



U.S. DEPARTMENT OF
ENERGY

STRATEGIC PLAN

— 2014-2018 —



Cover Photo Descriptions

Wind and Mountain

A multi-megawatt wind turbine at the Dillon Wind Power Project.

Aerial view, Ivanpah

An aerial view of the Ivanpah Solar Power Facility at sunrise.

The McNary Dam

The McNary Dam is one of the federal dams providing power to the Pacific Northwest. The Bonneville Power Administration (BPA), a federal agency created by Congress in 1937 has authority to market and deliver the power from such dams. BPA supplies more than half the electricity consumed in the Pacific Northwest.

Perry Nuclear Power Plant

Twin cooling towers at the Perry Nuclear Power Plant in Perry, Ohio.

B83 Bomb

The B83 is a gravity bomb developed by the Lawrence Livermore National Laboratory(LLNL) and was placed in the stockpile in 1983.

Electric Vehicle

Plug in Electric Vehicle charging in the Vehicle Testing and Integration Facility at the National Renewable Energy Laboratory.

Interior of the NIF Target Chamber

The National Ignition Facility (NIF) at LLNL is a contributor to DOE's stockpile stewardship program. NIF uses the world's largest laser to heat fusion fuel to thermonuclear ignition, resulting in experiments that will help scientists sustain confidence in the nuclear weapons stockpile without actual testing, as well as to produce additional benefits in basic science and fusion energy.

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Message from the Secretary



The Department of Energy (DOE) is ready to deliver the innovative and transformative scientific and technological solutions to energy, security, economic, and environmental challenges facing the United States in the 21st century. This strategic plan provides a roadmap for our work, highlights our major priorities for the next few years, and will be reflected in individual program plans.

Climate change is a key challenge for the energy sector. To address this problem, we will support implementation of the President's Climate Action Plan to cut carbon pollution and prepare the United States for climate change. We will also continue our work to reduce America's dependence on oil and improve our energy security. Although domestic oil production has increased to the extent that in 2012 net imports of petroleum fell to their lowest level in nearly 20 years, we must continue our efforts to develop alternative fuels and vehicles; as we are far from decoupling our economy from the global oil market.

We will pursue the President's "all of the above" energy strategy to develop a full range of energy options to support a transition to a secure clean energy system, aligned with the President's policies to encourage American innovation, create new jobs, enable economic growth, and contribute to increased U.S. manufacturing and net exports.

While mitigating climate change and reducing oil dependence are central components of our work, the Department also supports broader national missions. DOE plays a key role in advancing America's leadership in science through its unparalleled national laboratory system, with more than a hundred Nobel Prizes resulting from DOE-associated research. We must ensure that DOE continues to lead basic research in the physical sciences, develop the next generation of computation technology, and develop and maintain world-class scientific user facilities.

We also will advance the President's vision for reducing the levels of nuclear weapons in the world, strengthen nonproliferation efforts, and combat nuclear terrorism. DOE must maintain a safe, secure, and effective nuclear weapons stockpile in the absence of nuclear testing and manage the infrastructure for the research, development, and production activities needed to meet national security requirements. We will carry out our responsibilities for safety and security, in accordance with the Administration's Stockpile Stewardship and Management Plan, which lays out a comprehensive modernization plan to ensure that our nuclear arsenal remains an effective deterrent.

We will continue to strengthen efforts to reduce the nuclear terrorism threat through measures to identify, control and eliminate nuclear explosive materials worldwide. We also will provide support for the Administration's efforts to prevent the spread of nuclear weapons.

We will address the legal and moral imperative of cleaning up legacy nuclear waste to protect human health and the environment. Great progress has been made, but significant technical challenges remain. We will continue to utilize an integrated, systematic, and comprehensive process to address these issues.

We will strengthen Department and national missions through cross-cutting initiatives that leverage the science, technology and engineering capabilities in program offices and the DOE national laboratories. The Department will continue to partner with other agencies, industry, the national laboratories and academia to advance its missions and to foster technological innovation and technology transfer.

We will attract, manage, train, and retain the best workforce. We will foster excellence in DOE management and employee performance. Renewed emphasis will be given to improving major project execution and cost management; environmental, health and safety compliance; and physical and cybersecurity.

These and other priorities outlined in this plan are critical to advancing the nation's energy and security goals and strengthening our economy to provide a cleaner energy environment and a more secure and prosperous country for future generations. I am honored to lead the DOE team, and pleased to transmit the Strategic Plan of the Department of Energy for 2014-2018.

A handwritten signature in black ink, appearing to read "Ernest Moniz".

Ernest Moniz
Secretary of Energy
March 2014

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U.S. Department of Energy

STRATEGIC PLAN

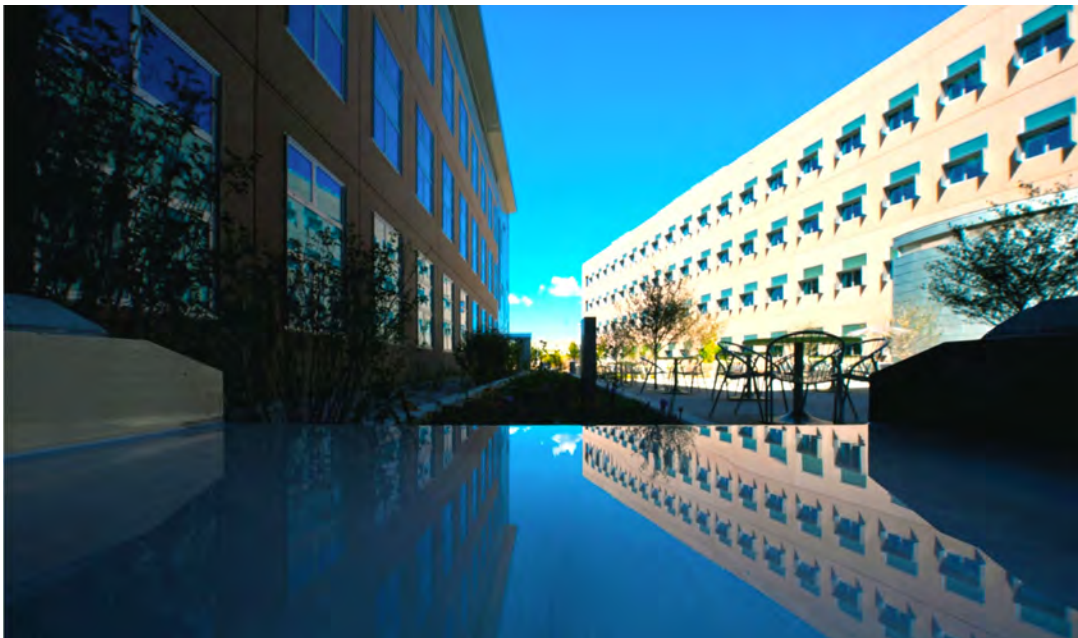
2014-2018

Overview

The Department of Energy (DOE) is responsible for advancing the energy, environmental, and nuclear security of the United States; promoting scientific and technological innovation in support of that mission; sponsoring basic research in the physical sciences; and ensuring the environmental cleanup of the nation's nuclear weapons complex.

The Science and Energy, Nuclear Security, and Management and Performance strategic goals in this Strategic Plan are aligned with the DOE organizational structure adopted in August 2013. Three Under Secretaries manage the core functions that carry out the DOE mission with significant cross-cutting work spanning across the enterprise. The DOE enterprise is comprised of approximately 14,000 federal employees and over 90,000 management and operating contractor and other contractor employees at the Department's headquarters in Washington, D.C., and at 85 field locations. DOE operates a nationwide system of 17 national laboratories that provides world-class scientific, technological, and engineering capabilities, including the operation of national scientific user facilities used by over 29,000 researchers from academia, government, and industry. The range, scale and excellence of science and technology (S&T) at the DOE laboratories provide strategic assets to accomplish DOE missions, support government responses to unforeseen domestic and international emergencies, and provide technical capabilities to help shape the global S&T agenda.

Science and Energy – DOE leads the nation in the transformational research, development, demonstration, and deployment of an extensive range of clean energy and efficiency technologies, supporting the President's Climate Action Plan and an "all of the above" energy strategy. DOE identifies and promotes advances in fundamental and applied sciences; translates cutting-edge inventions into technological innovations; and accelerates transformational technological advances in energy areas that



At the National Renewable Energy Laboratory, the Research Support Facility (RSF) houses about 1,300 federal and contractor employees and is one of the largest net-zero office buildings in the world — meaning it produces as much energy as it consumes. Energy efficiency features at the RSF include daylighting, low-emissivity windows, building orientation, and super insulation.

industry by itself is not likely to undertake because of technical or financial risk. DOE also leads national efforts to develop technologies to modernize the electricity grid, enhance the security and resilience of energy infrastructure, and expedite recovery from energy supply disruptions. DOE also conducts robust, integrated policy analysis and regional engagement to support the nation's energy agenda.

biological, environmental, and computational sciences contributes fundamental scientific discoveries and technological solutions that support the nation's primacy in science and innovation.

Nuclear Security – DOE enhances the security and safety of the nation through its national security endeavors: maintaining a safe, secure, and effective nuclear weapons stockpile in the absence of nuclear testing and managing the research, development, and production activities and associated infrastructure needed to meet national nuclear security requirements; accelerating and expanding efforts to reduce the global threat posed by nuclear weapons, nuclear proliferation and unsecured or excess nuclear materials; and, providing safe and effective nuclear propulsion for the U.S. Navy. As a result of the expertise developed to support these nuclear security missions, DOE laboratories also serve as strategic assets in support of broader national security

DOE is the largest federal sponsor of basic research in the physical sciences. DOE world-leading research in the physical, chemical,

missions.

Management and Performance – DOE leads the largest cleanup effort in the world to remediate the environmental legacy of over six decades of nuclear weapons and nuclear research, development, and production. As DOE carries out its mission, it will strengthen effective and cost-efficient management, support an engaged workforce, and provide a modern, secure physical and information technology infrastructure. DOE remains committed to maintaining a safe and secure work environment for all personnel and to ensuring that its operations preserve the health, safety, and security of the surrounding communities.

Stakeholder Engagement

DOE sought and incorporated comments from multiple stakeholders during the development of the Plan. In DOE, we obtained input from DOE employees, the national laboratories, and the Power Marketing Administrations. We also solicited comments from Congress and the public. In response to a 14-day public comment period announced December 4, 2013, in the Federal Register, DOE received over 180 comments a wide range of topics. These comments addressing alternative concepts, priorities, metrics, risks and uncertainties were considered as strategic goals and objectives were developed.

Mission

Enhance U.S. security and economic growth through transformative science, technology innovation, and market solutions to meet our energy, nuclear security, and environmental challenges

Goal 1: Science and Energy

Advance foundational science, innovate energy technologies, and inform data driven policies that enhance U.S. economic growth and job creation, energy security, and environmental quality, with emphasis on implementation of the President's Climate Action Plan to mitigate the risks of and enhance resilience against climate change

Contributing Programs

Advanced Research Projects Agency-Energy
Electricity Delivery and Energy Reliability
Energy Efficiency and Renewable Energy
Energy Information Administration
Energy Policy and Systems Analysis
Fossil Energy

Indian Energy Policy and Programs
International Affairs
Loan Programs
Nuclear Energy
Power Marketing Administrations
Science

We will closely integrate scientific research, applied energy research and development, and commercialization activities to provide new solutions for a clean energy future in a manner that will enable job creation and economic growth. In addition to integration of science and energy technology programs, DOE will focus cross-cutting technology teams on key challenges to coordinate investments in innovation spanning fundamental research to demonstration of emerging commercial solutions as well as to integrate data, models, and analysis to inform systems understanding. DOE will remain a lead provider of energy information for policymakers, energy markets, and the public to promote sound decision-making through understanding of energy and its interaction with the economy and the environment. DOE will continue to develop a systematic understanding of the impacts of water availability on meeting energy needs, as well as an understanding of energy efficiency in water treatment and conveyance. Supporting implementation of the President's June 2013 Climate Action Plan, including Secretariat support for a Quadrennial Energy Review led by the White House Domestic Policy Council and Office of Science and Technology Policy, will be a major focus of our efforts. The science and energy goal has three strategic objectives.

Strategic Objective 1 – Advance the goals and objectives in the President's Climate Action Plan by supporting prudent development, deployment, and efficient use of “all of the above” energy resources that also create new jobs and industries

DOE is committed to energy solutions that make best use of our domestic energy resources and help the nation achieve an approximately 17% reduction in greenhouse gas emissions below 2005 levels by 2020, and further reductions in the post-2020 period. We will accelerate innovation through development of technologies that make energy cleaner and more efficient, while leveraging American competitive advantages to seize market opportunities for manufacturing and deployment provided by a globally expanding clean energy industry. DOE will increase energy productivity, support safe and responsible deployment of domestic energy resources, and leverage federal credit authorities. DOE will implement the six parallel strategies described below to achieve this objective.

Improve energy productivity by increasing efficiency

The President has set ambitious goals to double the nation's energy productivity and to establish energy efficiency standards that will reduce carbon pollution by 3 billion metric tons by 2030. This includes defining technologically feasible and economically justified end-use standards for consumer products and industrial equipment and new capabilities to realize significant savings in the nation's buildings and in industry. DOE will focus its investments in technologies and practices that can improve the competitiveness of U.S. manufacturing through increased energy productivity and increased manufacturing of clean energy products. Clean energy manufacturing institutes will provide a framework for innovation in advanced manufacturing of essential components and processes.

Advance options for diverse energy resources and conversion devices for power

The President's Climate Action Plan contains a goal of doubling renewable energy generation from wind, solar, and geothermal sources between 2012 and 2020. A more diverse energy mix will provide multiple options to meet demand and to meet environmental goals, and DOE will continue to focus on significantly increasing the amount of cost-competitive electric power from renewable resources across the nation by further accelerating the development and commercialization of these technologies. We will do so by reducing technology costs and risks, as well as by reducing costs in siting and permitting, installation, inspection, maintenance, and customer acquisition for distributed and utility-scale generation projects, as well as improving performance and manufacturing processes.



Power County, Idaho Wind Farm

The President also has established a goal of permitting 10,000 megawatts of renewable energy on public lands by 2020, and DOE will continue its work with partner agencies to streamline permitting and to finance transmission to access America's richest renewable energy resources. DOE will advance research and development for sustainable hydropower technologies that continue to provide clean, reliable, low-cost, carbon-free power, and can be readily stored and dispatched, as well as technologies that harness energy from wave and tidal resources. DOE will support implementation of clean energy solutions for rural and economically distressed energy environments, including tribal communities.

Roughly one-third of U.S. carbon emissions come from power plants and other large point sources. DOE is committed to enabling the safe and permanent storage and utilization of CO₂ captured from these sources. Building on available first generation technologies, next generation carbon capture and storage (CCS) technologies or carbon dioxide utilization technologies, expected to become commercially available in the mid-2020s, will help put us on a path to a clean energy option for a world currently dependent on fossil fuels for 80% of its energy.

Nuclear energy is currently our largest source of carbon-free electricity. DOE will continue to pursue advancements in nuclear energy technologies to simultaneously support the Administration's "all of the above" strategy and the need to limit greenhouse gas emissions. We will work to better understand the issues associated with early closures of existing nuclear power plants, and we will work to help accelerate timelines for commercialization of small modular nuclear reactors through cost-shared agreements with industry partners. DOE also will work to advance the Administration's Strategy for the Management and Disposal of Used Nuclear Fuel and High Level Radioactive Waste within legislative authorities until the necessary full implementing legislation is enacted. In addition, DOE will continue to explore advanced concepts in nuclear energy that may lead to new types of reactors with further safety improvements and reduced environmental and nonproliferation concerns.

Leverage increased private sector financing for deployment of "all of the above" energy technologies

DOE loan programs play a critical role in catalyzing investment in clean energy by providing debt financing and guarantees to project developers, allowing them to deploy innovative clean energy technology projects at commercial scale that may not otherwise attract funding from the private sector. DOE will use federal loan and loan guarantee authorities to strategically support a range of clean energy and advanced vehicle technologies. DOE also will work with other agencies in addition to state and local governments to use existing authorities to remove barriers to increased financing for clean energy deployment.

Accelerate development and deployment of new transportation system technologies to diversify fuel sources, increase efficiency and reduce emissions

To achieve the President's goal to halve our net oil imports by 2020, DOE will partner with industry to discover and promote advanced sustainable transportation technologies. These include technologies to improve conventional vehicles with the use of advanced lightweight materials, improvements in aerodynamics, and engines and power train technologies that improve vehicle efficiency for both light-duty vehicles and heavy trucks. To provide more diverse vehicle and fuel options, DOE will continue to develop advanced batteries and fuel cells, encourage vehicle electrification, and work with our partners to address barriers to widespread adoption of all-electric-drive vehicles. We will develop alternative fuels, including advanced biofuels, made from sustainable resources that can directly substitute for petroleum and use existing infrastructure. DOE will work with our partners and other stakeholders to validate new transportation-sector production techniques using advanced, state of the art laboratory facilities.

Support environmentally responsible development, delivery and use of domestic petroleum and natural gas

DOE will sponsor activities to encourage safe and environmentally responsible development and use of domestic petroleum and natural gas resources. DOE will conduct research and development, data collection, modeling analysis and information dissemination programs to promote environmentally responsible development of unconventional domestic petroleum and natural gas resources. With the White House Office of Science and Technology Policy and contributors to the Interagency Methane Strategy, DOE will seek to improve the database on methane leakage from natural gas production, delivery and use, and encourage greater sharing of best practices for unconventional oil and gas production. We will work to reduce the risk and enhance the performance of subsurface energy systems, including geothermal energy. DOE will continue to advance state of the art methods for predicting, controlling and monitoring the flow of injected fluids, including captured CO₂ with particular attention to minimizing or eliminating impacts on our water resources.

Contribute to international efforts to address global climate change

DOE will continue to play a major role in supporting the Administration's international efforts to achieve significant global greenhouse gas emission reductions, enhance climate preparedness, and promote global deployment of clean energy technologies. These efforts will focus on implementing technical and policy collaborations with China, India, and other major emitting countries through bilateral engagement and multilateral fora such as the Clean Energy Ministerial and the International Renewable Energy Agency. DOE will provide support for broad-based international climate negotiations led by the U.S. Department of State, including under the United Nations Framework Convention on Climate Change. DOE will simultaneously advance the President's Climate Action Plan and National Exports Initiative by catalyzing international markets for U.S. clean energy solutions. DOE efforts will include advice, tools, and reviews of technical data; promotion of standards, test procedures and certification prevalent in the U.S.; and actions to promote sustainable renewable energy development, fuel switching to cleaner supplies, support for the safe and secure use of nuclear power, cooperation on clean coal technologies, and collaboration to promote market access for American clean energy technologies and services.

Agency Priority Goal (FY 2014-15)

Implement elements of the Climate Action Plan, including

- *Supporting the goal of reducing cumulative carbon pollution by 3 billion metric tons by 2030 through standards set since 2009 and promulgating new standards for consumer products and industrial equipment by the end of calendar year 2016*
- *Providing up to \$8 billion in loan guarantees for advanced fossil energy technologies that reduce greenhouse gas emissions by the end of FY 2017*

Performance Goals

- Provide cost-shared licensing technical support to selected private sector partners in support of their efforts to complete and submit a design certification application for at least one small modular reactor
- Operate three fully integrated CCS demonstrations and six large scale CO₂ storage injections by the end of FY 2015
- By the end of FY 2015, achieve best in class solar photovoltaic (PV) systems at \$1.85/watt utility, \$2.37/watt commercial, and \$3.10/watt residential scale

- Launch geothermal “Play Fairway” analysis effort in FY 2014 and demonstrate the ability to develop a 5-megawatt greenfield Enhanced Geothermal Systems (EGS) reservoir by 2020
- By the end of FY 2016, publish a report that includes the number of DOE/FE projects, including results on any completed projects, that addresses each of the DOE-led research topics contained in the Multi-Agency Strategy related to understanding unconventional oil and gas resources
- Demonstrate three grid-connected advanced offshore wind concepts by 2017
- Demonstrate the integration of 50% variable distributed energy resources on distribution feeders with electric vehicles and building energy management systems by 2020 with high reliability and resiliency
- By FY 2015, up to three commercial scale cellulosic ethanol biorefineries are operational with validation that their outputs are projected to yield a mature technology price that is competitive with gasoline and that there is a greater than 60% lifecycle greenhouse gas reduction relative to gasoline
- Reduce the cost of transportation fuel cells by more than 25% to meet the 2020 target of \$40/kilowatt and durability of 5,000 hours and efficiency of 60%
- Reduce the cost of plug-in vehicle battery technology to \$300/kilowatthour by 2015 and \$125/kilowatthour by 2022



View of hot springs located near the Steamboat Hills Geothermal Power Plant in Nevada.

Electric Vehicles: Driving Our Nation toward Clean, Affordable Transportation

With their immense potential for increasing the country’s energy, economic, and environmental security, electric vehicles such as plug-in hybrid electric, all-electric vehicles (also known as plug-in electric vehicles or PEVs), and fuel cell electric vehicles will play an increasingly important role in the country’s transportation future. Transportation accounts for two-thirds of U.S. petroleum usage, and on-road vehicles are responsible for 80% of this amount. Launched in March 2012, DOE’s EV Everywhere Grand Challenge (EV Everywhere) seeks to make the United States the first country to produce PEVs that are as affordable and convenient as gasoline-powered vehicles by 2022.

Current PEV battery costs are below \$400/kilowatthour (kWh). DOE analysis indicates that costs in the range of \$125/kWh are required for a broad range of PEVs to be cost-competitive with gasoline-powered vehicles. To achieve these aggressive cost targets, DOE is working with industry to conduct research and development to reduce cost and improve performance and has produced significant accomplishments. For lithium-ion batteries, DOE-funded research has reduced modeled costs for high-volume production from \$1,200/kWh in 2008 to the less-than-\$400/kWh modeled cost of high-energy, high-power batteries today – greater than a 65% reduction. DOE is on track to achieve our 2015 cost target of \$300/kWh. Similarly, DOE’s efforts reduced the projected costs of automotive fuel cells (assuming high-volume manufacturing) by more than 35% since 2008 and improved fuel economy by up to 50% for hybrid vehicles using nickel-metal hydride batteries compared to similar non-hybrid vehicles.

In addition to research and development, the EV Everywhere Grand Challenge also addresses key deployment barriers, including charging infrastructure. EV Everywhere’s Workplace Charging Challenge, launched in January 2013, aims to drive a tenfold increase in the number of American employers offering workplace charging in the next 5 years. To date, it already has more than 50 partners.

SunShot Initiative: Making Solar Cost Competitive with Conventional Electricity Sources

Launched in February 2011, DOE's SunShot Initiative is a national effort to make subsidy-free solar power cost competitive with conventional sources of electricity by 2020. SunShot targets for average installed system price are \$1.00/watt direct current (W_{dc}) for utility-scale, \$1.25/ W_{dc} for commercial-scale, and \$1.50/ W_{dc} for residential-scale, starting from 2010 baseline figures of \$3.80/ W_{dc} , \$5.00/ W_{dc} , and \$6.80/ W_{dc} for these various sectors respectively. Three years into a 10-year initiative, the solar industry has achieved progress of 60% toward the final 2020 targets. Technology improvements that have enabled that progress have been led by DOE. Over 50% of the world records over the past 35 years in solar cell efficiency have been supported by DOE, including three new world records in 2013. To compete in the global marketplace, SunShot is boosting innovation in manufacturing to ensure U.S.-developed technologies can capture a larger portion of the global "value add" in solar manufacturing, estimated at about \$100 billion worldwide. Working with State and local governments, DOE has shown that the permitting and interconnection processes for consumers who desire access to solar energy can be streamlined to a matter of days instead of months. Best in class utility scale PV systems can now be as low as \$1.92/ W_{dc} and commercial and residential systems at \$2.61/ W_{dc} and \$3.69/ W_{dc} respectively. From 2008 to 2012, cumulative PV deployment in the United States increased by about 10 times, from 0.8 gigawatts to 7.4 gigawatts. By the end of 2013, cumulative PV deployment reached approximately 11 gigawatts. All of this growth is leading to job creation and DOE is supporting this growing workforce through the Solar Instructor Training Network of 322 community colleges.

Strategic Objective 2 – Support a more economically competitive, environmentally responsible, secure and resilient U.S. energy infrastructure

The nation's transformation to a clean energy economy requires a modern energy infrastructure that can integrate a diverse energy portfolio, respond to and recover rapidly from disruptions, and deliver highly reliable and affordable energy. As called for in the Climate Action Plan, a modernized energy infrastructure also must become more resilient to prepare the United States for the impacts of climate change. In a clean energy economy, communications and control technologies that support



Bonneville Power Administration completes the modernization of the Celilo Converter Station (Dalles, Oregon) located at the northern end of the 846 mile direct Pacific Intertie that connects the Pacific Northwest with Los Angeles, California. The modernization project uses solid-state silicon chips that will allow the system to work cooler, safer and be ecologically improved.

the development and integration of variable energy resources become more critical, and DOE will seek pathways that expand the use of dispatchable renewable energy including hydropower, energy storage, and demand response capabilities. While advanced intelligent devices and communications networks improve the visibility, response, and control of energy systems, they also can increase the exposure to cyber attacks.

DOE will focus on addressing and helping to manage the increased vulnerability of the nation's energy infrastructures due to climate change, cyber vulnerabilities, physical vulnerabilities, and infrastructure interdependencies. DOE will facilitate the market-readiness of DOE-supported technologies and address non-technical barriers that will enable the marketplace to better understand the cost-saving and environmental benefits of these energy solutions, including engaging the future clean energy workforce. DOE will employ six strategies to achieve these goals.

Support the Quadrennial Energy Review (QER)

Innovation and new sources of domestic energy supply are transforming the nation's energy marketplace and creating economic opportunities, but at the same time they are raising environmental challenges. To ensure that federal energy policy meets our economic, environmental, and security goals in this changing landscape, the Administration will conduct a Quadrennial Energy Review. The review will be led by the White House Domestic Policy Council and Office of Science and Technology Policy, supported by a Secretariat established at the Department of Energy, and involves the robust engagement of other federal agencies and outside stakeholders. The first QER Report will focus on infrastructure challenges, and will identify the threats, risks, and opportunities for U.S. energy and climate security, enabling the federal government to translate policy goals into a set of analytically based, clearly articulated, sequenced and integrated actions.

Develop technologies to modernize the electric grid to improve resiliency, flexibility, and better integrate "all of the above" generation resources

The current power grid must be upgraded to handle the two-way flow of electricity, information, and automated control needed to integrate distributed generation, renewable sources, end-use efficiency, demand response, and other clean energy sources into the power grid in a reliable and cost-effective manner. Advanced technologies and innovative business models are urgently needed to overcome the complex technical and system integration challenges facing today's electricity delivery network. Working with utilities, states, other government agencies, and technology developers, DOE will facilitate grid modernization innovations that fully address all the safety, security, and reliability requirements of the electricity system. To facilitate these goals, DOE will develop models and next-generation grid operating systems, broaden integration of distributed resources, pursue techniques for decentralized and coordinated control of energy resources, and establish partnerships to address adoption barriers to meet Climate Action Plan goals.

Strengthen the effectiveness of Department of Energy incident management capabilities

DOE will collaborate with industry partners, state, local, and tribal governments, and other federal agencies - offering energy experts as part of the government-wide approach to incident management and response – whether the incident results from natural or unnatural causes, and is complex or crude, or cyber or physical. Such collaboration will better enable the Department to conduct regional emergency response preparedness exercises, revealing gaps and lessons learned. DOE will increase the functionality of its Energy Resilience and Operational Center, enhance its predictive modeling capabilities of risks and vulnerabilities to energy infrastructure, and improve its situational awareness through analysis and visualization capability.

Manage the Strategic Petroleum Reserve and be prepared to respond to petroleum market supply disruption

The Strategic Petroleum Reserve (SPR) benefits the nation by providing an insurance policy against actual and potential interruptions in U.S. petroleum supplies caused by international turmoil, hurricanes, accidents or terrorist activities. SPR planning will evolve to account for infrastructure changes driven by increased domestic oil production. The SPR helps the United States meet its stockholding obligations as a member of the International Energy Agency (IEA). IEA members are required to maintain 90 days of strategic stocks and participate with other stockholding nations in a coordinated release of stocks in the event of a major supply disruption.

Improve cybersecurity in the energy sector through effective government-industry collaboration

DOE will work with government and industry partners to improve cybersecurity in the energy sector by accelerating information sharing, promoting adoption of best practices, developing cutting-edge cybersecurity solutions, and strengthening incident response capabilities. With the expertise of national laboratories and energy sector partners, DOE also will develop and demonstrate next-generation technology for more secure interoperable communications within energy delivery system networks.

Work with states, localities and other stakeholders to develop climate change prevention/adaptation resilience strategies

DOE will work with the states, localities and other stakeholders to develop resilience strategies including energy assurance and preparedness efforts to reduce vulnerabilities and adapt to climate change. DOE will focus on addressing and helping to manage the increased vulnerability of the nation's energy infrastructures including infrastructure interdependencies. Many critical fuel (oil, natural gas, biofuels) and other infrastructures (telecommunications, water, transportation, and emergency

services) are increasingly reliant on electricity. Transportation infrastructures – ports, harbors, and rail – are essential for the delivery of energy supplies to consumers. These interdependencies need to be more fully understood to develop comprehensive emergency and prevention protocols.

Agency Priority Goal (FY 2014-15)

Enhance desirable characteristics and diminish vulnerabilities of the U.S. energy infrastructure to meet goals of economic competitiveness, national security, and environmental responsibility

- *Support the first installment of the Quadrennial Energy Review (QER) through early 2015 and begin implementation of relevant recommendations within DOE's existing authorities*

Performance Goals

- Ensure operational readiness of the Strategic Petroleum Reserve by achieving 95% of monthly maintenance and accessibility goals in all years, and maintain the capability to drawdown at a 4.4 million barrels/day rate
- Stand up the Energy Incident Management and Response Council by the end of FY 2015 to establish DOE's incident response capabilities for natural disasters and nuclear-related events
- Lower the cost of grid-scale (>1 megawatt) energy storage technologies by the end of FY 2015 to \$325 per kilowatt-hour for a 4-hour system to enable more clean energy solutions
- Complete energy impact analyses developed using an analytical framework by the end of FY 2015
- Support the implementation of the Cybersecurity Capability Maturity Models and Risk Management Process in the energy sector and demonstrate a tool that includes enhanced communications security between control centers by the end of FY 2015
- With the expertise of national laboratories and energy sector partners, DOE will develop and demonstrate next-generation technology for more secure interoperable communications within energy delivery system networks

Enhancing Cybersecurity in the Energy Sector

As the U.S. energy delivery networks (electricity, oil, and gas) become more intelligent and interconnected, strong cybersecurity has become critical for energy reliability and resilience. DOE partnered with industry leaders to develop the Roadmap to Achieve Energy Delivery Systems Cyber Security that has resulted in technologies and initiatives to strengthen cybersecurity. The Roadmap has guided initiatives to strengthen cybersecurity, as follows:

1. More than 10 vendors of power grid equipment have used LEMNOS, an interoperable and secure software architecture developed by Sandia National Laboratory, to develop advanced data communications devices for grid controls. These devices provide enhanced security features and interoperability across various vendor devices, reducing costs in system design, configuration, and operations and maintenance.
2. Utilities are deploying Padlock, a secure gateway, across the grid. Padlock, based on the LEMNOS architecture, provides secure communications between distribution control systems and the field devices they monitor. DOE launched Padlock six months earlier than planned to meet strong demand.
3. DOE's National Sector Supervisory Control and Data Acquisition (SCADA) Test Bed allows cybersecurity experts to systematically test deployed systems for vulnerabilities and recommend mitigations; it also has assessed the cybersecurity of more than 30 electricity SCADA systems since 2003.
4. Experts from DOE national laboratories have trained more than 2,300 operational personnel from more than 200 utilities in advanced cybersecurity techniques, including "live" exercises in test bed environments, strengthening the energy sector's ability to detect and respond to complex cyber attacks.
5. Since its release in 2012, more than 100 utilities have requested the Electricity Subsector Cybersecurity Capability Maturity Model (ES-C2M2) toolkit. The model, which helps utilities evaluate and benchmark cybersecurity capabilities and prioritize investments, is currently being adapted and expanded for the oil and natural gas subsector. To date, DOE has facilitated over 40 C2M2 self-assessments for both electricity and oil/natural gas companies.

Strategic Objective 3 – Deliver the scientific discoveries and major scientific tools that transform our understanding of nature and strengthen the connection between advances in fundamental science and technology innovation

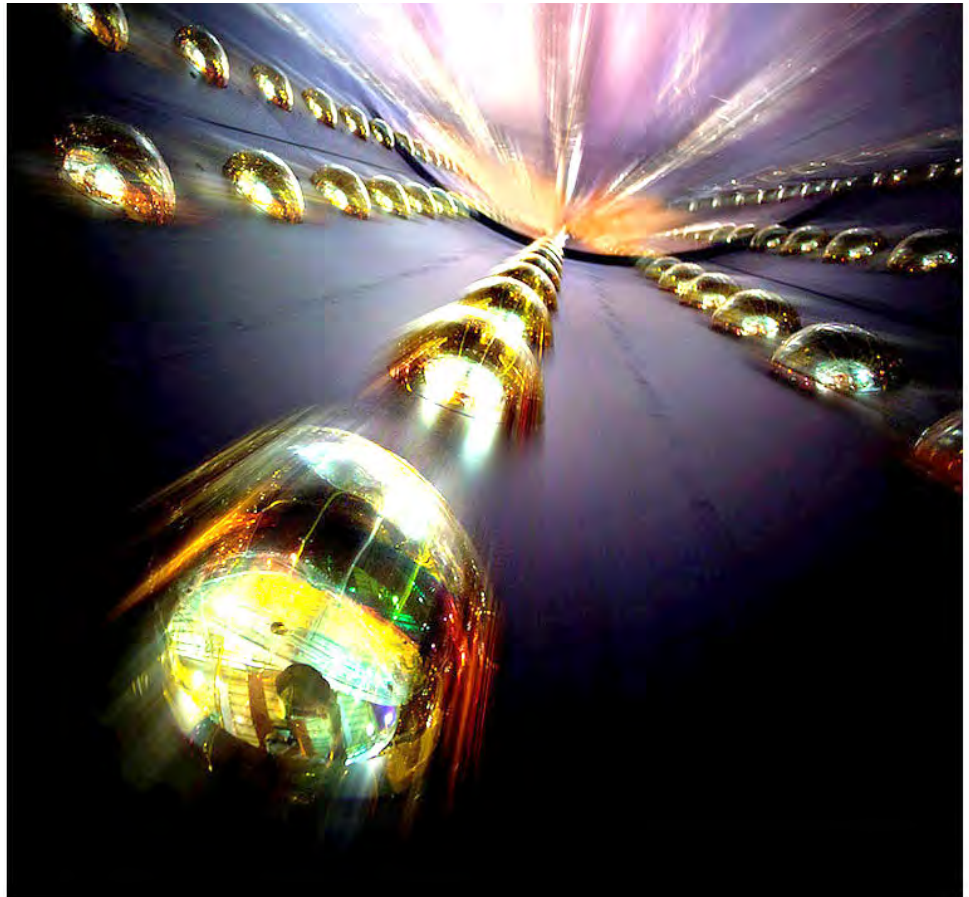
The Department of Energy manages a portfolio of basic research that spans exploring the origins of the cosmos to addressing emerging challenges in energy, environment, and national security. The scale and complexity of this research portfolio provide a competitive advantage to the nation as multidisciplinary teams of scientists, using some of the most advanced scientific instruments in the world, are able to respond quickly to national priorities and evolving opportunities at the frontiers of science. Our three strategies to accomplish this objective follow.

Conduct discovery-focused research to increase our understanding of matter, materials and their properties through partnerships with universities, national laboratories, and industry

Basic science is essential to fuel future innovation and applied technology efforts. As the federal agency funding the largest share of basic research in the physical sciences, DOE will continue to pursue scientific discoveries that lay the technological foundation to extend our understanding of nature and create new technologies that support DOE's energy, environment, and security missions.

Areas of concentration include:

- Advanced scientific computing to analyze, model, simulate, and predict complex phenomena, including the scientific potential that exascale simulation and data will provide in the future.
- Materials and chemical sciences to understand, predict, and control matter and energy to provide the foundation for new energy technologies and mitigate the environmental impacts of energy use.
- Biological and environmental sciences focused on exploring genome enabled biology, discovering the drivers and impacts of climate change, and seeking the determinants of environmental stewardship.
- Plasma science to expand the understanding of matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source.
- High energy physics to illuminate and answer questions about the unification of the forces of nature, the nature and origin of dark energy and dark matter, and the origins of the universe.
- Nuclear physics to create, detect, and describe the different forms and complexities of nuclear matter that can exist in the universe, including those that are no longer found naturally.



The Daya Bay Reactor Neutrino Experiment, led by the U.S. and China initiated by Lawrence Berkeley National Laboratory, is the most sensitive reactor experiment in the world. The results promise new insight into why enough ordinary matter survived after the big bang to form everything visible in the universe. Shown are the photomultiplier tubes that catch the fading trace of antineutrino reactions.

Provide the nation's researchers with world-class scientific user facilities that enable mission-focused research and advance scientific discovery

DOE plays a unique role in the nation's science enterprise through its investments in unique, world-leading open access scientific user facilities. These accelerators, supercomputers, x-ray light sources, neutron sources, and other facilities are some of the most advanced tools of modern science. Thousands of scientists from the national laboratories, universities, private companies, and other agencies of the U.S. Government use these extraordinary facilities each year to advance the frontiers of knowledge.

Dark Energy Survey: Why Is The Universe Speeding Up?

In 1998, two teams of astronomers studying distant supernovae made the remarkable discovery that the expansion of the universe is speeding up. Yet, according to Einstein's theory of General Relativity, gravity should lead to a slowing of the expansion. Cosmologists have developed two strikingly different ways to explain this cosmic acceleration: either 75% of the universe exists in an exotic form, now called dark energy, which appears to exhibit a force opposite to the attractive gravity that acts on ordinary matter or General Relativity must be replaced by a new theory of gravity on cosmic scales.

The Dark Energy Survey (DES) is designed to probe the accelerating universe and explore the nature of dark energy by measuring the 14-billion-year history of cosmic expansion with high precision. More than 120 scientists from 23 institutions in the United States, Spain, the United Kingdom, Brazil, and Germany are working on the project.

The main tool of the DES is the Dark Energy Camera, a 570-megapixel digital camera built at DOE's Fermilab in Batavia, Ill., and mounted on the four-meter Victor M. Blanco telescope at the National Science Foundation's Cerro Tololo Inter-American Observatory in the Andes Mountains in Chile. The camera includes five precisely shaped lenses, the largest nearly a yard across, that together provide sharp images over its entire field of view. The Dark Energy Camera is a unique and powerful survey instrument, able to see light from more than 100,000 galaxies up to 8 billion light-years away in each snapshot.

Over the next five years, the DES is expected to obtain color images of 300 million galaxies and 100,000 galaxy clusters and to discover 4,000 new supernovae, many of which were formed when the universe was half its current age. The data collected will be processed at the National Center for Supercomputing Applications at the University of Illinois in Urbana and then delivered to scientists and the public. The DES's observations will not be able to see dark energy directly. However, by studying the expansion of the universe and the growth of large-scale structure over time, the DES will give scientists the most precise measurements to date of the properties of dark energy.

Use the national laboratory system and leverage partnerships with universities and industry to conduct mission-focused research

The Department manages national laboratories with premier scientists and facilities and makes direct investments in hundreds of universities through research grants and other activities. The Department also works with U.S. companies to explore advanced technologies and solutions that can quickly find their way into the marketplace. As one of the few organizations in the world that manages such a diverse portfolio of research and technology performers, the Department has a unique opportunity to bring together multidisciplinary research partnerships, including national laboratory researchers, university scientists and industry, to work at the frontiers of science and technology.

DOE will assure the value and cohesiveness of its science and energy research and developmental programs by:

- Strengthening the partnership among DOE headquarters, DOE programs, and our national laboratories to focus scientific resources on solving U.S. energy, environmental, and economic security challenges.
- Promoting operational innovations in the Department and national laboratories to facilitate the achievement of our science and technology missions and expanding the networked approach to science and technology innovation across the national laboratories.
- Increasing no cost public access to Departmental research, especially journal literature and scientific data, to accelerate discovery through the sharing of scientific knowledge.

Agency Priority Goal (FY 2014-15)

Support and conduct basic research to deliver scientific breakthroughs and extend our knowledge of the natural world by capitalizing on the capabilities available at the national laboratories, and through partnerships with universities and industry. In support of this goal, DOE will, by the end of FY 2015:

- *Incorporate science user facility prioritization into program planning efforts*
- *Identify programmatic drivers and technical requirements in coordination with other Departmental mission areas to inform future development of high performance computing capabilities and in anticipation of capable exascale systems*

Performance Goal

- Develop capabilities to improve understanding of critical sub decadal processes and incorporate the results into Earth system models
- Keep variances from established cost and schedule baselines for major construction, upgrade, or equipment procurement projects to less than 10%
- Expand the coordination of research and technology innovation across our science and energy enterprise

Advancing U.S. Competitiveness through Broad Adoption of High Performance Computing

U.S. companies use cutting edge scientific and engineering research to develop products that can meet competitive global market demands. DOE piloted an Industrial Partnerships Program at the Oak Ridge Leadership Computing Facilities (OLCF) in late 2008 to promote the use of such tools by U.S. industries.

Access to OLCF systems and experts through the Industrial Partnerships Program helped companies address cutting edge science and engineering problems to reduce the number of physical prototypes and physical tests required, allowing firms to accelerate product development, bring concepts to market faster, and deliver them at lower costs. Additionally, these and other projects often provided important return-on-investment justification data for significant upgrades to corporate in-house computing resources for design and process engineering.

DOE's high performance computing capabilities more broadly have enabled accomplishments that include the following:

- A better understanding of how industrial fires spread to reduce fire losses that account for 30% of U.S. property loss costs.
- Models demonstrating that biomass can be a viable, sustainable feedstock for hydrogen production for fuel cells and other applications.
- Comprehensive computational physics based capability to address wind plant under performance. The Atmosphere to Electron (A2E) initiative is aimed at understanding the complex atmospheric incoming flow field, the turbines dynamic response, and the machine to machine interactions. When combined with high-resolution atmospheric information and advanced control strategies, overall plant output potentially can be improved by 20-30%.
- Identification of potential low-cost alternatives to the expensive platinum catalysts and electrolytes currently used in fuel cells.
- An optimized vehicle cooling package.
- Add-on parts that will substantially reduce the annual fuel consumption of a Class 8 long haul truck by up to 3,700 gallons and CO₂ by up to 41 tons.

Goal 2: Nuclear Security

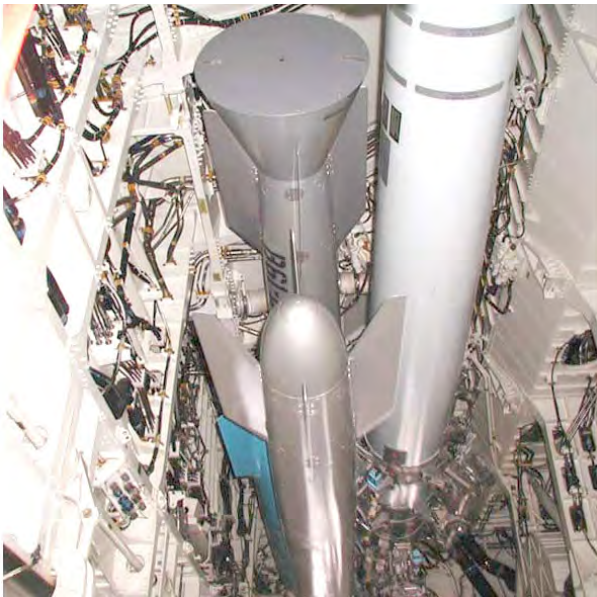
Strengthen national security by maintaining and modernizing the nuclear stockpile and nuclear security infrastructure, reducing global nuclear threats, providing for nuclear propulsion, improving physical and cybersecurity, and strengthening key science, technology, and engineering capabilities

Contributing Programs

National Nuclear Security Administration
Intelligence and Counterintelligence

International Affairs

The DOE national security mission supports nuclear security, intelligence and counterintelligence operations, and related national security needs. The President's 2010 National Security Strategy, the Nuclear Posture Review (NPR), and the ratification of the New Strategic Arms Reduction Treaty underscored the importance of the DOE's nuclear mission, and renewed the mandate for DOE to maintain a safe, secure, and reliable stockpile for as long as nuclear weapons exist. The NPR presented a path to reduce global nuclear security threats while permitting access to peaceful nuclear power for nations that respect the international nonproliferation regime. DOE will advance the President's vision to move toward a world free of nuclear weapons by both dismantling retired weapons and improving global stability through increased transparency and confidence building measures.



B61 test units mounted in the B-2A aircraft. Data acquired in this flight test provided new insights into cold temperature environments. (Sandia National Laboratory)

security, and intelligence missions, primarily through DOE's system of national laboratories and sites. DOE also provides expert knowledge and operational capabilities for physical security, classification, emergency preparedness and response, nuclear forensics and cybersecurity.

Strategic Objective 4 – Maintain the safety, security and effectiveness of the nation's nuclear deterrent without nuclear testing

In order to reassure allies and deter potential adversaries as long as nuclear weapons exist, the U.S. must sustain a safe, secure, and effective nuclear arsenal. NNSA will continue to work closely with the Department of Defense (DoD), through the Joint DoD/DOE Nuclear Weapons Council (NWC), to modernize the stockpile through timely execution of approved life extension programs, as outlined in the Stockpile Stewardship and Management Plan (SSMP). The SSMP, which is updated annually,

DOE, through the National Nuclear Security Administration's (NNSA) nuclear security enterprise, plays a central role in sustaining a safe, secure, and effective nuclear deterrent and combating proliferation and nuclear terrorism. The science, technology, engineering and manufacturing capabilities resident in the nuclear security enterprise underpin our ability to conduct stockpile stewardship and solve the technical challenges of verifying treaty compliance, combating nuclear terrorism and proliferation, and guarding against the threat posed by nuclear technological surprise. For example, 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. DOE is responsible for providing the design, development and operational support required to provide militarily effective naval nuclear propulsion plants and ensure their safe, reliable and long-lived operations.

By providing a modernized, responsive infrastructure, DOE prepares the nation for a range of potential future nuclear deterrence challenges. With its extensive science and technology capabilities and nuclear expertise, DOE provides support to defense, homeland

details the 25-year program of record for activities supporting the nuclear weapons stockpile. The SSMP, as well as the NWC, is informed by NNSA technical scoping studies, cost and risk analysis, and resource allocation modeling of alternatives.

As the nation's nuclear weapons age and exceed their stockpile design life, the NNSA must extend their lifespan. The 2010 NPR report, an extensive review of the nation's nuclear posture, recommended that study options for weapon life extension programs (LEP) consider three approaches: refurbishment of existing warheads, reuse of nuclear components from different warheads, and replacement of nuclear components. The NPR report recommended fully funding the ongoing LEP for the W76 submarine-based warhead, the LEP study and follow-on activities for the B61 bomb, and to initiate a study of LEP options for the W78 intercontinental ballistic missile warhead, including the possibility of reusing the warhead on submarine-launched ballistic missiles to reduce the number of warhead types.

Without recourse to nuclear testing, NNSA will deliver the scientific capability to assess weapon performance as well as the component and manufacturing technologies and supporting infrastructure required to execute the SSMP. NNSA will ensure the safe and secure transportation of nuclear materials and weapons components. At the same time, NNSA will advance the President's vision for reductions in nuclear weapons by dismantling retired weapons.

Agency Priority Goal (FY 2014-15)

Maintain and modernize the U.S. nuclear weapons stockpile and dismantle excess nuclear weapons to meet the national security requirements, as assigned by the President, through the Nuclear Posture Review. In support of this goal, DOE will:

- *Each year through FY 2015 and into the future, maintain 100% of the warheads in the stockpile as safe, secure, reliable, and available to the President for deployment*
- *Conduct activities necessary to complete planned W76-1 production in FY 2019 and achieve the first B61-12 production unit in FY 2020, as reported in the FY 2013 Selected Acquisition Reports*

Performance Goals

- By the end of FY 2024, demonstrate sufficient progress in scientific understanding, as evidenced by implementation of experimentally-validated models in weapons codes, by replacing at least four key parameters of current models with science-based, predictive, phenomenological models for use in weapons performance simulation
- Dismantle available retired assets from the pool of retired nuclear weapons identified in NNSA's Monthly Weapons Inventory Reports in a timely, efficient, safe and cost effective manner

Modernization through Life Extension Programs

Life extension programs (LEP) modify nuclear weapons to enhance margins against failure, increase safety, improve security, extend limited life component lifecycles, and address identified issues and component obsolescence. For example, insensitive high explosives can be used to replace conventional high explosives to improve weapon safety, and new use control features can enhance weapon security. Components and materials with known compatibility, aging issues or manufacturability problems can be replaced with modern alternatives. Without recourse to nuclear testing, NNSA's science, technology and engineering activities use simulation codes, validated models, and experimental facilities to mature technologies and provide critical data and analytical capabilities required to certify LEP products.

Strategic Objective 5 – Strengthen key science, technology, and engineering capabilities and modernize the national security infrastructure

In the National Security Strategy, the President renewed the Nation's commitment to being the global engine of scientific discovery and innovation. DOE helps prepare the Nation for a range of potential national security challenges by strengthening science, technology and engineering capabilities, and providing a modernized, responsive infrastructure. The Nuclear Posture Review notes that our specialized workforce is essential to managing the deterrent and supporting the full range of the President's nuclear security agenda. DOE provides the experimental and computational capability and infrastructure required to execute the Stockpile Stewardship and Management Program and other DOE national security missions. By working at the leading edge of multiple scientific and technical disciplines, the DOE nuclear security programs integrate scientific principles, address theory, field physical experiments, and conduct complex modeling and simulation to support not only the assessment and certification of the Nation's nuclear weapons, but also nonproliferation, counter-proliferation, nuclear counterterrorism, and intelligence activities. DOE will bolster the capabilities of the U.S. government to address cyber and other related security threats through research and development, vulnerability analyses, testing at physical and virtual ranges, and modeling and simulation.

NNSA will modernize the Department's infrastructure to safely and securely manage special nuclear materials, with priority on executing plans to ensure continuity of plutonium capability at Los Alamos National Laboratory and highly enriched uranium processing capability at the Y-12 Plant. NNSA will also ensure the safety and security of its facilities, which will include modernizing its infrastructure and added emphasis on site security across the nuclear security complex.

NNSA stewards the NNSA national laboratories and sites as an enterprise to deliver DOE programs, provide critical capabilities to support other national security missions, and drive innovation. Talented researchers, engineers, and technicians work across a range of national-level challenges and enhance their skills and expertise by working concurrently on stockpile stewardship and other national priority missions. For example, supercomputers are key to stockpile stewardship, but also have been used to provide foreign threat assessments and to open up the field of nanotechnology. NNSA relies on key capabilities at other DOE national laboratories to deliver its nuclear security missions, and works closely with DOE's Office of Nuclear Energy.

By sponsoring research programs at universities and student internships at DOE labs to secure a pipeline of national security professionals, DOE plays a critical role in ensuring the intellectual vitality of the national security technical enterprise. DOE also pursues strategic interagency partnerships with the Departments of State, Defense, and Homeland Security, and the U.S. Intelligence Community to ensure that our technical capabilities are accessible and applied to meet the needs of the broader national security community.

Performance Goals

- Complete Kansas City Responsive Infrastructure Manufacturing and Sourcing (KCRIMS) move in FY 2014 and complete the start-up of the High Explosive Pressing facility in FY 2017
- Annually, ensure that mission critical and mission dependent facilities are available to achieve key deliverables 95% of scheduled operating days without compromising safety or security
- By FY 2015, complete a plan for High Energy Density science on NNSA's Inertial Confinement Fusion facilities to support the requirements of the Stockpile Stewardship and Management Plan and incorporate input from a community workshop to be held and reported in 2014; by FY 2018, complete the initial set of experiments defined in the plan
- By FY 2016, complete a plan for experiments, in support of the Stockpile Stewardship and Management Plan, to enable certification of reuse and remanufacturing options for future LEPs; by FY 2020, complete the initial set of experiments defined in the plan

Science-based Stockpile Stewardship

The U.S. stopped underground nuclear testing in 1992. Science-based stockpile stewardship was developed to provide a comprehensive understanding of the science, technology and engineering phenomena in complex weapons to underpin the assurance of the nuclear deterrent. This approach required the development of a new generation of high-performance computer software and hardware well beyond those then available and a suite of experimental capabilities to investigate the extreme states of matter that occur in nuclear detonations. These states had been previously accessible only 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. Future stockpile stewardship plans are found in the Stockpile Stewardship and Management Plan.

The numerical simulations use sophisticated models and algorithms that are validated through extensive analysis of data from surveillance, the underground nuclear testing archives and new experiments. Unique facilities provide higher fidelity measurements of fundamental nuclear and materials properties while exercising the nuclear security enterprise skills needed to maintain and modernize the stockpile. Continued improvements in the science, technology and engineering understanding and predictive capabilities provide a deeper understanding of nuclear weapons performance, a foundation for design and qualification for the lifetime extension modernization activities, and assurance the stockpile can remain safe, secure and effective without underground nuclear testing.

Strategic Objective 6 – Reduce global nuclear security threats

Preventing nuclear terrorism and the spread of nuclear weapons-related materials, technology, and expertise is a key U.S. national security strategic objective defined in Presidential statements and national security strategy and policy documents. The Department pursues this objective by: providing policy and technical leadership to remove and eliminate, or secure and safeguard the most vulnerable nuclear materials worldwide; limiting or preventing the transfer and trafficking of weapons of mass destruction, WMD-related materials, technology, and expertise; advancing national and international technical



In November 2013, under a multi-year international effort coordinated among Hungary, the United States, the Russian Federation, and the International Atomic Energy Agency (IAEA), all remaining highly enriched uranium was successfully removed from Hungary.

capabilities to understand and detect foreign nuclear weapons production and detonation; and developing a comprehensive science-based predictive model for a broad range of nuclear threat devices. DOE also works to strengthen regulatory, safety, security and safeguards infrastructure in countries new to nuclear power; provide and maintain a technically trained-and-ready response to radiological or nuclear incidents worldwide; and provide technical and analytical support, and capability development,

for meeting and monitoring compliance with nuclear nonproliferation, counter-proliferation, nuclear forensics, and arms control treaties.

In pursuing this objective, NNSA works in partnership with the Departments of State, Defense, Homeland Security, the Nuclear Regulatory Commission, the Federal Bureau of Investigation, the Intelligence Community, and other U.S. agencies. Internationally, DOE has a strong and long-established partnership with the International Atomic Energy Agency (IAEA) and actively conducts bilateral program coordination, as well as multilateral consultations through fora such as the Nuclear Security Summit, the Global Initiative to Combat Nuclear Terrorism, and the Global Partnership against the Spread of Weapons and Materials of Mass Destruction. These exchanges, as well as a variety of domestic and international workshops, tabletop and national-level full-field exercises, provide a real-time capability to reduce nuclear security threats, and validate improvements to that capability. DOE also uses the knowledge gained from these information exchanges to inform its regular program strategy evaluations and assessments. For example, the Second Line of Defense program strategic review resulted in adjustments of program scope and priorities and the Highly Enriched Uranium (HEU) Reconciliation report identified additional nuclear materials for potential removal or elimination.

Agency Priority Goal (FY 2014-15)

Continue to make progress toward securing the most vulnerable nuclear materials worldwide. In support of this goal, DOE will:

- *Remove or confirm disposition of an additional 315 kilograms of highly enriched uranium and plutonium for a cumulative total of 5,332 kilograms by the end of FY 2015*

Performance Goals

- Complete disposition of 154 metric tons of surplus U.S. highly enriched uranium by the end of FY 2018
- Protect an estimated 2,327 buildings with high-priority nuclear and radiological materials by FY 2018
- Deploy 148 mobile radiation detection systems and training to 44 countries, deploy fixed systems at approximately 622 sites/ports, and complete transition of 531 sites to full sustainability by the partner country by the end of FY 2018
- Work with 38 countries to improve export control systems to prevent trade in weapons of mass destruction related materials, equipment, and technology by the end of FY 2018
- Work with five countries to build safety, security and safeguards capacity to minimize the risks of the expansion of nuclear power by the end of FY 2018
- Demonstrate improvements in Special Nuclear Material movement detection, warhead monitoring, chain-of-custody, and nuclear safeguards by the end of FY 2018
- Demonstrate Special Nuclear Material production characterization capabilities by the end of 2016
- Complete the validation of the national predictive modeling capability for threat devices by the end of FY 2019
- Maintain an Emergency Operations Readiness Index of 91 or higher annually

Securing Nuclear and Radiological Materials

Globally, there are vulnerable nuclear and radiological materials that are attractive targets to hostile powers or terrorist organizations for use in improvised nuclear devices or in radioactive dispersal devices (“dirty bombs”). To address these threats, DOE’s NNSA Office of Defense Nuclear Nonproliferation works with international partners to remove or secure high-priority vulnerable nuclear and radiological material around the world and to minimize the civilian use of proliferation-sensitive materials in research reactors and medical isotope production processes.

Since 2004, DOE has:

- Removed or disposed of more than five metric tons of vulnerable HEU and plutonium material – enough for more than 200 nuclear bombs;
- Completely removed HEU from 24 countries and locations;
- Secured more than 1,500 radiological sites around the world containing millions of curies – enough for tens of thousands of large dirty bombs;
- Upgraded physical protection at nearly 200 sites storing weapons-grade nuclear materials;
- Successfully converted to LEU use, or verified the shutdown of 88 HEU research reactors and isotope production facilities in 14 countries; and
- Removed and securely disposed of more than 33,000 high-activity radiological sources around the world.

Strategic Objective 7 – Provide safe and effective integrated nuclear propulsion systems for the U.S. Navy

DOE provides the design, development, and operational support required to provide militarily effective nuclear propulsion plants and ensure their safe, reliable, and long-lived operation. DOE is responsible for the reactor plant design and development for the *Ohio*-class ballistic missile submarine replacement, which will include new technology to allow lower-cost construction while enhancing plant safety and survivability and reducing life-cycle costs. It also will 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.

Performance Goals

- By 2015, provide the Navy with an A1B reactor plant design 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
- By 2027, provide the Navy with an S1B reactor plant design that extends core lifetime for the next-generation ballistic missile submarine



USS New Mexico (SSN-770) - The NNSA provides nuclear propulsion related research, development, operational support, and enriched uranium for the U.S. nuclear submarine fleet.

Fukushima Response

On March 11, 2011, an overwhelming tsunami generated by the 9.0 Richter scale Tohoku Region Pacific Coast Earthquake struck the Pacific Coast of Japan. The resulting flooding disabled the control systems at the Fukushima Daiichi Nuclear Power Plant operated by Tokyo Electric Power Company and led to a dispersal of radioactive material across a wide area. On March 14, NNSA and Environmental Management (EM) teams went to Japan to conduct both ground and aerial radiation surveys to assess the environmental conditions, providing data to inform protective actions decisions by the Government of Japan, the U.S. Armed Forces, and the U.S. Embassy in Tokyo. In addition to the field team, nuclear scientists and atmospheric modelers at DOE laboratories quickly analyzed field data and ran detailed atmospheric dispersion simulations to provide assessments for leaders in Japan and in Washington, D.C. This two-month deployment marked the first time a full complement of NNSA Consequence Management capabilities were fielded to a large scale nuclear emergency. Recognizing the Government of Japan's long-term need to characterize the environment and understand ingestion pathway issues, the NNSA Consequence Management team provided an Aerial Measurement capability to the Government of Japan by first training operators and then transitioning to a self-sufficient Japanese Aerial Measurement System. A joint database of radiological information has also been established, allowing access for scientists around the world. Post-accident clean-up support provided by EM was based on its 25 years of radioactive waste remediation experience.

Goal 3: Management and Performance

Position the Department of Energy to meet the challenges of the 21st century and the nation's Manhattan Project and Cold War legacy responsibilities by employing effective management and refining operational and support capabilities to pursue departmental missions

Contributing Programs

Environmental Management	General Counsel
Legacy Management	Health, Safety and Security
Chief Financial Officer	Independent Enterprise Assessments
Chief Human Capital Officer	Hearings and Appeals
Chief Information Officer	Inspector General
Congressional and Intergovernmental Affairs	Management
Economic Impact and Diversity	Public Affairs

Attaining mission success requires a sustained commitment to performance-based management and expectations of excellence from DOE headquarters to every site office, service center, laboratory, and production facility. At the center of this goal is a highly qualified, capable, and flexible federal workforce that can execute the mission in a safe, secure, efficient, and sustainable manner. DOE cultivates a performance-based system that links work to meeting agency and Administration goals and achieves results. Management of research and development involves prioritization of those activities with the greatest potential and likelihood for impact. Research decisions are informed by rigorous peer reviews at the portfolio level and solicitation levels. Also, improving contract and project management across the DOE enterprise is a top priority, along with vigilant protection of our cyber networks. Additional project cost and schedule analysis training will be provided, and upgrades will be sought for the information technology infrastructure.

Agency Priority Goals (FY 2014-15)

Increase the focus on efficient and effective management across the DOE enterprise and improve performance in the areas of environmental cleanup, construction project management, and cybersecurity. In support of this goal, DOE will:

- *Retrieve tank waste, close tanks, and dispose of transuranic waste within cost and schedule through FY 2015*
- *On a three-year rolling basis, complete at least 90% of departmental projects baselined since the start of FY 2008 within the original scope baseline and not to exceed 110% of the cost as reflected in the performance baseline established at Critical Decision 2 through FY 2015*
- *Achieve full operational capability of the Joint Cybersecurity Coordination Center (JC3), including TS-SCI operations, by the end of FY 2015*



Advanced techniques allowed crews at Los Alamos National Laboratory to decontaminate large boxes of waste so they could be shipped as mixed low-level, rather than transuranic, waste.

Restructure the relationship and interactions between the Department and the national laboratories and sites to ensure the continued status of the national laboratories as world-class research institutions best able to achieve DOE's mission, maximize the impact of federal R&D investment in the laboratories, accelerate the transfer of technology into the private and government sectors, and better respond to opportunities and challenges. In support of this goal, DOE will:

- *Establish the National Laboratory Policy Council to address high-level policy challenges and develop initiatives to build and focus the laboratory system on critical economic, research and national security priorities*
- *Establish the National Laboratory Operations Board to address operational and administrative issues and enhance the effectiveness and efficiency of DOE's management of the national laboratories*
- *Improve stewardship of national assets across the national laboratories and DOE operating sites to assure that DOE physical plants and their operating practices comply with DOE Directives and achieve Administration priority initiatives by end of FY 2015*

Strategic Objective 8 – Continue cleanup of radioactive and chemical waste resulting from the Manhattan Project and Cold War activities

DOE has been working for nearly 25 years to clean up the radioactive and chemical contamination left by six decades of weapons production and energy research during the Manhattan Project and the Cold War. While much has been completed, some of the highest risk and most technically complex work still lies ahead. The challenges include designing, building, starting up, and operating complex, hazardous, and unique nuclear facilities. These facilities include the Waste Treatment and Immobilization Plant in Hanford, Washington; the Integrated Waste Treatment Unit at Idaho National Laboratory; and the Salt Waste Processing Facility at the Savannah River Site in South Carolina. Successful cleanup depends on overcoming technical, quality assurance, schedule, regulatory, and management challenges. The Department will leverage past experience, applying best practices and lessons learned; identify, develop, and deploy practical technological solutions derived from scientific research at the national laboratories; and look for innovative and sustainable practices that make cleanup more efficient.

Performance Goals

- Retrieve waste from 11 tanks at Hanford Site, Idaho National Laboratory and Savannah River Site, and close a total of 2 tanks at Savannah River Site by FY 2016
- Remove more than 21,000 cubic meters of transuranic waste from site inventories in accordance with respective regulatory agreements by the end of FY 2016



The Environmental Management program at Los Alamos Laboratory exceeded its shipping goals in FY 2013, shipping twice as much waste as it did in FY 2012.

Cleaner and Safer Lands

This story has roots in a cold morning in December 1989, when workers at the Rocky Flats Plant in Colorado loaded the last plutonium “trigger” for a nuclear warhead into a tractor trailer bound southeast to the Pantex Plant near Amarillo, Texas. No one knew then that the nuclear weapon built with this plutonium trigger would be the last one made in the United States for the foreseeable future. Until then, the production of nuclear weapons had run continuously, beginning during World War II with the startup of the first reactor to produce plutonium for the top-secret Manhattan Project. But growing concerns about safety and environmental problems had caused various parts of the weapons-producing complex to be shut down in the 1980s. These shutdowns, at first expected to be temporary, became permanent when the Soviet Union dissolved in 1991. The nuclear arms race of the Cold War came to a halt for the first time since the invention of the atomic bomb.

Sixty years of nuclear weapons production and energy research generated millions of gallons of liquid radioactive waste, millions of cubic meters of solid radioactive wastes, thousands of tons of used nuclear fuel and special nuclear material, along with huge quantities of contaminated soil and water. One of the largest and most diverse and technically complex environmental cleanup operations in the world, DOE’s Environmental Management (EM) program has a mission to complete the safe cleanup of this environmental legacy. The EM program was created in the late 1980s to clean up the radioactive legacy of the Cold War. As of 2012, EM has reduced the number of contaminated sites from 107 to 17; and since 2009 EM has reduced its active footprint by 688 square miles, from 931 square miles to 243 square miles, demonstrating tremendous success in the accelerated cleanup of the Cold War legacy. Major successes include completing cleanup at the Rocky Flats, Mound, and Fernald sites as well as the construction and operation of the Defense Waste Processing Facility at the Savannah River Site.

DOE has made significant progress toward cleaning up the legacy of nuclear weapons production. The \$4.4 billion Fernald site cleanup was accomplished with the support and participation of the local community, and federal and state regulators. The 1,050-acre property has been returned to a natural state that features one of the largest man-made wetlands in Ohio, large tracts of open water, upland forests, a lengthy riparian corridor, and the beginnings of a tall grass prairie. The successful cleanup efforts are reflected in the diverse array of wildlife that now migrates to the site. The Savannah River site in Aiken, South Carolina, has successfully built and continues to operate the Defense Waste Processing Facility, the largest facility of its kind in the world. This facility vitrifies high-level waste into a more stable glass form and has produced over 3,500 (47%) of an anticipated 7,500 vitrified glass waste canisters to date. The Richland site in Washington State pioneered the deactivation of large complex and highly radioactive processing canyons by completing the first ever deactivation of B-Plant/PUREX in 1997.

Strategic Objective 9 – Manage assets in a sustainable manner that supports the DOE mission

Investment in world-class physical assets will continue, from brick and mortar facilities to cutting edge technology systems, to enable the United States to remain a world leader in scientific and technological advances. Sites and laboratories will address current and future use of land and facilities including sustainable operations and post-closure responsibilities. DOE efforts to operate more efficiently, perform cleanup, and address post-closure responsibilities are resulting in sites and laboratories with a smaller footprints and more efficient and effective infrastructure. Mission objectives, energy efficiency, and sustainability principles will drive decisions on capital infrastructure, real property, and information technology. This includes planning, divestiture, acquisition, and sharing of assets with other governments, communities, academia, and industry; supporting conveyance and reuse of unneeded land and facilities; and performing long-term surveillance and maintenance of legacy sites.

Performance Goals

- Identify the mission and core capability associated with all real property assets and assess the asset utilization for efficiency and efficacy by FY 2015
- Dispose of 10 federal excess land properties by FY 2016
- Eliminate 1,775,000 square feet of excess buildings and infrastructure through demolition or beneficial reuse by the end of FY 2016
- Establish a list of real property available for reuse or disposal to non-federal entities by the end of FY 2015

- Increase legacy site responsibility from 89 to 109 sites by FY 2016 (sites closed by DOE and sites remediated by the U.S. Army Corps of Engineers and Uranium Mill Tailings Radiation Control Act of 1978 Title II licensees)
- Meet sustainability goals by FY 2018, including 25% reduction in direct greenhouse gas emissions from FY 2008 baseline, through ongoing investment in energy efficiency and renewable energy, including fleet and building improvements

Strategic Objective 10 – Effectively manage projects, financial assistance agreements, contracts, and contractor performance

Improving the effectiveness and efficiency of DOE's financial assistance agreements, contract and project management performance remains a top priority. These efforts are central to delivering mission critical facilities and capabilities on time and within original budget. Contract provisions are being incorporated into contracts that will enhance the oversight of contractor cost and technical performance systems and ensure contractors are not rewarded unless performance standards and requirements are met. The use of small business vehicles and strategic sourcing for both federal and contractor management and operating procurements will be expanded.

Performance Goals

- Expand use of Federal Strategic Sourcing Initiative to DOE federal procurement operations while continuing focus on Contractor Supply Chain Council activities to achieve 4% cost savings against actionable spending in FY 2015
- Establish and meet small business prime contracting goals, and increase utilization of small businesses in DOE prime contracts and by DOE's M&O contractors
- Perform a comprehensive assessment of DOE's acquisition and project management workforce by the end of 2015 and implement a program to assure they are fully trained and qualified

Strategic Objective 11 – Operate the DOE enterprise safely, securely, and efficiently

The employees of DOE are its strongest asset. When employees' health and safety are protected and they are well trained, empowered, and free from discrimination, they will ensure mission success efficiently and effectively. DOE is entrusted with a unique mission to protect the nation's federal nuclear industrial operations, and thus holds a special responsibility to maintain oversight of the safety and security of those hazardous operations. Rigorous self-analysis is employed, including performance evaluations and testing conducted independent of site or headquarters line management. Because public trust is vital to success, DOE emphasizes openness, transparency, and collaboration with workers and their representatives, and the communities in which DOE operates. The DOE enterprise—including government-owned, contractor-operated sites—is also being strengthened to address a range of cyber threats that can adversely impact mission capabilities.

Performance Goals

- Minimize occupational illnesses and injuries to DOE federal and contractor employees and reduce radiation exposures to employees, the public, and the environment to as low as reasonably achievable
- Issue and implement policy on bullying and workplace violence by FY 2015
- Complete cross-organizational assessment of processes for resolving workplace conflict and develop recommendations for improvement, if warranted, by FY 2015
- Benchmark, by 2015, and optimize information processes, services, and technology to deliver high-quality solutions, reduce costs, improve security, and enhance collaboration across the Department by 2017

Strategic Objective 12 – Attract, manage, train, and retain the best federal workforce to meet future mission needs

DOE faces serious workforce challenges over the coming decade, with 15-25% of its federal employees projected to retire, including many of its most experienced and highly skilled professionals. To meet these challenges, the Department must engage in workforce planning and improve its outreach and recruitment programs in order to maintain a federal workforce with the technical skills and experience required to accomplish its science-driven missions. The Department must also significantly improve the quality and efficiency of its human resource operations. DOE is committed to improving human capital policies, programs, and systems through a corporate approach that reduces organizational redundancies and uses capable and cost-effective information technology systems. Since implementation of the President's Hiring Reform initiatives in FY

2010, the recruitment process for general schedule positions has been reduced from an average 174 days in FY 2009 to 97 days in FY 2013. Efforts are also underway to improve hiring quality and on-boarding processes and outcomes, with a continued focus on promoting diversity and inclusion within the workforce. There are plans to implement a strategy for leadership development across all levels of the organization. Skill gaps will be addressed by using such tools as employee skill assessments and individual development plans. Employee accountability will be addressed through employee performance plans and organizational annual action plans resulting from employee surveys. DOE will also advance its Women in Clean Energy, and Minorities in Energy programs to draw upon the entire American talent pool.

Performance Goals

- Reduce the per employee cost of providing human resource services by 50% by reducing organizational HR redundancies and moving to a corporate approach by the end of FY 2016
- Improve each year on the speed, quality, and diversity of hiring and on-boarding, as indicated by satisfaction surveys and demographic data, while maintaining an efficient time-to-hire and desired retention rates
- Improve the effectiveness of employee skills assessments, training curricula, delivery methods, and individual development plans to support corporate succession planning, closing skills gaps, and workforce development through FY 2018
- Implement a corporate leadership development strategy and framework by FY 2017 that improves leadership and management at all levels and mission performance, using results from the Federal Employee Viewpoint Survey and other trend analyses
- Ensure accountability for improving employee perceptions, engagement, and performance through the implementation of action items based on the annual Federal Employee Viewpoint Survey results and improved execution of employee performance management in line with the Goals-Engagement-Accountability-Results model by FY 2015



DEPARTMENT OF ENERGY NATIONAL LABORATORIES



National laboratories solve important problems in fundamental science, energy, and national security.

They collaborate with academia, other government agencies, and industry to develop and deploy scientific and technological solutions in support of national needs. Specifically, the laboratories:

- Conduct world-leading research in the physical, chemical, nuclear, biological, and information sciences that advances our understanding of the world around us;
- Advance U.S. energy security and leadership in clean energy technologies to ensure that energy is abundant, clean, affordable, and reliable; and
- Enhance our national security by ensuring the safety and effectiveness of our nuclear deterrent, helping prevent the proliferation of weapons of mass destruction, and securing our borders.

National laboratories steward vital scientific and engineering capabilities including technology transfer that are essential to our nation's continued science and technology primacy in a rapidly changing world.

These capabilities are used primarily to address long-term national problems, but also can be tapped to respond to technological surprises and nearer term challenges, as evidenced by the labs' responses to the Gulf oil spill and 9/11. The core of the national laboratories is a first-rate workforce of research scientists, engineers, and support personnel that is entrusted to serve the American people.

National laboratories design, build, and operate unique scientific instrumentation and facilities that serve tens of thousands of scientists and engineers from academia, government, and industry collaborating on solutions to pressing and complex problems.

These facilities, which are found nowhere else in the world, support open scientific research as well as classified work. They continually advance the state of the art through the development and use of next-generation tools and technologies. They enable fundamental scientific discoveries, ensure our national security, and assist industry (with new materials, improved manufacturing processes, and advanced product testing).

National laboratories promote innovation that advances U.S. economic competitiveness and contributes to our future prosperity.

They partner with others, especially industry, to integrate fundamental and applied research to the broad benefit of the economy. They contribute materially to U.S. economic prosperity by making key scientific discoveries, demonstrating the utility of these discoveries in early prototypes, and working with industry to move these technologies into the marketplace, thus creating high-paying jobs. The laboratories' prowess is evidenced by their disproportionately large number of R&D 100 Awards and proven track record in technology transfer and commercialization.



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