated quality decision making.

Management tools: A series of standardized reports and management tools provided transparent, consistent management data across program offices to measure progress and identify bottlenecks in workflow.

Communications: A set of customer-facing reforms helped make the Department easier to work with and more transparent to the public. Using management data to support communications helped structure an integrated calendar and share the results of our work.

We will continue to ensure we are getting the most out of ARRA funding. Monitoring, verification, and evaluation of project accomplishments will continue over the coming years.

Align Roles and Responsibilities Across the Complex

The Department is unique in the extent to which we use Federally Funded Research and Development Centers (FFRDCs) to support our national security mission, push the bounds of science, and accelerate technological innovation. The rationale for the FFRDC model was to allow each party to perform duties for which it is uniquely suited: the government establishes mission areas and provides the facilities while the private sector and university laboratories implement the missions, using best business practices and bringing the best science and technology to bear on the mission.

DOE Headquarters Forrestal Building in Washington, D.C.

Over time, the original FFRDC model has evolved with expanding multiprogram missions, increasing "work for others," and new partnerships with universities and the private sector. These changes make it essential that federal, laboratory, and contractor roles and responsibilities be clearly articulated. Clarity is also required within the Department—among programs, functions, and site administration activities—so that contractor management delivers an effective and efficient partnership of the national laboratory as an institution with its facility users, research collaborators, and the Department. We will reaffirm and, where necessary, clarify the roles and responsibilities of each party in the contracting management chain every 2 to 4 years to ensure we hold a shared view of the roles each party should play to maximize mission impact, productivity, and speed while reducing management risk, cost, and complexity.

Targeted Outcomes:

- Align functional and programmatic reporting and, where necessary, create organizational positions to focus and accelerate decision-making and accountability by 2011.
- Develop governance principles relevant to balancing mission and risk, collaboration, transparency, and dispute resolution by 2011.

The Department seeks to attract America's best and brightest to build a strong workforce.

Develop the Most Highly Qualified, Capable, and Flexible Federal Workforce

We have identified the root causes that make our hiring process today lengthy, cumbersome, and complicated. These impediments adversely impact our ability to attract and hire the best possible candidates. We will streamline our recruitment and hiring processes through the implementation of our agency hiring reform action plan in accordance with the President's hiring reform initiatives for General Schedule, Senior Executive Service, and equivalent positions. We will be more aggressive in recruiting top quality program managers. We will enrich the diversity of the Department workforce—including our technical staff—to make it more inclusive of women, minorities, veterans, and persons with disabilities. We have identified barriers to diversity and are implementing strategies to overcome them.

We will align, plan, and manage organizational learning and development activities with Departmental, technical, managerial, and leadership workforce needs 3 to 5 years in the future using competency-based needs assessments, training plans, and workforce plans. We will mentor, develop, and foster the professional growth and advancement through individual development planning for all individuals in the Department federal workforce to ensure our employees have fulfilling and productive careers with the Department.

To broaden the technical skills and understanding of our staff, we will institute a rotation program that affords opportunities for the highest-performing midcareer staff to be on assignment outside their home organization for a period of at least 6 months. This will enable them to develop a broader knowledge of multiple Department assets, capabilities, and technologies, and the opportunities and constraints in pursuing our various missions. We will empower and expect our program managers to make decisions based on a deep understanding of the latest scientific and technology developments.

Targeted Outcomes:

- Measure and reduce our average time-to-hire for General Schedule positions and equivalent positions by every human resources office (from initiation date to entry on duty date) from 174 calendar days to an 80-day average that includes a 50-day target to job offer by the end of FY 2012.
- Achieve the highest possible quality of leadership, talent management, performance culture, and satisfaction of the workforce, as measured on the public website HR.Performance.Gov.

- Improve and integrate the planning and implementation of individual learning and strategic organizational workforce development through annual targeted increases in the use of individual development plans and annual training plans.

Assure Excellence in R&D Management

The Department spends a higher percentage of its funds on research and development than any of the other 15 Cabinet-level agencies. It is therefore essential that we examine and optimize our practices so that our research programs rely upon analytically grounded planning, seek broad input from stakeholders in establishing clear priorities, and make decisions based upon rigorous peer review. Good research and development management procedures throughout the Department will enhance stakeholder confidence and justify the stable funding environments that are a prerequisite for successful long-term RD&D.

Support Activities with the Greatest Potential. Focusing programs on eliminating the most significant problems and barriers allows the most rapid progress toward our goals. Programs that have constantly churning priorities, pursue quick wins, or dilute resources in the face of too many options sap the effectiveness of our efforts. Programs that ramp up and down before the hard work can be conducted to test an idea, develop an essential tool, or prove a technology cannot effectively deliver results. We must be clear-eyed and focused in assessing those fields in which we want to be clear leaders, those in which parity is sufficient, and those in which we are content to be informed observers. We are unequivocal in our commitment to supporting world-leading programs in materials science and engineering and in simulation. Both these areas are critical to progress in our energy, security, and science missions.

All of our programs will use broadly constituted expert advisory committees to identify the most significant barriers to progress and inform priorities with 5-year horizons. In developing program priorities, future opportunities must compete on the quality of their ideas, the rigor of their technical approach, and the value of their knowledge return. Because of their importance in prioritization, technology assessments must be made within a systems context under realistic assumptions of scale, technology headroom, and economics.

Peer Review and Research Management. We will make program decisions through empowered program managers informed by qualified peer review of proposals. "Committees of Visitors" will be employed throughout the Department to periodically assess and improve the quality and integrity of program operations and program-level technical and managerial matters in proposal decisions. We will improve our processes for recruiting and selecting highly qualified reviewers and panelists to create a pool of highly qualified reviewers; reviewers and panelists will reflect the diversity of our nation's technical talent.

Disseminate our Results. Our success should be measured not when a project is completed or an experiment concluded, but when scientific and technical information is disseminated. Beyond broad availability of technical reports,

e-prints and multimedia, and publication in peer-reviewed journals, open access to experimental data and analysis codes is increasingly important in policy-relevant research areas. The Department will establish guidelines for use with both grants and contracts to ensure appropriate access to, and retention of, scientific data and analysis methods. In more applied areas, knowledge of what did not work can be of equal value with positive results, for that can prevent the misapplication of significant private resources. The Department will therefore encourage the documentation and archiving of negative results from all its performers using the most advanced informatics tools.

Evaluate our Programs. Department program and support offices have robust expertise in various forms of program evaluations. These include peer and merit reviews, advisory committee reviews, National Academies of Science studies, and U.S. Government Accountability Office (GAO) / Office of Inspector General audits. When possible, project reporting and verification activities are augmented with detailed process and impact evaluations. Evaluations are conducted by independent, third-party professional evaluators, and their work is also reviewed by experts. The Department will collect an annual inventory of current and proposed evaluations, and will undertake a process to identify and prioritize evaluations to fund them based on needs and potential impact. Tracking and archiving systems will ensure all evaluations conducted are properly documented and available for lessons learned and auditing purposes.

The High-Level Waste Vitrification Facility, shown here, is one of four major facilities under construction as part of the Hanford Tank Waste Treatment and Immobilization Plant, which is being built at the Hanford Site in Washington State. The plant will treat radioactive and hazardous waste currently stored in 177 underground tanks.

Improve Contract and Project Management

The Department will continue to play a leadership role in energy security, nuclear security, scientific discovery, and environmental stewardship. We will build, modernize, and maintain the facilities and infrastructure that are essential to support these efforts. In doing so, the Department maintains a large cadre of top-notch contract and project management professionals to deliver cost-effective contracts and successful projects.

To improve contract and project management, the Department will structure our contracts to align contractor incentives with taxpayer interests; provide clear lines of accountability and authority; and manage projects so they are completed within the original scope and cost performance baseline and are fully capable of meeting the mission. We will continue to improve management and oversight, strengthen cost estimating, and assure accountability. We will work to achieve the removal of all our programs from the GAO High Risk list by 2013.

As demonstrated through the National Nuclear Security Administration's recent Supply Chain Management initiative, we will apply pricing and process efficiencies through Department-wide strategic sourcing to save hundreds of millions of dollars. For the longer term, applying those principles will make the contractor community's acquisition process strategically driven and integrated.

We will also work to strengthen our commitment to openness and diversity among our performers. We will strengthen partnerships with minority institutions, promulgating policy to level the playing field for small businesses to win contracts, and integrating environmental justice principles into our program missions.

Targeted Outcomes:

- Complete at least 90% of our capital asset projects (achieving Critical Decision 4 [CD-4] project completion within a 3-year rolling timeline) at original scope and within 110% of the cost baseline by 2012.
- Develop independent cost estimates for 100% of major systems projects prior to Critical Decision 2 (CD-2).

Leverage Infrastructure to Support the Mission

The Department owns a real property portfolio with a value in excess of approximately $86 billion. A well-managed real property portfolio is essential to mission accomplishment. We will ensure the real property portfolio is managed effectively and sustainably to meet current and future needs by the most economical means available. We will use a suite of appropriate performance measures to assess outcomes against expectations and industry-standard benchmarks.

The Research Support Facility, completed in June 2010 at the National Renewable Energy Laboratory, demonstrates the application of cutting-edge principles in sustainable building design.

Targeted Outcomes:

- Incorporate cool roof technology for 100% of new or replacement roofs on Department real property, unless economically infeasible.
- Achieve a level of 15% by 2015 of enduring buildings compliant with the High Performance Sustainable Buildings Guiding Principles contained in Executive Order 13423.[1]

Create a Regulatory Process That is Strategic and Efficient

When this Administration took office, the Department was at risk of judicial sanctions for violating an appliance regulation consent decree schedule. We made emergency reforms to the regulatory process for appliance standards and, as a result, have been able to comply with all consent decree deadlines. The Department, however, continues to miss other statutory deadlines that are not subject to the consent decree. Reform of our internal regulatory development procedures is necessary. We must have a regulatory process that is efficient and provides senior policy-makers with an opportunity to participate in the process – and one that is driven by policy priorities instead of missed deadlines. Accordingly, the Department will implement procedural changes to its regulatory process, including the development of a prioritized regulatory agenda.

[1] *Strengthening Federal Environmental, Energy, and Transportation Management in Acquisition*. 2009. Executive Order 13423, Office of the President. Available at http://edocket.access.gpo.gov/2007/pdf/07-374.pdf.

Targeted Outcomes:

- Track all Department regulatory actions on the Department's wiki site—Powerpedia—for transparency by the end of 2011.

IMPLEMENT A PERFORMANCE-BASED CULTURE

Through the Recovery Act, we have demonstrated we can increase transparency of operations and performance to provide reliable and timely information for internal decision makers, as well as educate external stakeholders. Enhanced transparency that originated with the Recovery Act will also increase insight into core processes to identify opportunities to streamline operations and better manage performance and costs. We will continue to advance our data collection systems, cyber security policies, and business analytic tools to improve planning, evaluation, and reporting. We will develop an information distribution strategy that enables easy access for both internal and external stakeholders.

Cultivate a Performance-Based Framework

We will develop a culture of competent, ethical, and motivated performers who produce results. The framework of our performance-based culture will consist of four principles:

- Clear performance expectations
- Clear accountability
- Responsible empowerment
- Timely and responsible performance assessment.

This framework will be supported by performance management systems and processes that link work to mission goals. Our communications strategy will include steps to clarify performance expectations and accountability, as well as describe supportive behaviors addressing ethical conduct and best practices for identifying and rewarding meaningful distinctions between levels of performance.

Targeted Outcome:

- Improve and continue to refine Department performance management systems and processes by 2012 so that they clearly link work to mission goals, expected outcomes, and accomplishment measures. Ensure that meaningful distinctions between levels of performance are identified and rewarded appropriately.

Improve Transparency

We are committed to making the Department more open and more accessible to the American people. We have significantly expanded the amount of information available online about our programs, our funding awards, and our progress, as well as valuable data about energy production and consumption and trends within the

energy industry. For example, we provide datasets on our government website on the 2010 gulf oil spill, including oil and gas flow and recovery measurements, air and water sample data, and other data of interest to scientists, recovery workers, and citizens. We use internet social media tools to engage the public in the national energy conversation. Our Open Government initiatives are driven by the principles of transparency, participation, and collaboration.

Various datasets are available on the Department's website.

Our Department-wide Financial Transparency Initiative (FTI) aims to provide the same level of financial and management information transparency for our base programs and projects as is currently available for ARRA projects. The long-term goal of the FTI is to broadly implement the ability to quickly and seamlessly access information linking our Strategic Plan, budget, appropriations and program execution data. This capability will also help decrease the number of data requests, while giving managers and senior executives the ability to efficiently select and review timely, accurate and reliable management information. Additionally, using this enhanced reporting capability will also help support the transformation of our acquisition processes from tactical and reactive to strategically driven and integrated.

Targeted Outcomes:

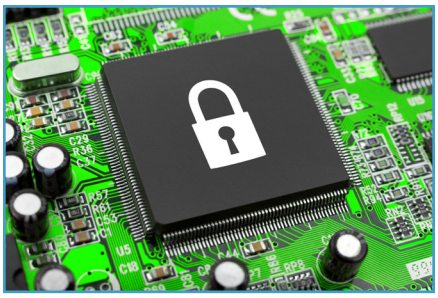
- Create and deploy a quarterly reporting capability by 2011 for timely and reliable functional institutional cost information from our national laboratories.
- Design and deploy a Department-wide advanced management information environment by 2011, enabled through state-of-the-art reporting and display tools, to provide timely and accurate information supporting in-depth program and project performance analysis and review.

Transform Our Approach to Safety and Security

Security officers check vehicles at the entrance to Sandia National Laboratories, Albuquerque, New Mexico.

While maintaining the highest standards of safe and secure operations at Departmental facilities and recognizing line management's significant responsibility for safety and security, we will transform the Department's framework of requirements and oversight to enhance productivity and achieve our vital mission goals. We will conduct the following:

- Increase coordination of enforcement actions with line management
- Work with the Field Management Council to understand where reform in its oversight and enforcement practices is needed
- Maintain rigorous and informed oversight of high hazard operations or high-value security assets
- Focus independent oversight of low-hazard operations and lower-value security assets on sites where site performance requires increased attention
- Continue a disciplined and systematic review of the Department's safety and security regulatory model, including all Office of Health, Safety, and Security directives.



Cybersecurity protects the Department's information systems.

Enable Missions Through Responsive IT and Cyber Security

Information Technology (IT) and cyber security are enablers of the Department's goals and must reflect the missions and risks of the Department. This means building systems and infrastructure that are cost effective and support efficient operations, and ensuring the cutting edge application of technology and creative solutions in a framework that provides flexibility. Cyber security must be managed in the broader context of risk, with tailored protections and a continually evolving and responsive program that adjusts to changing threats, vulnerabilities, and needs. We will implement a Department-wide approach to risk management for unclassified and classified IT environments.

Targeted Outcome:

- Implement a plan by 2012 for incident reporting and response in the Department.

Refresh Our Strategy Regularly

The *Government Performance and Results Modernization Act of 2010*[1] mandates that "…the strategic plan shall cover a period of not less than four years following the fiscal year in which the plan is submitted. As needed the head of the agency may make adjustments to the strategic plan to reflect changes in the environment to which the agency is operating."

Going forward, the major programs will develop implementation plans based upon this document in consultation with the Under Secretary for Science as the Department's Chief Research Officer.[2] The Department will formally review its Strategic Plan every 4 years, and the Office of the Under Secretary for Science will coordinate that effort with broad consultation of leadership and senior career staff from Department Headquarters and the field. An annual review of progress against the plan will occur at the beginning of the budget formulation process.

[1] *Government Performance and Results Modernization Act of 2010*. 2010. Available at http://www.govexec.com/pdfs/092810rb1.pdf.
2 *Section 1006 of the Energy Policy Act of 2005* (Public Law 109-58) states that the Under Secretary for Science will "advise the Secretary with respect to long-term planning, coordination, and development of a strategic framework for Department research and development activities." Available at http://doi.net/iepa/EnergyPolicyActof2005.pdf.

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http://www.energy.gov/media/DOE_StrategicPlan.pdf

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