U.S. DEPARTMENT OF ENERGY

Transition 2016

CORPORATE OVERVIEW APPENDICES

Book Two

INTRODUCTION

This book provides a number of appendices that support the Corporate Overview of the Department of Energy (DOE). Section One covers the budget highlights for the Department.

Section Two includes brief descriptions of all DOE program and staff offices. A high-level look at each of the Department's National Laboratories and major Boards and Councils follows. Section Three includes a current look at the federal, laboratory and contractor staffing at the Department as well as the recently released results of the 2016 Federal Employee Viewpoint Survey (FEVS).

Given that DOE is one of the most highly-leveraged agencies in regards to use of contractor support, we have included a discussion of the Department's largest contractors along with major financial assistance agreements in Section Four.

External oversight of DOE is performed by a number of organizations including the Congress, the General Accountability Office (GAO), and the Office of the Inspector General (IG). Section Five includes a discussion on Congressional Oversight as well as reports from two independent commissions chartered by Congress to evaluate DOE and DOE's response to those independent commissions is included. Also included is the Interim Report of the Secretary of Energy Task Force on DOE National Laboratories and the DOE assessment and response to recommendations. A listing of recent GAO and IG reports follows.

DOE Statutory authorities and major rulemakings for both the past year and those expected in the near-term are included in Section Six and, finally, the Executive Summaries for three major publications issued by DOE – the Quadrennial Energy Review, the Quadrennial Technology Review, and the Annual Energy Outlook for 2016 – are included in Section Seven.

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BUDGET OVERVIEW

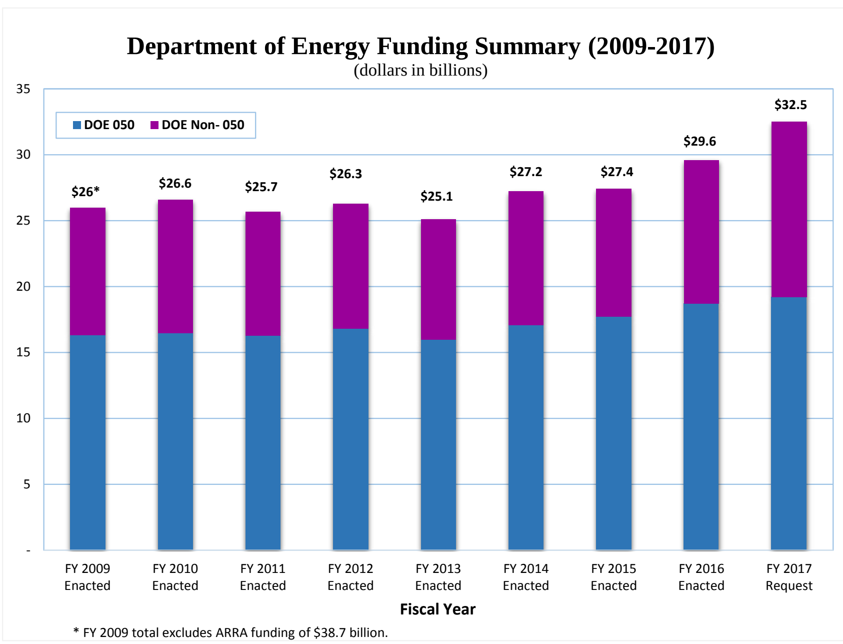
This section provides an overview of the Department of Energy (DOE) budget, including highlights of the FY17 Budget Request focusing on the funding profiles of the important issues presented in these transition materials, and provides summary tables presenting the FY17 request by program office and appropriation, and appropriations by state and by national laboratory. The accompanying FY17 Budget in Brief provides more information about the FY17 request and funding for individual program offices and their activities.

The DOE budget supports a broad portfolio of energy, science, and national security programs, including support for the 17 national laboratories which carry out critical responsibilities for America's security and economy in three areas:

- Building the Future through Science and Clean Energy
- Ensuring Nuclear Security
- Organizing, Managing and Modernizing the Department to Better Achieve Its Enduring Missions

The DOE budget is divided into two categories – Defense (budget function 050) and Non-Defense (non-050). The Defense 050 category funds the National Nuclear Security Administration (NNSA); defense environmental cleanup, approximately 85% of the environmental management program; and several other smaller programs. The DOE non-defense non-050 category funds energy, science, non-defense environmental cleanup, and management and departmental administration programs.

Over the past eight years, total appropriated funding increased $3.6 billion (13.8%). Most of this growth took place between FY15 and FY16 in the NNSA and Environmental Management defense budgets. Funding for energy, science, and other non-defense programs decreased by nearly $2.1 billion (18.1%) in FY13 because of budget sequestration, increased $1.2 billion (12.7%) in FY14, and since then has been generally flat.



FY 2017 Budget Request

The DOE FY 2017 Budget Request is $32.5 billion and consists of $30.2 billion in discretionary funding (appropriated spending) and $2.3 billion in new mandatory spending proposals requiring new legislation.

The House and Senate Appropriations Committees passed their versions of the FY17 Energy and Water Appropriations bill that funds DOE. The Senate passed its bill on May 12, 2016 (H.R. 2028, S.Rept. 114-236) that provides $29.975 billion in DOE budget authority, $265 million below the discretionary budget request and $372 million above the FY16 budget. The House Appropriations Committee completed action on April 19, 2016 (H.R. 5055, H.Rept. 114-532), but the bill was defeated on the House floor on May 26, 2016. As passed by the Appropriations Committee, the House bill provides $29.886 billion in DOE budget authority, $354 million below the discretionary budget request and $283 million above the FY16 budget.

As shown in the table below, taking into account one-time rescissions and Uranium Enrichment Decontamination and Decommissioning (UED&D) contributions, the House bill provides $310 million more defense program funding and $89 million more non-defense program funding than FY16 enacted, while the Senate bill provides $504 million more defense program spending and $151 million more non-defense spending than FY16 enacted.

$ Millions	FY16 Enacted	FY17 Request	FY17 HEWD	vs. FY16	vs. Req.	FY17 SEWD	vs. FY16	vs. Req.
DOE, Budget Authority	**29,603**	**30,240**	**29,886**	**+283**	**-354**	**29,975**	**+372**	**-265**
DOE, Program Funding*	**29,630**	**30,549**	**30,029**	**+400**	**-519**	**30,285**	**+655**	**-264**
DOE, Defense (050)	18,739	19,119	19,049	+310	-70	19,243	+504	+124
DOE, Nondefense (non-050)	10,891	11,430	10,980	+89	-450	11,042	+151	-388

* *Reflects adjustments to 302(b) allocations from rescissions and a UED&D Fund contribution.*

Department of Energy (DOE) Important Issues Funding Profiles

The *Important Issues* section provides papers on a series of important issues facing DOE. This section presents funding profiles for the program addressing the following issues and provides the current FY17 budget request status for each program.

Science and Energy

Strategic Petroleum Reserve (SPR) Modernization

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request $	Change FY 2017 Request %
Strategic Petroleum Reserve (SPR)						
Facilities Development and Operations	174,999	174,999	186,870	228,069	41,199	22.0%
Management for SPR Operations	25,001	25,001	25,130	28,931	3,801	15.1%
Total, Strategic Petroleum Reserve	200,000	200,000	212,000	257,000	45,000	21.2%

The Strategic Petroleum Reserve (SPR) protects the United States (U.S.) from severe petroleum supply interruptions through the acquisition, storage, distribution, and management of emergency petroleum stocks and to carry out U.S. obligations under the International Energy Program.

Issue

The Bipartisan Budget Act of 2015 (Public Law 114-74) required DOE to submit to Congress a long-term Strategic Review of the U.S. Strategic Petroleum Reserve and authorized DOE to sell up to $2 billion in SPR oil over four years from FY17-20 to fund SPR infrastructure modernization, subject to appropriation. The FY17 sale cannot exceed $375.4 million of crude oil. The sale proceeds will be deposited into the Energy Security and Infrastructure Modernization Fund to remain available until expended SPR construction, maintenance, repair, and replacement activities.

Status

The FY17 Budget Request included $257 million to increase SPR durability and reliability and ensure operational readiness. The House FY17 Energy and Water Appropriations Bill provides the requested $257 million, and the Senate FY17 Energy and Water Appropriations Bill provides $200 million, $57 million below the request.

In April 2016 a proposed FY17 Budget Amendment was submitted to Congress that allows for the deposit of oil sale proceeds in the Energy Security and Infrastructure Modernization Fund, authorized by the Bipartisan Budget Act of 2015. This proposed amendment also makes the proceeds available to fund SPR modernization activities, including life extension of SPR infrastructure and marine terminal distribution enhancements.

In August 2016 DOE submitted to Congress the report, "*Long-Term Strategic Review of the U.S. Strategic Petroleum Reserve.*

Carbon Capture and Storage

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request $	Change FY 2017 Request %
Carbon Capture and Storage (CCS)						
Carbon Capture	116,000	112,400	101,000	109,200	8,200	8.1%
Carbon Storage	100,000	96,896	106,000	90,875	(15,125)	-14.3%
Total, Carbon Capture and Storage (CCS)	216,000	209,296	207,000	200,075	(6,925)	-3.3%

The Fossil Energy Research and Development (FER&D) program leads Federal research, development, and demonstration (RD&D) efforts on advanced Carbon Capture and Storage (CCS) technologies to cut carbon pollution. Carbon Capture focuses on development of post-combustion and pre-combustion CO_2 capture and compression technologies for new and existing fossil fuel-fired power plants and industrial sources. Carbon Storage develops and validates technologies to ensure safe and permanent geologic storage of captured CO_2 from both coal and natural gas power systems.

Issue

Advancing transformational Research &Development (R&D) in critical technology areas such as carbon capture and storage will further the reliable, efficient, affordable, and environmentally sound use of fossil fuels that are important to our Nation's security and economic prosperity.

Status

The FY17 Budget Request for Carbon Capture of $109.2 million will fund one additional large-scale post-combustion capture pilot and a total of three large-scale post-combustion pilots. FY17 funding also continues transformational research and development (R&D) technology development for pre- and post-combustion capture. The program also will support a Front End Engineering Design (FEED) study and initial construction of a large pilot facility to capture CO_2 from a natural gas power system. The requested increase would support two additional (four total) FEED studies for advanced combustion systems.

The FY17 Budget Request for Carbon Storage of $90.9 million supports: (1) storage field management projects, including the Regional Carbon Sequestration Partnerships, and other field characterization and injection projects; (2) risk and integration tool development; and (3) advanced storage R&D efforts to develop laboratory and bench-scale technologies for identifying and obtaining new subsurface signals, ensuring wellbore integrity, and increasing understanding of the stress state and induced seismicity.

The House FY17 Energy and Water Appropriations Bill provides the requested $109.2 million for Carbon Capture and $85.5 million for Carbon Storage, $5.4 million below the request. The Senate FY 2017 Energy and Water Appropriations Bill provides $101 million for Carbon Capture, $8.2 million below the request, and $106 million for Carbon Storage, $15.1 million above the request.

International Thermonuclear Experimental Reactor (ITER)

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
International Thermonuclear Experimental Reactor (ITER) Project						
ITER Project	150,000	150,000	115,000	125,000	10,000	8.7%

The International Thermonuclear Experimental Reactor (ITER) is an international nuclear fusion research and engineering megaproject, which will be the world's largest magnetic confinement plasma physics experiment. It is an experimental tokamak nuclear fusion reactor that is being built next to the Cadarache facility in Saint-Paul-lès-Durance, south of France. The ITER fusion reactor has been designed to produce 500 megawatts of output power for several seconds while needing 50 megawatts to operate. ITER aims to demonstrate the principle of producing more energy from the fusion process than is used to initiate it, something that has not yet been achieved in any fusion reactor.

The project is funded and run by seven member entities—the European Union, India, Japan, China, Russia, South Korea, and the United States. The EU, as host party for the ITER complex, is contributing about 45% of the cost, with the other six parties contributing approximately 9% each.

Issue

The ITER project members and ITER organization (IO) continue to make progress on construction, delivery and fabrication. The design for First Plasma (FP) is 79% complete through manufacturing design, while the overall design to Deuterium-Tritium (DT) is 61% complete. The U.S. remains concerned about the ITER Members meeting the ITER project schedule because of past delays and anticipated funding constraints. The U.S. ITER in-kind contributions have been designed, constructed and delivered consistent with the key milestones. Four of the twelve U.S. hardware systems are currently in final fabrication.

In May 2016 DOE delivered a report to Congress, *U.S. Participation in the ITER Program*, that recommended the U.S. remain a partner in the ITER project through FY18, at which time the U.S. will reassess the project, continue the reforms already underway, and implement additional measures described in the report.

Status

The FY17 Budget Request includes $125 million to continue the U.S. contribution to the ITER project for further design and fabrication of several subsystems. The House FY 2017 Energy and Water Appropriations Bill provides the requested $125 million while the Senate FY17 Energy and Water Appropriations Bill does not fund ITER.

Nuclear Waste

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Fuel Cycle Research and Development						
Fuel Cycle Research and Development	197,000	191,242	203,800	249,938	46,138	22.6%

Nuclear power has reliably and economically contributed almost 20% of U.S. electrical generation over the past two decades. It remains the single largest contributor (more than 60%) of U.S. non-greenhouse-gas-emitting electric power generation. The use of nuclear technology for commercial electricity production or for national defense activities generates radioactive waste. The most hazardous of these wastes are used (or "spent") nuclear fuel assemblies that come from nuclear power plants, naval nuclear vessels, and nuclear production or test reactors. Also very hazardous are the high-level radioactive waste (HLW) left over from the processing of nuclear materials for nuclear weapons production.

Issue

DOE is responsible for the safe, long-term management and permanent disposal of spent nuclear fuel (SNF) and HLW critical to national defense and maintaining nuclear power as part of our diversified clean-energy portfolio. DOE is designing a phased, adaptive, consent-based approach to siting new nuclear waste facilities as part of an integrated waste management system.

To support the nuclear waste management program over the long term, the FY17 Budget request proposed to reform the current funding arrangement to include a funding system consisting of ongoing discretionary appropriations, access to annual fee collections provided in legislation either through their reclassification from mandatory to discretionary or as a direct mandatory appropriation, and eventual access to the Nuclear Waste Fund balance.

Status

The FY17 Budget Request for Fuel Cycle Research and Development includes $76.3 million, an increase of $53.8 million, for integrated waste management system activities in transportation, storage, disposal, and consent-based siting. The $76.3 million includes $61 million from the Nuclear Waste Fund and $15.3 million in defense funding. The FY17 Request includes $39.4 million for consent-based siting, including $25 million for grants to states, Tribes, and local governments. The request includes $74.3 million for related generic used fuel and HLW disposition R&D which includes $26 million to complete characterization of a field test borehole and to initiate drilling.

The House FY17 Energy and Water Appropriations Bill provides $177.2 million for Fuel Cycle Research and Development, $72.7 million below the request. Within available funds, the House provides $61.1 million for Used Nuclear Fuel Disposition (UNFD), $89.5 million below the request. The House also provides $61.1 million to continue generic UNFD research and development activities, $13.2 million below the request. Within available funds, the House provides $6 million to support activities to design and certify rail cars for use with licensed and anticipated transportation casks; and $12 million to support preparation activities for testing of high burnup fuel and post-irradiation examination of spent fuel rods for the high burnup demonstration project. Within the amounts for UNFD, the House recommendation does not include defense funds. The Senate FY17 Energy and Water Appropriations Bill provides $219.7 million for Fuel Cycle Research and Development, $30.2 million below the request.

The House Report 114-532 states that Yucca Mountain in Nevada remains the law of the land as the disposal site (or "repository") for SNF and HLW and comments that DOE did not request funding for its development in FY17 and instead proposed large increases for new activities that ignore the significant investments already made at Yucca Mountain. The House Report further states that it rejects this approach and provides no funds for integrated waste management system activities.

The Senate Report 114-236 continues to support the recommendations of the Blue Ribbon Commission on America's Nuclear Future and believes that near-term action is needed to address this issue, and recommends $61 million for Integrated Waste Management System activities. The Senate Report further states that funding should be used to advance plans to consolidate SNF from around the U.S. to an interim central storage facility(s), with priority given to shutdown reactors, and to accelerate the development of a transportation capability to move the commercial spent fuel from its current storage locations. The Senate Report provides support for DOE efforts to develop a process for consent-based siting by engaging State, local, and tribal government entities on the possible conditions under which an interim storage facility could be sited within their jurisdictions. In addition, the Senate supports ongoing coordination between the DOE and the Nuclear Regulatory Commission to clarify the regulatory framework under which transportation and centralized interim storage of spent fuel could occur.

The Senate Report further encourages DOE to ensure lessons learned from the demonstration project in North Dakota are incorporated into its plan to develop a process for future consent-based siting. Within the amounts recommended for used nuclear fuel disposition, $14.2 million is provided for ongoing research and development activities to address the nuclear waste disposal with priority on the ongoing study of the performance of high-burnup fuel in dry storage and on the potential for direct disposal of existing spent fuel dry storage canister technologies.

Mission Innovation

($K)

	FY 2016 Enacted		FY 2017 Budget		Mission Innovation Change FY 2017 Request	
Issue	Total Budget	Mission Innovation	Total Budget	Mission Innovation	$	%
Mission Innovation by Program						
Discretionary Mission Innovation						
Energy Efficiency and Renewable Energy	2,073,000	1,406,000	2,898,000	2,108,000	702,000	49.9%
Electricity Delivery and Reliability	206,000	153,000	262,000	177,000	24,000	15.7%
Fossil Energy Research and Development	632,000	533,000	600,000	564,000	31,000	5.8%
Nuclear Energy	986,000	862,000	994,000	804,000	(58,000)	-6.7%
Advanced Research Projects Agency-Energy (ARPA-E)	291,000	291,000	350,000	350,000	59,000	20.3%
Science	5,350,000	1,577,000	5,572,000	1,853,000	276,000	17.5%
Total, Discretionary Mission Innovation	9,538,000	4,822,000	10,676,000	5,856,000	1,034,000	21.4%

Mission Innovation is an initiative launched by the U.S. and 19 other countries to accelerate widespread clean energy technology innovation and cost reduction. Each of the 20 participating countries, which together represent over 80% of global governmental clean energy research and development, will seek to double its governmental investment in clean energy research and development over five years.

The DOE Mission Innovation programs include use-inspired basic research sponsored by the Office of Science, Advanced Research Projects Agency-Energy (ARPA-E) and portions of the applied energy programs that support clean energy research, development, and demonstration activities.

Issue

Large scale penetration of clean energy technologies will require funding commitments by governments followed by private-sector investments. Mission Innovation is complemented by a separate private sector-led effort that has pledged to invest private capital in clean energy, focusing on early-stage innovations. This parallel initiative -- spearheaded by Bill Gates -- includes a coalition of over 28 significant private capital investors from 10 countries, and will be called Breakthrough Energy Coalition.

Status

The FY17 Budget Request takes a significant first step toward fulfilling the U.S. pledge to seek to double federal clean energy R&D over the next 5 years by providing $7.7 billion across 12 federal agencies, with DOE responsible for approximately 76% of the government-wide total. The DOE FY17 request provides $5.856 billion in discretionary funding for clean energy R&D, an increase of over 21% above the FY16 baseline of $4.822 billion of appropriated funds.

The House FY 2017 Energy and Water Appropriations Bill provides $4.649 billion for DOE applied energy R&D and related programs, $961 million below the discretionary FY17 request. The Senate FY17 Energy and Water Appropriations Bill provides $4.654 billion for DOE applied energy R&D and related programs, $957 million below the discretionary FY17 request. Both bills provide $5.4 billion for Science, $172 million below the discretionary FY17 request.

Exascale Computing

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Exascale Computing Initiative						
Exascale Computing Initiative	149,000	149,000	252,624	285,000	32,376	12.8%

Exascale computing is a multi-year collaboration between the Office of Science and NNSA to accelerate development and deployment of capable exascale computing systems, applications and software infrastructure to meet national security needs and to provide next-generation tools for scientific discovery.

Issue

Exascale Computing provides U.S. leadership in the development of the next generation of high performance computing (HPC). The importance of HPC is increasing as the U.S. faces serious and urgent economic, environmental, and national security challenges. Providing tools for solving these and future problems requires exascale capabilities. Committed U.S. leadership toward exascale computing is a critical contributor to our competitiveness in science, national defense, and energy innovation as well as the commercial computing market. Equally important, a robust domestic industry contributes to our nation's security by helping avoid unacceptable cybersecurity and computer supply chain risks.

Status

Addressing this national challenge requires a significant investment by the Federal government, and the DOE Exascale Computing initiative is organized around four pillars: application development, software technology, hardware technology, and exascale systems. In FY17, DOE proposes to expand its efforts in the first three technical focus areas, and begin efforts in the fourth focus area in FY18. The FY17 Budget Request includes $190 million across three Office of Science programs, plus $95 million in NNSA to develop exascale-class HPC to meet national security needs; accelerate development of capable exascale computing systems with a thousand-fold improvement in performance over current high-performance computers; and accelerate the development of clean energy technologies.

The House FY17 Energy and Water Appropriations Bill provides $151 million in Office of Science for Exascale computer and does not specify amounts in NNSA for Exascale, but provides $634 million for Advanced Simulation and Computing, $11 million above the FY16 budget.

The Senate Report 114-236 that accompanied the Senate FY17 Energy and Water Appropriations Bill states that exascale computing could not be fully funded because of budgetary constraints.

Grid Modernization

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Grid Modernization						
Departmental Administration	0	0	1,000	1,000	0	0.0%
Electricity Delivery and Energy Reliability	113,700	110,626	169,000	186,800	17,800	10.5%
Energy Efficiency and Renewable Energy	76,444	75,226	124,947	189,730	64,783	51.8%
Tribal Energy Program: Tribal Energy Grant Program	0	0	500	1,000	500	100.0%
Total, Grid Modernization	190,144	185,852	295,447	378,530	83,083	28.1%

Grid Modernization is an ongoing initiative that is supported by a Grid Modernization National Laboratory Consortium comprising 400 partners, including the release of DOE's new comprehensive new Grid Modernization Multi-Year Program Plan and the announcement of a $220 million funding opportunity for the National Labs and partners.

Issue

Electricity grid technology modernization accelerates the development of the technologies and tools to enable modernization of the grid to support U.S. economic growth, environmental quality and security objectives. Grid Modernization supports strategic investments by DOE in foundational technology development, enhanced security and resilience capabilities, and greater institutional support and stakeholder engagement to provide tools for the evolution to the grid of the future. Investment is critical now as industry is considering approaches to address aging infrastructure.

Status

The FY17 Budget Request includes $262 million for the Office of Electricity Delivery and Energy Reliability of which $186.8 million is for grid modernization research to support a smart, resilient electric grid for the 21st century and the storage technology that underpins it, as well as funding critical emergency response and grid physical security capabilities. The request provides $14 million to establish a new competitively-selected Grid Clean Energy Manufacturing Innovation Institute as a part of the multi-agency National Network for Manufacturing Innovation, to focus on technologies related to critical metals for grid application, and advances will be broadly applicable in multiple industries and markets.

Although the House supports grid modernization, the House Report 114-532 that accompanied the House FY17 Energy and Water Appropriations Bill does not designate funding for grid modernization activity. The Senate also supports grid modernization although Senate Report 114-236 that accompanied the Senate FY17 Energy and Water Appropriations Bill states that the requested increase for grid modernization was not fully funded because of budgetary constraints.

Nuclear Energy Small Modular Reactors Program

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Small Modular Reactor (SMR) Program						
SMR Licensing Technical Support	54,500	54,500	62,500	89,600	27,100	43.4%

The successful deployment of a small modular reactor (SMR) design would provide U.S. utilities with a greater range of nuclear energy options to reduce air pollution and greenhouse gases. Small modular reactors feature compact, scalable designs that are expected to offer a host of safety, construction and economic benefits, and could potentially supply low-carbon baseload energy to small electric grids and locations that cannot support larger reactors.

Issue

DOE has placed a high priority on accelerating the commercialization and deployment timelines for SMR technologies. The SMR Licensing Technical Support (LTS) program supports first-of-a-kind costs associated with design certification and licensing activities for SMR technologies and site licensing activities through cost-shared arrangements with industry partners (industry contributions are a minimum of 50% of the cost). If industry chooses to widely deploy these technologies in the U.S., SMRs could help meet the Nation's economic, energy security, and climate change goals. The goal of the program is to support the industry first-movers as they complete the design development, certification, and licensing for SMR deployment in the early to mid-2020s. DOE cost-shared agreements awarded under this program will reduce the risk of domestic development of commercial SMRs.

Status

The FY17 Budget Request includes $89.6 million to continue funding for a cost-shared cooperative agreement for licensing technical support of a small modular reactor design, including support for a SMR certification application to the Nuclear Regulatory Commission (NRC) by December 2016, for application review by the NRC, and to continue development of permit and license applications for the first domestic SMR deployments.

The House FY17 Energy and Water Appropriations Bill provides $96 million for SMR Licensing Technical Support, $7 million above the request to encourage DOE to continue to support design certification, site permitting, first of a kind engineering, and related licensing activities necessary to deploy SMR technologies. The Senate FY17 Energy and Water Appropriations Bill provides $95 million for SMR Licensing Technical Support, $6 million above the request.

Nuclear Security

National Nuclear Security Administration (NNSA) Life Extension Programs (LEPs)

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request $	Change FY 2017 Request %
Life Extension Programs and Major Alterations						
B61 Life Extension Program	643,000	644,420	643,300	616,079	(27,221)	-4.2%
W76 Life Extension Program	259,168	234,168	244,019	222,880	(21,139)	-8.7%
W78/88-1 Life Extension Program	0	0	0	0	0	0.0%
W88 Alt 370	165,400	204,400	220,176	281,129	60,953	27.7%
Cruise Missile Warhead Life Extension Study	9,418	10,360	0	0	0	0.0%
W80-4 Life Extension Program	0	0	195,037	220,253	25,216	12.9%
Total, Life Extension Programs and Major Alterations	1,076,986	1,093,348	1,302,532	1,340,341	37,809	2.9%

The Life Extension Programs (LEPs) and Major Alterations program extends the lifetime of the nation's nuclear stockpile and enables the nuclear security enterprise to respond to 21st century threats without developing new weapon systems. The NNSA LEPs ensure the stockpile remains safe, secure, and effective. The LEP program repairs/replaces components of nuclear weapons to ensure the ability to meet military requirements and to extend the lifetime of a weapon for an additional 20 to 30 years. By extending the "life," or time that a weapon can safely and reliably remain in the stockpile without having to be replaced or removed, NNSA is able to maintain a credible nuclear deterrent without producing new weapons or conducting new underground nuclear tests.

NNSA must develop individual LEPs by using science-based research for each weapon type and develop specific solutions to extend the lifetime of each particular weapon because each is unique. Over time, the components of nuclear warheads deteriorate, even when kept in storage. LEPs will address known aging issues in weapon systems, and each LEP will study the options for increasing the safety, security and reliability of weapons on a case-by-case basis. The current planning scenario envisions that the useful lifetimes of the W76, B61, W78 and the W88 will have been extended through major LEP efforts by 2031.

Issues

Underlying the LEP planning process, NNSA remains committed to supporting the President's nuclear agenda as articulated in the 2010 Nuclear Posture Review. LEP activities will support the President's goal to reduce both the number of warhead types and the stockpile size by formulating options for interoperable (i.e., common or adaptable) warheads that could be flexibly deployed across different delivery platforms. Additionally, a well-planned and well-executed stockpile life extension strategy will result in improved safety and security while also enabling the Department of Defense to build a deployment and hedge strategy to establish a smaller, yet still effective, deterrent.

Status

The FY17 Budget Request includes $1.3 billion for LEPs and major alterations that implement the Nuclear Weapons Council-approved "3+2" strategy to consolidate the stockpile to three ballistic missile warheads and two air-delivered systems, reducing the number of weapons in the deployed stockpile and simplifying maintenance requirements. Both House and Senate FY17 Energy and Water Appropriations Bills fully fund the $1.3 billion request.

Mixed Oxide (MOX) Fuel Fabrication Facility, Savannah River Site (SRS)

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request $	Change FY 2017 Request %
Nonproliferation Construction						
Mixed Oxide (MOX) Fuel Fabrication Facility, Savannah River Site (SRS)	345,000	345,000	340,000	270,000	(70,000)	-20.6%

The Plutonium Management and Disposition Agreement (PMDA) calls for the U.S. and Russia to each dispose of 34 metric tons (MT) of excess weapon---grade plutonium by irradiating it as mixed oxide fuel (MOX), or by any other method that may be agreed by the Parties in writing. Since the 1997 decision to pursue the MOX pathway, the situation has evolved in significant ways:

- Nonproliferation policy has been increasingly focused on potential threats from non-state actors, which increases the urgency for timely disposition and potentially offers greater flexibility in the final form of the material to prevent future use;
- Cost of the MOX approach has increased dramatically compared to early estimates;
- A disposition alternative previously not available has been successfully demonstrated in support of the closure of Rocky Flats and other projects—down blending or dilution of PuO_2 with adulterating material and disposal in the Waste Isolation Pilot Plant (WIPP).

Issues

The Consolidated and Further Continuing Appropriations Act, 2015, directed construction on the MOX project continue and that cost studies and technology alternative studies be conducted. The National Defense Authorization Act for FY 2015 mandated an independent assessment and validation of the 2014 Plutonium Working Group (PWG) analysis. Analyses conducted by Aerospace Corporation, a federally funded research and development center (FFRDC), and a Secretary of Energy assembled Red Team confirmed that the MOX fuel approach will be significantly more expensive than anticipated and will require approximately $800 million to $1 billion annually for decades.

The State of South Carolina sued DOE to enforce provisions of previous National Defense Authorization Acts that require DOE to begin removing plutonium intended for MOX or pay fines to the State of South Carolina of up to $100 million per year.

Status

The FY17 Budget Request proposes that the MOX approach to plutonium disposition be terminated and adoption of the dilute and dispose (D&D) option. In FY17, the MFFF project would be terminated and DOE would complete pre-conceptual design and begin conceptual design for the D&D option.

The House FY17 Energy and Water Appropriations Bill provides $340 million for the MFFF, the same as the FY 2016 enacted level. The House Report 114-432 accompanying the FY17 Energy and Water Appropriations Bill includes $5 million, the same as in FY16, to continue development of conceptual plans of the MOX Alternative and to support independent reviews. The House Report 114-432 prohibits funds from being used to dilute plutonium that could otherwise be used for MOX feedstock or to meet U.S. commitments under the PMDA. The Senate FY17 Energy and Water Appropriations Bill provides the requested $270 million.

Management and Performance

Environmental Management

The mission of the Environmental Management (EM) program is to complete the safe cleanup of the environment from decades of nuclear weapons development and government-sponsored nuclear energy research. The EM program is responsible for the cleanup of millions of gallons of liquid radioactive waste, thousands of tons of spent (used) nuclear fuel and special nuclear material, disposition of large volumes of transuranic and mixed/low-level waste, huge quantities of contaminated soil and water, and deactivation and decommissioning of thousands of excess facilities. This environmental cleanup program results from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research. EM has completed cleanup activities at 91 sites in 30 states and in the Commonwealth of Puerto Rico; EM is responsible for the remaining cleanup at 16 sites in 11 states.

The FY17 Budget Request includes $6.127 billion for EM. The FY17 request proposed funding through discretionary appropriations; mandatory funding from the $5.4 billion United States Enrichment Corporation (USEC) Fund for deactivating, decommissioning, and demolition of the excess gaseous diffusion plants at Oak Ridge, Tennessee, Paducah, Kentucky, and Portsmouth, Ohio, and for the Title X Uranium/Thorium Reimbursement Program; and continued transfers of excess material assets, including uranium, to allow for environmental remediation and decontamination and decommissioning activities at the gaseous diffusion facilities at the Portsmouth Site.

The House FY17 Energy and Water Appropriations Bill provides $6.152 billion in discretionary appropriations, $25 million above the request. The Senate FY17 Energy and Water Appropriations Bill provides $6.352 billion in discretionary appropriations, $224 million above the request.

More detailed information is provided below for the Waste Treatment and Immobilization Plant (WTP) in Hanford, Washington, the Waste Isolation Pilot Plant (WIPP) in Carlsbad, New Mexico, the Integrated Waste Treatment Unit (IWTU) at the Idaho Site, and the Portsmouth Site in Piketon, Ohio.

Waste Treatment and Immobilization Plant (WTP), Hanford, Washington

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request $	Change FY 2017 Request %
Office of River Protection						
Waste Treatment and Immobilization Plant (WTP)	690,000	690,000	690,000	693,000	3,000	0.4%

From 1943 to 1987, the Hanford Site in southeastern Washington State produced plutonium for nuclear weapons used during World War II and stockpiled during the Cold War. This effort resulted in the production of 56 million gallons of radioactive and chemical wastes, which are currently stored in 177 aging underground tanks. The Waste Treatment and Immobilization Plant (WTP) is a massive, complex first-of-a-kind plant that will be the cornerstone to completing the cleanup of this tank waste at Hanford. As planned, the WTP will include five facilities: (1) Analytical Laboratory; (2) Balance of Facilities; (3) Low-Activity Waste (LAW) Facility; (4) High-Level Waste Facility; and (5) Pretreatment Facility. Construction of additional facilities to support the operation of these five facilities is also planned. The plant is being designed to process tank farm waste over roughly 40 years.

Issue

The original plan required waste to be processed through the Pretreatment Facility, where it would be separated into a low-activity waste stream to be vitrified in the LAW Facility and a high-level waste stream to be vitrified in the High-Level Waste Facility. The Analytical Laboratory and Balance of Facilities support these vitrification activities. Since significant technical issues must be resolved for the retreatment and, to a lesser degree, for the High-Level Waste Facilities, DOE is pursuing the construction of the LAW Facility, Balance of Facilities and Analytical Laboratory and the work necessary to feed low-activity waste directly to the Low-Activity Waste Facility instead of routing it through the Pretreatment Facility (an approach called Direct Feed Low Activity Waste (DFLAW)). DOE is also continuing with those activities necessary to resolve the technical issues associated with the Pretreatment and High-Level Waste facilities.

EM currently faces court ordered milestones to complete commissioning of the WTP LAW Facility by December 31, 2023; and to have WTP fully operational by 2036.

Status

The FY17 Budget Request of $693 million supports analysis and preliminary design of a LAW Pretreatment System Facility that allows DOE to address the most mobile tank waste (liquid) in the near term while in parallel working to resolve the technical and design issues associated with the High-Level Waste and Pretreatment Facilities.

The House and Senate FY17 Energy and Water Appropriations Bills fund the requested $693 million.

Waste Isolation Pilot Plant (WIPP), Carlsbad, New Mexico

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request[1]	Change FY 2017 Request $	Change FY 2017 Request %
Waste Isolation Pilot Plant						
Waste Isolation Pilot Plant	320,000	320,000	299,978	270,653	(29,325)	-9.8%

[1]The FY 2017 Budget Request was amended on April 5, 2016 to increase the request from $262.253 million to $270.653, an increase of $8.4 million, to fund a portion of settlement costs with the State of New Mexico related to the February 2014 incidents at WIPP.

The DOE Waste Isolation Pilot Plant (WIPP) site located in southeast New Mexico about 26 miles from Carlsbad is a deep geologic repository for permanent disposal of a specific type of waste that is the byproduct of the nation's nuclear defense program. The underground repository is carved out of a 2,000-foot-thick salt bed formed 250 million years ago. WIPP is the nation's only repository for the disposal of nuclear waste known as transuranic, or TRU, waste. It consists of clothing, tools, rags, residues, debris, soil and other items contaminated with small amounts of plutonium and other man-made radioactive elements. TRU waste is long-lived and has to be isolated to protect public health and the environment.

Issue

In February 2014 two incidents occurred at WIPP that led to the current shutdown of the facility. On February 5, 2014, WIPP suffered an underground fire in a salt hauler vehicle. Workers were evacuated and the underground portion of WIPP was shut down. On February 14, 2014, a radiation leak was detected below ground in WIPP's south mine. A chemical reaction caused a release from a waste drum and trace amounts of americium and plutonium were detected about a half-mile outside of the facility.

After contamination was discovered, site access was restricted to essential personnel, and WIPP has remained closed without accepting any shipments since the radiation leak.

Status

The FY17 Budget Request includes $270.7 million to maintain progress toward resuming waste emplacement at WIPP by the end of 2016 as long as it is safe to do so. This includes funding to resume waste emplacement operations such as continued implementation of corrective actions, safety management program improvements, and completion of Operational Readiness Reviews; commence waste emplacement operations and other activities such as mine stabilization, mining, mine habitability activities in all underground areas, continued decontamination of contaminated areas, and upgrades; and support for completion of repairs of New Mexico Roads used for the transportation of DOE shipments of transuranic waste to WIPP. The budget supports the Central Characterization Project and maintains shipping capability between the generator sites and WIPP as well as funding to continue progress in design of a new permanent ventilation system that is needed to support normal operations.

The House FY17 Energy and Water Appropriations Bill provides $292.7 million for WIPP, $22 million above the request. The Senate FY17 Energy and Water Appropriations Bill provides $274.5 million, $3.8 million above the request. Both House and Senate bills include $26.8 million for economic assistance to the State of New Mexico.

Integrated Waste Treatment Unit (IWTU), Idaho Site, Idaho

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Idaho National Laboratory						
Idaho Cleanup and Waste Disposition	377,293	377,293	393,000	359,088	(33,912)	-8.6%

The Idaho Cleanup Project is responsible for treatment, storage, and disposition of a variety of radioactive and hazardous waste streams, including removal and disposition of targeted buried waste sitting above the Snake River Plain Aquifer. The project is also responsible for removing or deactivating unneeded facilities, and removing DOE inventory of spent (used) nuclear fuel and high-level waste from Idaho.

Issue

In May 2016, DOE for the third time in four years, delayed the start-date for treating almost 1 million gallons of liquid waste at its Idaho site. DOE notified the State of Idaho that it was unlikely to meet the September 30 regulatory deadline for initiation of waste treatment of the sodium-bearing waste at the Integrated Waste Treatment Unit (IWTU) at the Idaho National Laboratory Site. Per the 1992 consent order between DOE and the state, IWTU was supposed to come online in 2012. IWTU is designed to treat 900,000 gallons of liquid radioactive waste now stored in underground tanks. The facility was complete in 2012, but during test runs with non-radioactive simulant liquid, has experienced technical issues. DOE currently has no firm start-date for the facility.

Status

The FY 2017 Budget Request provides $359.1 million to support key requirements to continue progress in meeting the Idaho Settlement Agreement commitments. These include supporting operations of the Advanced Mixed Waste Treatment Facility to process transuranic and mixed low level wastes. The request will continue progress in retrieving targeted waste at the Subsurface Disposal Area under the Accelerated Retrieval Project. It will also continue activities for retrieval and treatment of sodium bearing waste from the four remaining tanks and continue progress towards closure of the tank farm and management of spent nuclear fuel, including retrieval of fuel from wet storage to dry storage.

The House FY17 Energy and Water Appropriations Bill provides $379.1 million for the Idaho Cleanup and Waste Disposition, $20 million above the request, to support commissioning and startup activities at the IWTU and to complete the Advanced Mixed Waste Treatment Infrastructure Reliability Project ensuring equipment availability to support transuranic waste commitments. The Senate FY17 Energy and Water Appropriations Bill provides the requested $359.1 million.

Portsmouth Site (Uranium Barter), Piketon, Ohio

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Portsmouth						
Uranium Enrichment Decontamination and Decommissioning Fund (UED&D)[1]						
Portsmouth, Decontamination and Decommissioning (D&D)[2]	209,524	209,524	203,417	214,682	11,265	5.5%
Construction, On-site Waste Disposal Facility	4,500	4,500	21,749	41,168	19,419	89.3%
Pension and Community and Regulatory Support	1,795	1,795	1,795	1,795	0	0.0%
Subtotal, UED&D	215,819	215,819	226,961	257,645	30,684	13.5%
Non-Defense Environmental Cleanup						
NM Stabilization and Disposition-Depleted (DUF6) Uranium Hexafluoride Conversion	51,517	49,517	51,517	50,959	(558)	-1.1%
Defense Environmental Cleanup						
Safeguards and Security	8,492	8,492	10,492	14,049	3,557	33.9%
Total, Portsmouth	275,828	273,828	288,970	322,653	33,683	11.7%

[1]New Department of Energy Mandatory Funding.

[2]The Request for Portsmouth is supplemented by continuing transfers of uranium for cleanup services at the Portsmouth Gaseous Diffusion Plant.

The Portsmouth Gaseous Diffusion Plant located in the Ohio Valley was originally built to enrich uranium for nuclear weapons. In the 1960s the mission was changed to produce fuel for commercial nuclear power plants and other national security applications. The extensive environmental cleanup program began at the 3,777-acre federal plant site in 1989 as a result of a Consent Decree signed between DOE and the state of Ohio and an Administrative Consent Order with DOE and the U.S. Environmental Protection Agency.

<u>Issue</u>

Funding of deactivation and decommissioning (D&D) at the Portsmouth site is comprised of discretionary appropriations and continued transfers of excess material assets, including uranium. The annual amount of uranium transfers is determined by the Secretary of Energy, and actual value of the material is based on the final amount transferred and the market value at the time of the transfer. Over the next two to three years, uranium prices are expected to remain depressed. Since funding of this project relies on the uranium transfers, or barter, between the contractor and the DOE, the drop in uranium prices has put the project in a challenging situation. If barter proceeds decrease significantly it could result in adjustments to D&D work if additional discretionary appropriations are not provided. A reduction in D&D work would result in layoffs at the site that would have a significant negative impact on the local community.

Status

The FY17 Budget Request includes $322.7 million, including $257.6 million in proposed mandatory funding, to support the Portsmouth D&D project for D&D of gaseous diffusion plant ancillary facilities and systems, disposal of waste, small equipment removal, utility optimizations, and hazardous material abatement. The request also includes funding for design and construction of an onsite landfill for the disposal of waste, which is expected to be generated from the demolition of the Portsmouth Gaseous Diffusion Plant and associated facilities. In addition, the request provides $51 million in the Non-Defense Environmental Cleanup appropriation, to continue safe operation of the DUF6 Conversion facility that converts depleted uranium hexafluoride into a more stable depleted uranium oxide form suitable for reuse or disposition.

The House FY17 Energy and Water Appropriations Bill provides $339.5 million for the Portsmouth Site, $16.8 million above the request, including $274.5 million for the UED&D appropriation. The Senate FY17 Energy and Water Appropriations Bill provides $331.4 million, $8.7 million above the request, including $266.4 million for the UED&D appropriation.

Department-wide Challenges

Cybersecurity

($K)

Issue	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
					$	%
Information Technology						
Cybersecurity Crosscut						
Cybersecurity	311,098	310,006	323,941	333,479	9,538	2.9%
Departmental Administration						
Chief Information Officer (CIO)	74,164	74,164	73,218	93,074	19,856	27.1%
Cybersecurity [1]	*21,364*	*21,006*	*26,524*	*20,026*	*(6,498)*	*-24.5%*
Total, Information Technology	385,262	384,170	397,159	426,553	29,394	7.4%

[1] A portion of the Cybersecurity Crosscut is funded out of the Departmental Administration Congressional Control Point.

The DOE Chief Information Officer (CIO) funds cybersecurity and corporate IT program support and leads enterprise-wide cyber coordination and IT investment and planning. DOE is engaged in two categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely impact mission capabilities and improving cybersecurity in the electric power subsector and the oil and natural gas subsector.

Issue

DOE continues to build and modernize the IT infrastructure in support of DOE's mission needs and strengthen cybersecurity across the enterprise to protect DOE from a range of cyber threats and improve cybersecurity in the electric power and oil and natural gas subsectors.

Status

The $93 million FY 2017 CIO Budget Request supports several critical IT improvements to modernize and further secure DOE IT infrastructure, including core networking layers, data centers, and access technologies. The request also includes $333.5 million to further strengthen cybersecurity including

$45.5 million for cybersecurity for energy delivery systems, $20 million to protect DOE from a range of cyber threats, and $146.6 million for cybersecurity solutions to meet increased proliferation-resistance and security.

The House FY17 Energy and Water Appropriations Bill provides $73.2 million for the CIO to support critical IT projects and infrastructure. The House Report 114-532 accompanying the House FY17 Energy and Water Appropriations Bill recommends not less than $21 million of the $73.2 million be used for Cybersecurity and to secure information. The Senate FY17 Energy and Water Appropriations Bill provides CIO funding in a new congressional control point line, "Other Departmental Administration". The Senate does not specify how funding is split among the Departmental Administration offices and funds the line $23 million below the combined request for these offices.

Infrastructure (Maintenance Backlog and Excess Facilities)

FY 2017 Investments in General Plant Projects (GPP) for General Purpose Infrastructure

($M)

Issue	FY 2016 Enacted	FY 2017 Request	Change FY 2017 Request	
			$	%
General Purpose Infrastructure				
Nuclear Energy	2.4	0	(2.4)	-100.0%
Fossil Energy	15.8	24.2	8.4	53.2%
Office of Science	40.5	44.6	4.1	10.1%
National Nuclear Security Administration (NNSA)	220.7	307.3	86.6	39.2%
Environmental Management	26.9	41.9	15.0	55.8%
Total, General Purpose Infrastructure	306.3	418.0	111.7	36.5%

Managing DOE infrastructure is critical to DOE operations. Supporting infrastructure, including office space, general laboratory spaces, maintenance shops, and utilities, forms the backbone of laboratory and production plant sites. In addition to an aging infrastructure, excess contaminated facilities are a drain on infrastructure resources, and can pose a risk to safety, security, and programmatic objectives.

<u>Issue</u>

DOE is responsible for a portfolio of world-leading scientific and production assets as well as the general purpose infrastructure that supports those assets. While DOE has made significant investments in its world class mission facilities, much of the supporting infrastructure is aging and is in need of greater attention. Based on Department-wide facility assessments and data analyses, DOE is facing a systemic challenge of degrading infrastructure due to the age of the complex – which dates back to the Manhattan project – and increasing levels of deferred maintenance.
DOE adopted a policy to halt further increases in the backlog of deferred maintenance across the complex; compiled the first uniform assessment of general purpose infrastructure at all National Laboratories and NNSA plants; and formed a working group to assess and prioritize the disposition of excess facilities.

Contaminated excess facilities and properties are typically transferred to the Office of Environmental Management (EM). EM cannot accept additional excess contaminated facilities because of budget constraints and competing regulatory and compliance obligations. In 2015, reports from the DOE Inspector General (IG) and the Government Accountability Office (GAO) raised concerns with management of high-risk excess facilities, particularly those awaiting transfer to EM. The reports described increasing levels of risk due to delays in cleanup and disposition of contaminated excess facilities and indicated that current funding levels for excess facilities are insufficient to address the highest priority and highest risk excess facilities.

Status

The FY17 Budget Request supports safe and reliable world class facilities by investing in new and existing infrastructure. The FY17 request proposes $400 million for general purpose infrastructure modernization, an increase of 36% from FY16. This request will allow DOE to continue infrastructure modernization and address deferred maintenance backlog.

Fossil Energy

The House FY17 Energy and Water Appropriations Bill recommends $53.141 million for National Energy Technology Laboratory (NETL) Infrastructure, $11 million below the request, and the Senate FY17 Energy and Water Appropriations Bill provides $52.055 million, $12.086 below the request (the General Purpose Infrastructure is part of the NETL Infrastructure). The Senate Report 114-236 directs DOE to prioritize NETL infrastructure funds to provide site-wide upgrades for safety and avoid an increase in deferred maintenance.

Science

The House Report 114-532 recommends $122.397 million for Science Laboratories Infrastructure, $7.603 million below the request. In addition, the House Report recommends $63.451 million for Science Laboratories Infrastructure construction. The Senate Report 114-236 recommends $130 million for Science Laboratories Infrastructure as requested. Within these funds, the Committee recommends $26 million for nuclear operations at Oak Ridge National Laboratory.

National Nuclear Security Administration (NNSA)

The House FY17 Energy and Water Appropriations Bill provides $313.309 million for Infrastructure and Safety which when combined with $235.4 million for Facility Disposition (a new reprogramming control point to eliminate excess facilities through demolition, transfer, or sale) is $5.9 million below the request.

The Senate FY17 Energy and Water Appropriations Bill provides the requested $554.643 million, including $200 million for the transfer of the Bannister Road Complex (not included in the chart above). Senate Report 114-236 accompanying the Senate FY17 Energy and Water Appropriations Bill supports the NNSA proposal to turn over the Bannister Road Complex to a private entity, consistent with section 3143 of the FY14 National Defense Authorization Act.

Environmental Management

The House FY17 Energy and Water Appropriations Bill did not provide additional funds for Infrastructure Recapitalization at EM sites. The Senate FY17 Energy and Water Appropriations Bill provides $41.9 million for Infrastructure Recapitalization at the EM Richland and Office of River Protection in Hanford, Washington; the Savannah River Site, Aiken, South Carolina; and the Waste Isolation Pilot Plan in Carlsbad, New Mexico, as requested.

Funding by Organization

	($K)					
	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request[1]	FY 2017 vs. FY 2016 $	%
Department of Energy Budget by Organization						
National Nuclear Security Administration						
Weapons Activities	8,180,359	8,180,609	8,846,948	9,243,147	+396,199	+4.5%
Defense Nuclear Nonproliferation	1,615,248	1,612,651	1,940,302	1,807,916	-132,386	-6.8%
Naval Reactors	1,233,840	1,233,840	1,375,496	1,420,120	+44,624	+3.2%
Federal Salaries and Expenses	369,587	369,587	363,766	412,817	+49,051	+13.5%
Total, National Nuclear Security Administration	**11,399,034**	**11,396,687**	**12,526,512**	**12,884,000**	**+357,488**	**+2.9%**
Science and Energy						
Science	**5,067,738**	**5,132,813**	**5,347,000**	**5,672,069**	**+325,069**	**+6.1%**
Energy						
Energy Efficiency and Renewable Energy	1,914,195	1,840,847	2,069,194	2,898,400	+829,206	+40.1%
Electricity Delivery and Energy Reliability	146,975	143,901	206,000	262,300	+56,300	+27.3%
Fossil Energy	791,117	783,829	869,100	878,450	+9,350	+1.1%
Use of Prior Year Balances	0	0	0	-240,000	-240,000	N/A
Nuclear Energy	833,379	821,883	986,161	993,896	+7,735	+0.8%
Office of Indian Energy Policy and Programs	16,000	16,000	16,000	22,930	+6,930	+43.3%
Office of Technology Transitions	0	0	0	8,400	+8,400	N/A
21st Century Clean Transportation Plan Investments	0	0	0	1,335,000	+1,335,000	N/A
Total, Energy	**3,701,666**	**3,606,460**	**4,146,455**	**6,159,376**	**+2,012,921**	**+48.5%**
Total, Science and Energy	**8,769,404**	**8,739,273**	**9,493,455**	**11,831,445**	**+2,337,990**	**+24.6%**
Advanced Research Projects Agency - Energy (ARPA-E)	**279,982**	**279,982**	**291,000**	**500,000**	**+209,000**	**+71.8%**
Energy Information Administration	**117,000**	**117,000**	**122,000**	**131,125**	**+9,125**	**+7.5%**
Credit Programs						
Title 17 - Innovative Technology Loan Guarantee Program	17,000	17,000	17,000	10,000	-7,000	-41.2%
Advanced Technology Vehicles Manufacturing Loan	4,000	4,000	6,000	5,000	-1,000	-16.7%
Total, Credit Programs	**21,000**	**21,000**	**23,000**	**15,000**	**-8,000**	**-34.8%**
Management and Performance						
Environmental Management	5,861,017	5,860,585	6,218,491	6,119,099	-99,392	-1.6%
Office of Legacy Management	171,811	171,811	167,180	154,320	-12,860	-7.7%
Environment, Health, Safety and Security Mission Support	180,911	182,911	180,998	197,212	+16,214	+9.0%
Chief Information Officer	71,959	71,959	73,218	93,074	+19,856	+27.1%
Management	62,946	62,946	65,000	59,114	-5,886	-9.1%
Project Management Oversight and Assessments	0	0	0	18,000	+18,000	N/A
Chief Human Capital Officer	24,500	24,500	24,500	25,424	+924	+3.8%
Hearings and Appeals	5,242	5,242	5,500	5,919	+419	+7.6%
Office of the Energy Jobs Development	0	0	0	3,700	+3,700	N/A
Economic Impact and Diversity	9,000	8,800	10,000	11,319	+1,319	+13.2%
Total, Management and Performance	**6,387,386**	**6,388,754**	**6,744,887**	**6,687,181**	**-57,706**	**-0.9%**
Corporate Management						
Office of the Secretary	5,008	5,008	5,008	5,300	+292	+5.8%
Cost Estimating and Program Evaluation	0	0	0	5,000	+5,000	N/A
Strategic Partnership Projects and Revenues	-928	-928	-6,800	-20,300	-13,500	-198.5%
Other Revenues	-77,171	-77,171	-77,171	-85,171	-8,000	-10.4%
Chief Financial Officer	47,000	47,000	47,024	53,084	+6,060	+12.9%
Congressional and Intergovernmental Affairs	4,700	4,246	6,300	6,200	-100	-1.6%
Public Affairs	3,431	3,231	3,431	3,431	0	0
General Counsel	31,000	30,554	31,000	33,000	+2,000	+6.5%
International Affairs	13,000	24,943	18,000	19,107	+1,107	+6.2%
Energy Policy and Systems Analysis	31,181	31,181	31,297	31,000	-297	-0.9%
Office of Small and Disadvantaged Business Utilization	2,253	2,253	3,000	3,300	+300	+10.0%
Total, Corporate Management	**59,474**	**70,317**	**61,089**	**53,951**	**-7,138**	**-11.7%**
Specialized Security Activities	**203,115**	**203,115**	**230,377**	**237,912**	**+7,535**	**+3.3%**
Office of Enterprise Assessments	**73,534**	**71,534**	**73,534**	**76,473**	**+2,939**	**+4.0%**
Office of the Inspector General	**40,500**	**40,500**	**46,424**	**44,424**	**-2,000**	**-4.3%**
Power Marketing Administrations	**80,368**	**80,368**	**82,000**	**83,870**	**+1,870**	**+2.3%**
Federal Energy Regulatory Commission	**-28,485**	**-17,325**	**-23,587**	**-9,426**	**+14,161**	**+60.0%**
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	**0**	**0**	**-68,000**	**-37,000**	**+31,000**	**+45.6%**
Total, Funding by Organization	**27,402,312**	**27,391,205**	**29,602,691**	**32,498,955**	**+2,896,264**	**+9.8%**

[1] FY 2017 Request includes mandatory spending: $1.335B for Clean Transportation Plan, $674M for UED&D Fund, $150M for ARPA-E, and $100M for Science.

Funding by Appropriation

	($K)					
	FY 2015 Enacted	FY 2015 Current	FY 2016 Enacted	FY 2017 Request[1]	FY 2017 vs. FY 2016 $	FY 2017 vs. FY 2016 %
Department of Energy Budget by Appropriation						
Energy and Water Development, and Related Agencies						
Energy Programs						
Energy Efficiency and Renewable Energy	1,914,195	1,840,847	2,069,194	2,898,400	+829,206	+40.1%
Electricity Delivery and Energy Reliability	146,975	143,901	206,000	262,300	+56,300	+27.3%
Nuclear Energy	833,379	821,883	986,161	993,896	+7,735	+0.8%
Office of Technology Transitions	0	0	0	8,400	+8,400	N/A
21st Century Clean Transportation Plan Investments	0	0	0	1,335,000	+1,335,000	N/A
Fossil Energy Programs						
Clean Coal Technology	-6,600	-2,876	0	0	0	N/A
Fossil Energy Research and Development	560,587	548,885	632,000	600,000	-32,000	-5.1%
Use of Prior Year Balances	0	0	0	-240,000	0	N/A
Naval Petroleum and Oil Shale Reserves	19,950	20,640	17,500	14,950	-2,550	-14.6%
Elk Hills School Lands Fund	15,580	15,580	0	0	0	N/A
Strategic Petroleum Reserve	200,000	200,000	212,000	257,000	+45,000	+21.2%
Northeast Home Heating Oil Reserve	1,600	1,600	7,600	6,500	-1,100	-14.5%
Total, Fossil Energy Programs	**791,117**	**783,829**	**869,100**	**638,450**	**-230,650**	**-26.5%**
Uranium Enrichment Decontamination and Decommissioning (UED&D) Fund	625,000	625,000	673,749	673,749	0	0
Energy Information Administration	117,000	117,000	122,000	131,125	+9,125	+7.5%
Non-Defense Environmental Cleanup	246,000	246,030	255,000	218,400	-36,600	-14.4%
Science	5,067,738	5,132,813	5,347,000	5,672,069	+325,069	+6.1%
Advanced Research Projects Agency - Energy (ARPA-E)	279,982	279,982	291,000	500,000	+209,000	+71.8%
Departmental Administration	125,043	135,686	130,971	144,866	+13,895	+10.6%
Office of Indian Energy	0	0	0	22,930	+22,930	N/A
Office of the Inspector General	40,500	40,500	46,424	44,424	-2,000	-4.3%
Title 17 - Innovative Technology Loan Guarantee Program	17,000	17,000	17,000	10,000	-7,000	-41.2%
Advanced Technology Vehicles Manufacturing Loan Program	4,000	4,000	6,000	5,000	-1,000	-16.7%
Total, Energy Programs	**10,207,929**	**10,188,471**	**11,019,599**	**13,559,009**	**+2,539,410**	**+23.0%**
Atomic Energy Defense Activities						
National Nuclear Security Administration						
Weapons Activities	8,180,359	8,180,609	8,846,948	9,243,147	+396,199	+4.5%
Defense Nuclear Nonproliferation	1,615,248	1,612,651	1,940,302	1,807,916	-132,386	-6.8%
Naval Reactors	1,233,840	1,233,840	1,375,496	1,420,120	+44,624	+3.2%
Office of the Administrator	-413	-413	0	0	0	N/A
Federal Salaries and Expenses	370,000	370,000	363,766	412,817	+49,051	+13.5%
Total, National Nuclear Security Administration	**11,399,034**	**11,396,687**	**12,526,512**	**12,884,000**	**+357,488**	**+2.9%**
Environmental and Other Defense Activities						
Defense Environmental Cleanup	4,990,017	4,989,555	5,289,742	5,226,950	-62,792	-1.2%
Other Defense Activities	753,449	753,449	776,425	791,552	+15,127	+1.9%
Total, Environmental and Other Defense Activities	**5,743,466**	**5,743,004**	**6,066,167**	**6,018,502**	**-47,665**	**-0.8%**
Total, Atomic Energy Defense Activities	**17,142,500**	**17,139,691**	**18,592,679**	**18,902,502**	**+309,823**	**+1.7%**
Power Marketing Administrations						
Southeastern Power Administration	0	0	0	0	0	N/A
Southwestern Power Administration	11,400	11,400	11,400	11,057	-343	-3.0%
Western Area Power Administration	91,740	91,740	93,372	95,581	+2,209	+2.4%
Falcon and Amistad Operating and Maintenance Fund	228	228	228	232	+4	+1.8%
Colorado River Basins Power Marketing Fund	-23,000	-23,000	-23,000	-23,000	0	0
Total, Power Marketing Administrations	**80,368**	**80,368**	**82,000**	**83,870**	**+1,870**	**+2.3%**
Federal Energy Regulatory Commission (FERC)	0	0	0	0	0	N/A
Subtotal, Energy and Water Development and Related Agencies	**27,430,797**	**27,408,530**	**29,694,278**	**32,545,381**	**+2,851,103**	**+9.6%**
Uranium Enrichment Decontamination and Decommissioning Fund Discretionary Payments	-463,000	-463,000	0	-155,100	-155,100	N/A
Uranium Enrichment Decontamination and Decommissioning Fund Contribution	463,000	463,000	0	155,100	+155,100	N/A
Excess Fees and Recoveries, FERC	-28,485	-17,325	-23,587	-9,426	+14,161	+60.0%
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	0	0	-68,000	-37,000	+31,000	+45.6%
Total, Funding by Appropriation	**27,402,312**	**27,391,205**	**29,602,691**	**32,498,955**	**+2,896,264**	**+9.8%**

[1] FY 2017 Request includes mandatory spending: $1.335B for Clean Transportation Plan, $674M for UED&D Fund, $150M for ARPA-E, and $100M for Science

Appropriation by State

($K)

State	FY 2015 Current	FY 2016 Enacted	FY 2017 Request
Alabama	$31,785	$26,871	$33,123
Alaska	$2,514	$3,366	$4,466
All Other (Foreign)	$300	$652	$0
American Samoa	$355	$372	$418
Arizona	$122,701	$109,966	$125,334
Arkansas	$16,755	$14,503	$13,150
California	$2,753,265	$2,821,402	$2,766,559
Colorado	$1,182,708	$1,232,247	$1,559,183
Connecticut	$28,255	$15,113	$14,177
Delaware	$6,421	$4,443	$4,691
District of Columbia	$3,672,065	$4,106,140	$5,017,315
Florida	$31,861	$19,896	$19,090
Georgia	$91,358	$78,248	$70,129
Guam	$365	$384	$431
Hawaii	$2,359	$2,038	$2,343
Idaho	$1,309,124	$1,401,808	$1,339,005
Illinois	$1,082,788	$1,318,848	$1,362,281
Indiana	$31,092	$21,171	$20,939
Iowa	$75,893	$86,463	$83,507
Kansas	$9,829	$6,754	$7,337
Kentucky	$291,188	$290,534	$295,661
Louisiana	$149,301	$159,106	$183,714
Maine	$2,945	$3,394	$3,444
Maryland	$77,058	$65,634	$65,887
Massachusetts	$132,602	$66,230	$53,208
Michigan	$147,396	$129,094	$129,398
Minnesota	$29,949	$36,447	$36,458
Mississippi	$3,335	$2,676	$2,897
Missouri	$704,655	$734,199	$872,958
Montana	$63,033	$60,829	$62,463
Nebraska	$27,628	$41,376	$41,785
Nevada	$548,987	$543,787	$566,383
New Hampshire	$7,471	$2,584	$2,208
New Jersey	$116,798	$88,540	$89,544
New Mexico	$4,670,313	$5,075,819	$4,892,061
New York	$1,209,880	$1,254,135	$1,258,695
North Carolina	$32,318	$20,389	$14,888
North Dakota	$64,426	$98,563	$97,534
Northern Mariana Islands	$355	$372	$844
Ohio	$402,435	$401,837	$415,335
Oklahoma	$41,648	$41,623	$35,535
Oregon	$9,390	$6,345	$5,041
Pennsylvania	$573,857	$542,827	$565,408
Puerto Rico	$1,268	$1,347	$850
Rhode Island	$6,999	$4,792	$5,769
South Carolina	$1,983,757	$2,049,516	$2,142,831
South Dakota	$52,817	$61,798	$62,856
Tennessee	$2,877,416	$2,927,966	$3,020,083
Texas	$669,358	$739,499	$797,907
Undesignated State	$502,557	$457,120	$652,963
Utah	$72,052	$70,828	$67,561
Vermont	$1,651	$1,476	$1,576
Virgin Islands	$383	$401	$447
Virginia	$189,316	$168,650	$174,141
Washington	$2,932,892	$3,098,230	$2,922,095
West Virginia	$412,644	$665,509	$919,401
Wisconsin	$59,988	$42,452	$41,955
Wyoming	$30,908	$19,653	$15,268
Total Department of Energy	$29,552,767	$31,246,262	$32,960,530

Department of Energy Appropriations by Laboratory – 2017

(dollars in thousands)

	FY 2015 Current	FY 2016 Enacted	FY 2017 Request
Ames Laboratory	$52,638	$49,836	$46,832
Argonne National Laboratory	$587,203	$599,856	$585,279
Brookhaven National Laboratory	$484,814	$482,292	$476,992
Fermi National Accelerator Laboratory	$373,928	$372,104	$394,639
Idaho National Laboratory	$1,105,586	$1,199,335	$1,099,903
Lawrence Berkeley National Laboratory	$651,466	$690,884	$643,876
Lawrence Livermore National Laboratory	$1,251,466	$1,255,933	$1,239,440
Los Alamos National Laboratory	$1,953,616	$2,201,726	$2,104,443
National Energy Technology Lab	$699,784	$850,002	$988,457
National Renewable Energy Laboratory	$306,551	$292,274	$325,743
Oak Ridge National Laboratory	$1,074,535	$1,087,990	$1,058,672
Pacific Northwest National Laboratory	$591,736	$591,720	$517,782
Princeton Plasma Physics Laboratory	$93,090	$74,969	$76,882
Sandia National Laboratories	$1,875,289	$1,898,607	$1,913,937
Savannah River Site	$1,373,612	$1,497,418	$1,655,451
SLAC National Accelerator Laboratory	$459,604	$546,264	$543,072
Thomas Jefferson National Accelerator Facility	$129,635	$120,937	$125,574
All remaining sites and field offices	$16,488,214	$17,434,115	$19,163,556
Total Department of Energy	$29,552,767	$31,246,262	$32,960,530

Department of Energy Laboratory Total Operating Budget – 2015

(dollars in thousands)

	FY 2015 Appropriation	FY 2015 Strategic Partnership Projects	FY 2015 Total Budget
Ames Laboratory	$52,638	$913	$53,551
Argonne National Laboratory	$587,203	$116,651	$703,854
Brookhaven National Laboratory	$484,814	$53,356	$538,170
Fermi National Accelerator Laboratory	$373,928	$927	$374,855
Idaho National Laboratory	$1,105,586	$186,381	$1,291,967
Lawrence Berkeley National Laboratory	$651,466	$106,439	$757,905
Lawrence Livermore National Laboratory	$1,251,466	$267,356	$1,518,822
Los Alamos National Laboratory	$1,953,616	$207,125	$2,160,741
National Energy Technology Lab	$699,784	$12,820	$712,604
National Renewable Energy Laboratory	$306,551	$37,579	$344,130
Oak Ridge National Laboratory	$1,074,535	$227,898	$1,302,433
Pacific Northwest National Laboratory	$591,736	$258,447	$850,183
Princeton Plasma Physics Laboratory	$93,090	$2,290	$95,380
Sandia National Laboratories	$1,875,289	$963,602	$2,838,891
Savannah River Site	$1,373,612	$30,520	$1,404,132
SLAC National Accelerator Laboratory	$459,604	$13,332	$472,936
Thomas Jefferson National Accelerator Facility	$129,635	$5,233	$134,868

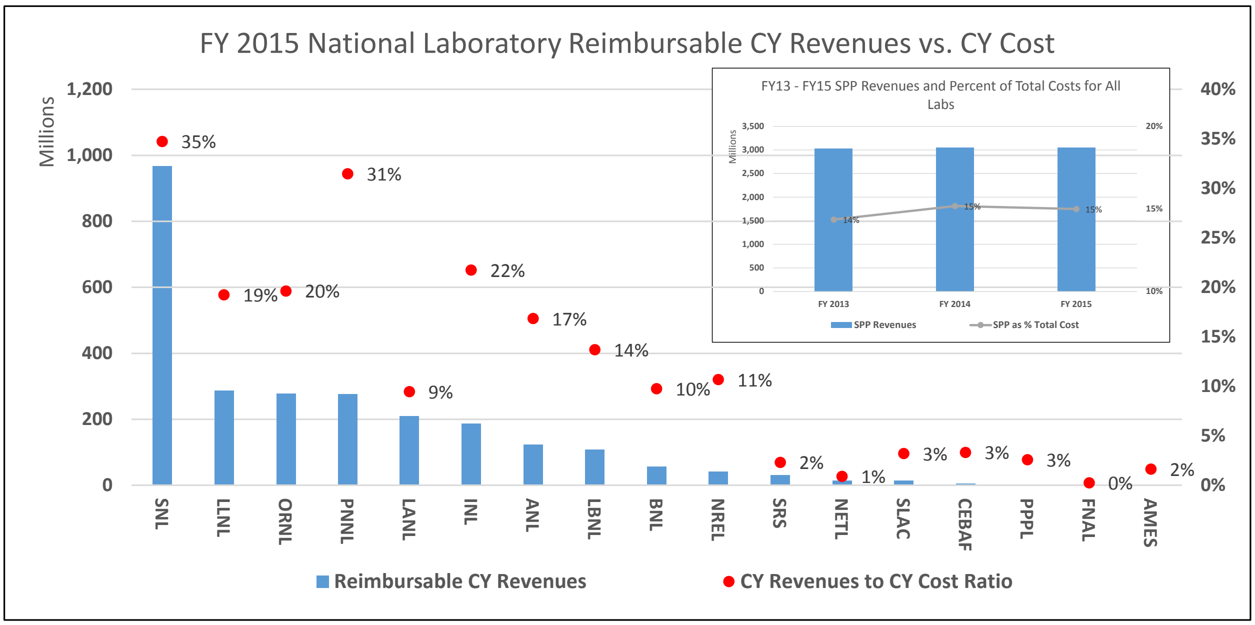
*Strategic Partnership Projects includes reimbursable work for federal and non-federal entities.

Strategic Partnership Projects (SPP) at DOE National Laboratories

Over the past decades, the 17 national laboratories have developed substantial capabilities in areas not directly tied with the DOE mission, such as homeland security, intelligence, space, and health. Many laboratories accept significant revenues from non-DOE entities, including DOD, DHS, NASA, NIH, intelligence agencies, other federal agencies, and to a smaller extent, state and local governments as well as foreign sources and the private and non-profit sectors.

Across the laboratories, this reimbursable work has grown to over $3 billion per year, or about 15% of total cost, although the amount and percentage of Strategic Partnership Projects (SPP) varies widely among laboratories as illustrated in the following chart. The chart shows the dollar amount of FY15 SPP revenues at each laboratory, as well as SPP as a percentage of total costs. The insert chart gives a composite picture of total SPP revenues from FY 2013 to FY 2015.

National Laboratory Reimbursable FY 2015 Revenues
(Percentages above columns are % of Total Costs*)



*Total costs are defined as all direct and allocable costs to projects, based on cost accounting standards, as implemented at each lab, and as reported to DOE.

DOE Organizations At A Glance

This section contains brief descriptions of the Department's offices and programs arranged alphabetically by reporting relationship to the Secretary and Deputy Secretary or by Under Secretary as shown below. There are more detailed descriptions of each program in the Organization Overviews book.

Secretary/Deputy Secretary:

- Advanced Research Projects Agency-Energy
- Chief Financial Officer
- Congressional and Intergovernmental Affairs
- Enterprise Assessments
- Energy Information Administration
- Energy Policy and Systems Analysis
- General Counsel
- Inspector General
- Intelligence and Counterintelligence
- International Affairs
- Loan Programs Office
- Ombudsman
- Power Marketing Administrations
- Public Affairs
- Small and Disadvantaged Business Utilization

Under Secretary for Science and Energy:

- Electricity Delivery and Energy Reliability
- Energy Efficiency and Renewable Energy
- Fossil Energy
- Indian Energy Policy and Programs
- Nuclear Energy
- Science
- Technology Transitions

National Nuclear Security Administration:

- Cost Estimating and Program Evaluation
- Defense Programs

- Defense Nuclear Nonproliferation
- Naval Reactors
- Emergency Operations
- Safety, Infrastructure and Operations
- Defense Nuclear Security
- Counterterrorism and Counterproliferation
- Acquisition and Project Management
- External Affairs
- General Counsel
- Information Management and Chief Information Officer
- Management and Budget

Under Secretary for Management and Performance:

- Chief Information Officer
- Economic Impact and Diversity
- Energy Jobs Development
- Environment, Safety, Health and Security
- Environmental Management
- Hearings and Appeals
- Human Capital Management
- Laboratory Operations Board
- Legacy Management
- Management
- Project Management Oversight and Assessments

Secretary and Deputy Secretary

Advanced Research Projects Agency-Energy (ARPA-E)

Authorized Federal Employees = 56
FY 2017 Budget Request = $500 Million
Headed By: Political Appointee /Senate Confirmed

ARPA-E was established to bring a dynamic and urgent focus to accelerating the development of innovative advanced energy technologies. Pursuant to its authorizing statute – The America COMPETES Act of 2007 – APRA-E accelerates transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty. In addressing this challenge, ARPA-E works in a complementary, non-duplicative fashion to DOE's basic and applied energy R&D programs and uses a modified version of the Defense Advanced Research Projects Agency's (DARPA) operational model.

ARPA-E strategically assesses opportunities for technical innovation on a continuing basis with close attention to DOE's strategic planning and on-going research and development (R&D) investments. The Agency maintains a dynamic R&D funding portfolio in which about one-third of its programs turn over every year, making it possible to quickly address new opportunities. Each R&D program area supports 10-15 projects, which are selected to provide a portfolio of different approaches with the potential to address the program's goals. Each project is actively managed by an ARPA-E Program Director and Tech-to-Market Advisor, with the goal of reducing the technical and commercial risks of the project. One key success metric is moving new technologies toward readiness for follow-on investment, including supporting DOE's commitment to Mission Innovation.

Chief Financial Officer

Authorized Federal Employees = 212
FY 2017 Budget Request = $53 Million
Headed By: Political Appointee /Senate Confirmed

The Office of the Chief Financial Officer (CFO) provides accounting and financial management services for DOE programs and activities; develops and oversees execution of the DOE budget; develops and maintains the financial management, procurement, human capital, and payroll systems; manages the DOE internal controls program; develops, implements, and monitors DOE-wide financial management policies; leads development of the DOE strategic plan and establishment of priority goals; and monitors progress in achieving goals and objectives.

The CFO and its field office counterparts (which are managed by program offices) operate under extensive Federal law and other Treasury, Office of Management and Budget, and General Accountability Office guidance, covering the full life cycle of budget formulation and financial execution transactions and reporting.

Congressional and Intergovernmental Affairs

Authorized Federal Employees = 33
FY 2017 Budget Request = $6.2 Million
Headed By: Political Appointee/Senate Confirmed

The Office of Congressional and Intergovernmental Affairs (CI) leads the Department's relations with members of Congress, governors of the 50 States and the U.S. Territories, and sovereign Tribal Nations.

CI works with the Secretary and senior Department officials to develop policy and outreach strategies, to explain and encourage support within the Congress and among governors for the Department's goals and missions. CI monitors legislation; articulates the Department's views to members and key committee staff; and supports the Secretarial Officers in their Congressional hearings and meetings. CI also manages ongoing, interactive communication with governors and Tribal leaders, and assures that their views and concerns are appropriately represented in the Department's policy and program deliberations.

Enterprise Assessments

Authorized Federal Employees = 92
FY 2017 Budget Request = $76.5 Million
Headed By: Career Employee

The Office of Enterprise Assessments (EA) is DOE's autonomous organization responsible for performance of assessments in the areas of nuclear and industrial safety; cyber and physical security; and other critical functions as directed by the Secretary, Deputy Secretary and their leadership team. The Office is responsible for implementing Congressionally-mandated enforcement functions in the areas of worker safety and health, nuclear safety, and security. EA is also responsible for incorporating the lessons learned from inspections, reviews, and assessments into safety and security training courses through its management of the National Training Center, and provides an open and effective means of communicating and creating collaborative relationships within and outside the Department through its stakeholder outreach program.

Energy Information Administration

Authorized Federal Employees = 375
FY 2017 Budget Request = $ 131 Million
Headed By: Political Appointee /Senate Confirmed

The Energy Information Administration (EIA) is the statistical agency of DOE. EIA is the Nation's premier source of unbiased energy data, analysis, and forecasting. EIA provides this information to promote sound policy making, efficient energy markets, and public understanding about energy and its interaction with the economy and the environment. By law, EIA's products are prepared independent of Administration policy considerations. EIA neither formulates nor advocates any policy proposals.

EIA conducts over 60 recurring surveys providing current data on a broad range of energy resources, reserves, production, consumption, and distribution, as well as related economic and statistical information. EIA issues a wide range of weekly, monthly, and annual reports on energy production, stocks, demand, imports, exports, and prices, and prepares analyses and special reports on topics of current interest. EIA's data and analyses are widely used by Federal and state agencies, Congress, industry, news media, consumers, and educators. EIA's products can be accessed through its website, which logs more than two million user sessions per month.

Energy Policy and Systems Analysis

Authorized Federal Employees = 70
FY 2017 Budget Request = $31 Million
Headed By: Political Appointee

The Office of Energy Policy and Systems Analysis (EPSA) serves as the focal point for energy policy within DOE. EPSA delivers independent, objective analysis on existing and prospective energy-related policies, focusing in part on providing integrative analysis of energy systems to the Department's leadership. As the primary energy policy advisor to the Secretary and Deputy Secretary, the Director of EPSA manages the development and implementation of domestic energy policy, as well as DOE policy analysis and activities, and coordinates with the Office of International Affairs on international energy policy.

EPSA develops and maintains a set of analytical capabilities and conducts independent, objective, strategic studies and policy analyses. By undertaking assessments of the strength and resiliency of anticipated challenges to domestic energy systems, EPSA identifies and prioritizes ways in which these systems can be strengthened to contribute to the economic well-being, environmental quality, and national security of the United States and North America.

General Counsel

Authorized Federal Employees = 145
FY 2017 Budget Request = $33 Million
Headed By: Political Appointee /Senate Confirmed

The Office of the General Counsel (GC) is responsible for providing comprehensive legal services to the Secretary, Deputy Secretary, and all Departmental elements (except for the Federal Energy Regulatory Commission), and effectively representing the Department as counsel before Federal, State, and other governmental agencies and courts (with the Department of Justice). These services are intended to advance the missions and objectives of the Department through advice, negotiation dispute resolution, rulemaking, legislation, and, when necessary, litigation. GC is organized so as to provide each Departmental element with "program counsel" specifically skilled in its unique issues. Separate elements of GC provide specialized legal expertise that affect many program offices, such as procurement, fiscal, regulatory, and environmental law issues. In addition, GC administers the Department's ethics program and is responsible for establishing property rights in and licensing of intellectual property owned by DOE; resolving claims of patent and copyright infringement; and granting of all patent waivers, which determine contractor ownership of new inventions.

Inspector General

Authorized Federal Employees = 279
FY 2017 Budget Request = $44.4 Million
Headed By: Political Appointee /Senate Confirmed

The *Inspector General Act of 1978*, as amended, established an independent statutory Inspector General (IG) at the DOE that is responsible for conducting independent and objective audits, investigations, and other reviews of Departmental programs and operations; promoting economy, efficiency, and effectiveness in the administration of Departmental programs; preventing and detecting fraud, waste, abuse, and mismanagement related to Departmental programs and operations; and informing the Secretary and Congress about problems and deficiencies in Department programs and operations and the need for corrective action. As an independent reviewer of the activities of the Department, the IG operates under its own strategic plan, goals, and measures.

Intelligence and Counterintelligence

Authorized Federal Employees = Classified
FY 2017 Budget Request = Classified
Headed By: Career Employee

The Office of Intelligence and Counterintelligence (IN) supports the national security mission of the Department and provides the Secretary, the Secretary's staff, and other DOE policy makers with timely, technical intelligence analysis on all aspects of foreign nuclear weapons, nuclear materials, and energy issues worldwide. IN helps protect the Department's assets from foreign infiltration. IN also informs U.S. national security policy by collecting and analyzing information in the fields of nuclear terrorism, counterintelligence, cyber threats, nuclear proliferation, and energy and environmental security.

International Affairs

Authorized Federal Employees = 72
FY 2017 Budget Request = $19 Million
Headed By: Political Appointee /Senate Confirmed

The Office of International Affairs (IA) performs a combination of strategy development, coordination, execution, and support functions for the international engagements of DOE. IA integrates the institutional capacity found across DOE's program elements and national laboratories – capacity in science, technology, markets, and policies – to pursue United States Government objectives on energy and national security issues. IA develops and manages DOE's energy engagements with other countries in close coordination with the Department of State and other U.S. Government agencies.

IA leads DOE's bilateral and multilateral energy science and technology cooperation activities and represents the Department in interagency processes and intergovernmental forums. IA supports cooperative efforts with other government agencies to address clean energy technology and climate change issues internationally, and advance clean energy technology development via research and policy.

Loan Programs Office

Authorized Federal Employees = 125
FY 2017 Budget Request = $42 Million
Headed By: Political Appointee

The Loan Programs Office (LPO) aims to accelerate the domestic commercial deployment of innovative clean energy technologies and advanced vehicle and component manufacturing to help achieve national energy objectives including reduced pollution, greater job creation, reduced dependency on foreign oil, improving America's environmental legacy, and enhancing American competitiveness in the global economy of the 21st century. LPO executes this mission by guaranteeing loans to eligible innovative clean energy projects through the innovative clean energy Title XVII loan guarantee program, and by providing direct loans to eligible manufacturers of advanced technology vehicles and components through the Advanced Technology Vehicles Manufacturing program.

Ombudsman

Authorized Federal Employees = 4
FY 2017 Budget Request = $1 Million
Headed By: Career Employee

The Office of the Ombudsman provides the federal workforce with a confidential, independent, informal, and neutral alterative to address any workplace issue. The Office of the Ombudsman engages on many complex and high profile issues, and has successfully worked with employees at all levels to help remedy difficult situations that can otherwise distract from achieving the Department's mission. The Office of the Ombudsman acts in accordance with the International Ombudsman Association's Code of Ethics and Standards of Practice, to the extent that the ethics and standards conform to federal agency rules and regulations, and other federally mandated requirements. These govern the way in which the office receives complaints, works to resolve issues, and assists with general improvement of the Department.

Power Marketing Administrations

Authorized Federal Employees = 4,807
FY 2017 Budget Request = $112.9M
Appropriated (Total Budget = $5.7B)
Headed By: Career Employees at all PMAs

The Power Marketing Administrations (PMAs) are agencies within DOE whose primary mission is to market the electrical power produced at Federal dams. No PMA employees are political appointees. The PMA Administrators, as well as all other PMA employees (excluding contractors) are career Federal employees.

There are four PMAs – Bonneville Power Administration (BPA), Southeastern Power Administration (SEPA), Southwestern Power Administration (SWPA), and Western Area Power Administration (WAPA) – each operating in a different geographic region. The four PMA Administrators report to the Deputy Secretary of Energy.

By law, each of the PMAs is a distinct and self-contained entity within DOE, much like a wholly owned subsidiary of a corporation.

Public Affairs

Authorized Federal Employees = 24
FY 2017 Budget Request = $3.4 Million
Headed By: Political Appointee

The Office of Public Affairs (PA) is the principal point of contact for DOE with the news media and the general public. PA is responsible for ensuring that the public is informed about the Department's activities, as well as the policies and priorities of the Secretary and the President with regard to energy policy, nuclear security, and scientific discovery. PA also manages and maintains all technical and editorial aspects of energy.gov, DOE's primary public-facing website, and produces original written and multimedia content for publication online and across the Department's enterprise social media accounts. PA advises the Secretary and other senior Departmental officials on all aspects of media relations, digital communications, public speaking engagements, and other communications opportunities.

Small and Disadvantaged Business Utilization

Authorized Federal Employees = 12
FY 2017 Budget Request = $3.3 Million
Headed By: Political Appointee

The Office of Small and Disadvantaged Business Utilization (OSDBU) is responsible for maximizing prime contracting and subcontracting opportunities for small businesses interested in doing business with DOE by working in partnership with program elements to achieve Departmental prime and subcontracting small business goals set forth by the U.S. Small Business Administration. OSDBU monitors, enforces, and strengthens small and disadvantaged business support at the Department. OSDBU implements and executes Sections 8 and 15 of the Small Business Act. Per Section 15, small businesses must receive a fair portion of the total purchases and contracts for property and services for the Federal government.

Under Secretary for Science and Energy

Authorized Federal Employees = 2,868
FY 2017 Budget Request = $10.4 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of the Under Secretary for Science and Energy is responsible for driving transformative science and technology solutions through coordinated planning and management oversight of the Department's science and energy programs. The Under Secretary for Science and Energy (US/SE) is charged with building on the legacy of the Department and its National Laboratories as world leaders in science and technology innovation, a role that is now essential to addressing the global challenges of climate change. In addition to responsibilities at DOE Headquarters, the US/SE provides oversight for Departmental offices, including 17 National Laboratories.

Electricity Delivery and Energy Reliability

Authorized Federal Employees = 118
FY 2017 Budget Request = $262.3 Million
Headed By: Political Appointee /Senate Confirmed

The Office of Electricity Delivery and Energy Reliability (OE) addresses the complexities and interdependencies of the Nation's energy infrastructure and energy systems through a comprehensive and integrated approach using technology innovation, policy implementation, and risk management.

OE leads the Department's efforts to ensure that the Nation's energy delivery system is affordable, reliable, and resilient. OE achieves this mission by developing new technologies that improve infrastructure and assist in developing methods to meet the Federal and state electricity policies and programs that shape electricity system planning and market operations. OE also works with government and industry partners to bolster the resiliency of the energy infrastructure and assists with restoration efforts when major energy supply interruptions occur.

Energy Efficiency and Renewable Energy

Authorized Federal Employees = 697
FY 2017 Budget Request = $2.9 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of Energy Efficiency and Renewable Energy (EERE) is charged with creating and sustaining American leadership in the transition to a global clean energy economy. EERE is divided into three primary technology sectors – Sustainable Transportation, Renewable Power, and Energy Efficiency – and includes the following goals: accelerating the development and adoption of sustainable transportation technologies; increasing the generation of electric power from renewable resources; improving the energy efficiency of our homes, buildings, and industries; stimulating the growth of a thriving domestic clean energy manufacturing industry; enabling the integration of clean electricity into a reliable, resilient, and efficient grid; leading efforts to improve federal sustainability and implementation of clean energy solutions; and enabling a high-performing, results-driven culture through effective management approaches and processes. Much of EERE's work is accomplished through the promulgation of Federal regulations, awarding of Federal financial assistance (grants) to private sector organizations, and operation of the National Renewable Energy Laboratory (NREL).

Fossil Energy

Authorized Federal Employees = 744
FY 2017 Budget Request = $869.1 Million
Headed By: Political Appointee /Senate Confirmed

The Office of Fossil Energy (FE) plays a key role in helping the United States meet its continually growing need for secure, reasonably priced, and environmentally sound fossil energy supplies. FE's primary mission is to ensure the nation can continue to rely on traditional resources for clean, secure, and affordable energy while enhancing environmental protection. FE is comprised of a research and development portfolio encompassing two primary areas: clean coal and carbon management, and oil and gas technologies. FE also oversees the Nation's petroleum reserves to protect against severe supply interruptions through the acquisition, storage, distribution, and management of emergency petroleum stocks, and carries out U.S obligations under the International Energy Program (IEP). FE provides management and oversight of the National Energy Technology Laboratory (NETL), the only government owned, government operated laboratory in the DOE National Laboratory system.

Indian Energy Policy and Programs

Authorized Federal Employees = 9
FY 2017 Budget Request = $23 Million
Headed By: Political Appointee

The Office of Indian Energy Policy and Programs (IE) is authorized to fund and implement a variety of programmatic activities that assist American Indian Tribes and Alaskan Native villages with energy development, capacity building, energy cost reduction, and electrification of Indian lands and homes.

To advance its mission, IE works with American Indian Tribes and Alaska Natives to maximize the value of their energy resources through education and training, technical assistance, and funding. IE also leverages inter- and intra-governmental coordination and government-to-government partnerships to maximize the return on investments in the future of Native American communities. This includes activities such as the Indian County Energy and Infrastructure Working Group, Tribal Energy Summit, and National Strategy for the Arctic Region.

Nuclear Energy

Authorized Federal Employees = 372
FY 2017 Budget Request = $994 Million
Headed By: Political Appointee /Senate Confirmed

The Office of Nuclear Energy (NE) is responsible for advancing nuclear power as a resource capable of meeting the Nation's clean energy, environmental, and national security needs. NE resolves technical, cost, safety, proliferation resistance, and security barriers through research, development, and demonstration (RD&D). NE supports the diverse civilian nuclear energy programs of the U.S. government by leading federal RD&D efforts in nuclear energy technologies; including generation, safety; waste storage and management; and security technologies. NE provides oversight for the Idaho National Laboratory (INL).

Science

Authorized Federal Employees = 908
FY 2017 Budget Request = $5.6 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of Science (SC) plays a unique and complementary role as a mission-driven organization supporting discovery science in six areas, in addition to mission-relevant, use-inspired research necessary to advance DOE's missions in energy, environment, and national security.

SC is the largest Federal supporter of basic research in the physical sciences in the U.S. SC funds programs in physics, chemistry, materials science, biology, environmental science, applied mathematics, and computer and computational sciences, and is the Federal steward for several disciplines within these fields, such as high energy and nuclear physics; high performance computing science and technology; and accelerator and detector science and technology. SC is also the largest Federal supporter of fundamental research relevant to future solutions for clean energy. The scale and complexity of the SC research portfolio provides a competitive advantage to the nation. SC, using some of the most advanced scientific instruments in the world, is able to respond quickly to national priorities and evolving opportunities at the frontiers of science.

The SC portfolio has two principal areas of focus: direct support of scientific research, and direct support of the design, construction and operation of unique, open-access scientific user facilities. SC supports over 22,000 researchers located at over 300 academic institutions and at all 17 of the DOE National Laboratories. SC provides oversight for 10 of the National Laboratories.

Technology Transitions

Authorized Federal Employees = 18
FY 2017 Budget Request = $8.4 Million
Headed By: Political Appointee

The Office of Technology Transitions (OTT) expands the commercial impact of DOE's portfolio of research, development, demonstration, and deployment (RDD&D) activities over the short, medium, and long term. OTT's work includes implementing the key responsibilities and duties assigned to the statutorily-created Technology Transfer Coordinator (*U.S. Code Title 42 Section 16391, Improved Technology Transfer of Energy Technologies*); program management of the Technology Commercialization Fund (TCF); development of the statutory Technology Transfer Execution Plan and Annual Technology Transfer Report; and the implementation and management of the Clean Energy Investment Center (CEIC). OTT serves as a DOE-wide functional unit that coordinates the commercial development of DOE's research outputs. OTT is charged with developing and overseeing delivery of the DOE strategic vision and goals for technology commercialization and engagement with U.S. business and industrial sectors such as manufacturing, energy, and technology, and with coordinating Department-wide technology transitions activities to derive the maximum impact for the Department's investments.

National Nuclear Security Administration

Authorized Federal Employees = 1,690
FY 2017 Budget Request = $12.5 Billion
Headed By: Political Appointee /Senate Confirmed

The semi-autonomous National Nuclear Security Administration (NNSA) ensures nuclear security by maintaining the nuclear weapons stockpile, reducing global nuclear dangers, and providing for naval nuclear propulsion. NNSA 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 that reside in NNSA's nuclear security enterprise underpin abilities to conduct stockpile stewardship; solve the technical challenges of verifying treaty compliance; and combat nuclear terrorism and proliferation..

Cost Estimating and Program Evaluation

Authorized Federal Employees = 15
FY 2017 Budget Request = $2.7 Million
Headed By: Career Employee

The Office of Cost Estimating and Program Evaluation (CEPE) provides the Administrator with independent, data driven analysis on all aspects of the nuclear security enterprise, leading to better mission planning and performance. CEPE was established to independently determine the costs of projects and provide adequate budget for project execution for improved mission performance. NNSA developed a CEPE implementation plan in coordination with the Office of the Secretary of Defense, Cost Assessment and Program Evaluation (CAPE), and in consultation with Congressional staff. CEPE is a key reform advocated by the Mies-Augustine Congressional Panel on the NNSA Governance to establish a trusted, independent cost and resource analysis capability within the NNSA. CEPE conducts independent cost estimates (ICEs) and evaluates cost and schedule baselines for major acquisition programs and projects.

Defense Programs

Authorized Federal Employees = 736
FY 2017 Budget Request = $6.3 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of Defense Programs (DP) is responsible for sustaining a safe, secure, and effective nuclear deterrent through the application of science, technology, engineering, and manufacturing. DP uses and oversees a wide range of breakthrough science experiments, engineering audits, and high-performance simulations – including extensive laboratory and flight tests of warhead components and subsystems – to ensure the U.S. nuclear weapons stockpile remains safe, secure, and effective. DP's Stockpile Stewardship Program uses of science-based research and development in the absence of underground nuclear testing in order to maintain the portion of the Nation's nuclear deterrent for which DOE is responsible.

NNSA's DP nuclear weapons activities are carried out in a nationwide network of government-owned, contractor-operated, national security laboratories, test sites, and nuclear weapons production sites. These sites, collectively known as NNSA's nuclear security enterprise, provide the necessary research, development, and production capabilities needed to maintain the reliability, security, and safety of the weapons stockpile.

In addition to maintaining the actual weapons, DP is also focused on their security and safety. Robust security protects weapons and weapons material at each facility, and while securely transporting materials and weapons between facilities and military locations. NNSA also strives to conduct operations in ways that are safe for the environment and the public.

Defense Nuclear Nonproliferation

Authorized Federal Employees = 187
FY 2017 Budget Request = $1.5 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of Defense Nuclear Nonproliferation (DNN) provides policy and technical leadership to limit or prevent the spread of materials, technology, and expertise relating to weapons of mass destruction; to advance technologies to detect the proliferation of weapons of mass destruction worldwide; and to eliminate or secure inventories of surplus materials and infrastructure usable for nuclear weapons. DNN actively uses the science, technology, engineering, and manufacturing capabilities of the DOE complex of national laboratories, plants, and sites to solve the technical challenges of monitoring foreign weapons programs; verifying treaty compliance; combating nuclear terrorism and proliferation; and guarding against the threat posed by nuclear technological surprise.

Specifically, DNN minimizes and, when possible, eliminates excess weapons-usable nuclear material, ensures sound management principles for remaining nuclear materials, and supports peaceful uses of nuclear energy by making nuclear materials available for these purposes. DNN also enhances security, protection, control, and accounting for all nuclear and radiological materials worldwide (in accordance with internationally accepted recommendations), and prevents the illicit trafficking of nuclear weapons and nuclear and radiological materials. DNN leads DOE efforts to prevent the proliferation of weapons of mass destruction (WMD) – as well as relevant dual-use materials, equipment, technology, and expertise – by state and non-state actors through nuclear safeguards and export controls, and by strengthening nonproliferation and arms control regimes. DNN also develops innovative unilateral and multilateral technical capabilities to detect, identify, and characterize foreign nuclear weapons program activities; illicit diversion and movement of special nuclear material; and nuclear detonations globally. This includes capabilities to meet U.S. nuclear treaty verification and detonation detection requirements, as well as broader U.S. government nuclear security missions, such as interdiction and nuclear counterterrorism and incident response activities.

Naval Reactors

Authorized Federal Employees = 238
FY 2017 Budget Request = $1.4 Billion
Headed By: Career Naval Officer

The Naval Reactors (NR) Program is solely responsible for all naval nuclear propulsion work, beginning with reactor technology development, continuing through reactor operation, and ending with reactor plant disposal. NR ensures the safe and reliable operation of reactor plants in nuclear-powered submarines and aircraft carriers (constituting over 45 percent of the Navy's major combatants), and fulfills the Navy's requirements for new and affordable nuclear propulsion plants to meet current and future national defense requirements.

Emergency Operations

Authorized Federal Employees = 50
FY 2017 Budget Request = $34.7 Million
Headed By: Career Employee

The Office of Emergency Operations (EO) administers and directs the implementation of emergency management programs across the DOE/NNSA complex. The program ensures that DOE/NNSA can respond promptly, efficiently, and effectively to any emergency involving or affecting DOE/NNSA sites and facilities or activities. EO responds to any emergency in which DOE/NNSA and its interests could be impacted by applying the necessary resources to mitigate the consequences and protect workers, the public, the environment, and national security using the National Preparedness System and its associated frameworks. EO supports the development of an integrated departmental emergency management enterprise through planning, preparedness, readiness assurance, and response.

EO manages the Department's Operations Center; promulgates appropriate departmental policies, to include requirements and implementing guidance; supports the full spectrum of exercise activities and other readiness activities; and establishes a close partnership between headquarters and field elements to ensure seamless implementation and integration of emergency response capabilities during a crisis. EO maintains a trained cadre of employees capable of supporting DOE/NNSA emergency management functions in order to support a response to any operational emergency and/or an incident requiring technical assistance, resources, and capabilities.

Safety, Infrastructure and Operations

Authorized Federal Employees = 111
FY 2017 Budget Request = $1.8 Billion
Headed By: Career Employee

The Office of Safety, Infrastructure and Operations (SIO) enables safe operations, ensures effective infrastructure, and provides enterprise services for the nuclear security enterprise. SIO includes the Chief for Defense Nuclear Safety and the Senior Advisor for Safety and Health, and supports the development and consistent implementation of safety programs and requirements across the nuclear security enterprise, including federal nuclear safety responsibilities and execution of worker safety and health programs.

SIO maintains, operates, and modernizes NNSA base infrastructure in a safe, secure, and cost-effective manner, and provides the necessary short- and long-term planning, systems analyses, and real estate services. The office provides program management of facility operations, maintenance, and modernization (recapitalization, construction, and disposition) to ensure the infrastructure is sustainable. In the area of Enterprise Stewardship, SIO provides cost-effective packaging, nuclear material, and environmental stewardship services, and integrates nuclear material management activities across activities to address environmental compliance and sustainability requirements in support of a revitalized enterprise and mission objectives.

Defense Nuclear Security

Authorized Federal Employees = 83
FY 2017 Budget Request = $670 Million
Headed By: Career Employee

The Office of Defense Nuclear Security (DNS) develops and implements NNSA security programs to protect special nuclear material (SNM), people, information, networks, and facilities, and to control and account for SNM across the nuclear security enterprise. DNS establishes operational direction of the NNSA security program, evaluates the execution of the field security programs, and ensures line management evaluation programs are rigorous and provide high confidence that contractor security programs are operating in an effective manner.

Counterterrorism and Counterproliferation

Authorized Federal Employees = 51
FY 2017 Budget Request = $237 Million
Headed By: Career Employee

The Office of Counterterrorism and Counterproliferation (CTCP) is responsible for countering nuclear terror threats; responding to nuclear incidents and accidents in the U.S. and abroad; and sustaining readiness in support of DOE's "all hazards" emergency management capability. CTCP focuses on the following areas:

- Providing technical assessment of potential nuclear terrorism threats, including real-time support to operational response teams;
- Providing technical equipment, trained personnel, and National Laboratory resources to respond to the threat of nuclear terrorism and to counter proliferation;
- Sustaining capabilities to mitigate the threat of nuclear terrorism in coordination with the Federal Bureau of Investigations (FBI); and
- Informing policies and executing training for radiological and nuclear emergency preparedness, and responding to incidents or accidents both domestically and internationally.

Acquisition and Project Management

Authorized Federal Employees = 175
FY 2017 Budget Request = Included in NNSA Administrator's funding
Headed By: Career Employee

The NNSA Office of Acquisition and Project Management (NA-APM) provides the leadership and corporate integration for the development and execution of NNSA's facilities management policies, programs, and project management systems. APM awards all contracts, financial assistance instruments, and Inter-Agency Agreements on behalf of NNSA. The majority of NNSA's procurement funds are obligated to Management and Operating (M&O) contracts at seven major sites. NA-APM also oversees all construction projects over $10 million and uses proper upfront project planning to establish objective performance measures that demonstrate achievement of program objectives within approved cost, schedule, and performance parameters. Projects include complex, first-of-a-kind nuclear facilities needed to achieve the most challenging aspects of NNSA's mission, and are of profound importance to national security.

External Affairs

Authorized Federal Employees = 20
FY 2017 Budget Request = $0.5 Million
Headed By: Political Appointee

The NNSA Office of External Affairs (NA-EA) is responsible for effectively communicating, promoting, and defending the mission, goals, and budget of NNSA through proactive outreach and sustainable relationship building with Federal, state, and local stakeholders, and with the public through the media. EA manages relationships on behalf of NNSA with members of Congress, their committees, and their staffs to promote and defend NNSA's program missions and their budgets; track proposed legislation; and foster interagency collaboration between DOE, Department of Defense, Department of State, National Security Council, and the Nuclear Weapons Council. EA also manages incoming media inquiries and NNSA's social media presence, including relationships on behalf of NNSA with other elements of DOE; other federal agencies; state, tribal and local governments; and the public, through stakeholder and nongovernmental organizations.

General Counsel

Authorized Federal Employees = 37
FY 2017 Budget Request = Included in NNSA Administrator's funding
Headed By: Career Employee

The NNSA General Counsel (NA-GC) is the chief legal officer for NNSA. NA-GC advises the Administrator on various legalities attendant to the Administrator's program decisions. NA-GC advice includes a variety of legal matters such as the implications of proposed legislation, relevant laws, executive orders, court decisions, and the binding decisions of third-party judicial and administrative appellate bodies. The NA-GC is the chief promulgator of NNSA's legal program policies. NA-GC provides legal services, counsel, and support to NNSA elements worldwide. The office also manages the Freedom of Information Act and Privacy Act programs for NNSA, and ensures NNSA fulfills its obligations under the National Environmental Policy Act (NEPA) by providing NEPA Compliance Officers and policy for NNSA.

Information Management and Chief Information Officer

Authorized Federal Employees = 35
FY 2017 Budget Request = $177 Million
Headed By: Career Employee

The NNSA Office of Information Management (NA-IM) is the principal organization for federal information management, information technology (IT), and complex-wide cybersecurity for the NNSA. NA-IM has the responsibility to ensure the availability of a secure infrastructure for mission support and information sharing for the nuclear security enterprise. NA-IM manages federal IT investments, services, and projects, and oversees the NNSA IT portfolio. NA-IM is responsible for all aspects of cybersecurity across NNSA, including but not limited to: policy, planning, and budgeting; Federal and congressional reporting; continuous monitoring; risk management; and the daily operations of classified and unclassified networks and systems.

Management and Budget

Authorized Federal Employees = 211
FY 2017 Budget Request = $413 Million
Headed By: Career Employee

The NNSA Office of Management and Budget (NA-MB) is responsible for providing timely, cost-effective, and efficient management, administrative, and financial support for NNSA Headquarters staff, and serving as the principal agent for program planning, budgeting, and execution. NA-MB exercises responsibility and authority for program direction and overall management in accomplishing the mission, functions, and responsibilities of the organization. Functional areas include: audits and internal affairs; quality management; executive secretariat; financial integration; human resources management; business services; international operations; and financial performance.

Under Secretary for Management and Performance

Authorized Federal Employees = 2,344
FY 2017 Budget Request = $6.7 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of the Under Secretary for Management and Performance (S-3) is the Department's primary management organization, overseeing project management, the mission support functions of the Department, and the cleanup of the legacy waste of the Cold War. In addition to responsibilities at DOE Headquarters, S-3 oversees offices in a number of field locations including Oak Ridge, TN; Aiken, SC; Los Alamos, NM; Richland, WA; Cincinnati, OH; Grand Junction, CO; Westminster, CO; Morgantown, WV; and a number of smaller clean-up and legacy sites throughout the United States.

Chief Information Officer

Authorized Federal Employees = 113
FY 2017 Budget Request = $93 Million
Headed By: Political Appointee

The Office of the Chief Information Officer (OCIO) leads the Department's Information Technology (IT) reform initiatives. The CIO is also responsible for leading DOE's cyber coordination across the extended DOE enterprise, including strategic policy approach and implementation that includes information sharing and information safeguarding; increasing transparency and cooperation across the DOE enterprise on IT investment and planning; enhancing collaboration on cyber programs, investments, and incident responses with continued emphasis on streamlining DOE governance bodies; ensuring expanded participation by the entire DOE enterprise in support of the broader energy sector; and maturing the DOE enterprise information resources, by focusing on information technology, leadership and management.

Economic Impact and Diversity

Authorized Federal Employees = 37
FY 2017 Budget Request = $11.3 Million
Headed By: Political Appointee /Senate Confirmed

The Office of Economic Impact and Diversity (ED) advises the Secretary of Energy on the impact of energy policies, regulations, and DOE programs on minority communities, minority institutions, and specific segments of the U.S. population. ED is tasked with facilitating involvement of minority serving institutions, minority businesses, and other organizations in all aspects of energy. ED is also responsible for monitoring and strengthening DOE programs and policies by implementing a wide range of initiatives that address underrepresentation of minorities, women, and Native Americans in the Department's programs and the energy workforce. ED develops and executes programs that support full participation of minority and tribal communities, businesses, and educational institutions in energy programs, while supporting a high-performing DOE workforce through fairness, opportunity, redress, and an overall inclusive culture.

Energy Jobs Development

Authorized Federal Employees = 6
FY 2017 Budget Request = $3.7 Million
Headed By: Political Appointee

The mission of the Office of Energy Jobs Development (EJD) is to accelerate the growth of and access to jobs in all sectors of the U.S. energy economy.. EJD focuses on the following key areas: managing the collection of annual energy jobs growth data and issuing an annual energy jobs report; coordinating the ongoing energy workforce development activities within the program offices and laboratories; managing external partnerships with other federal agencies on the energy workforce; and proving energy economic development technical services to states, municipalities, and Tribal governments.

Environment, Safety, Health and Security

Authorized Federal Employees = 260
FY 2017 Budget Request = $197 Million
Headed By: Career Employee

The Office of the Associate Under Secretary for Environment, Health, Safety and Security (AU) is the DOE central organization responsible for developing health, safety, environment, and security policy, and providing corporate level leadership and strategic vision to coordinate and integrate these vital programs. AU provides a key corporate role in enabling DOE to perform its mission in a safe and secure manner in order to protect DOE's workers, the public, the environment, and national security interests. AU works closely with stakeholders – including DOE program and field office management, subject matter experts, and labor and community representatives – to develop and improve environment, health, safety, and security policy and guidance; foster continuous improvement before incidents occur; and provide corporate technical assistance, coordination, and integration to support all DOE organizations in the resolution of environment, health, safety, and security issues.

Environmental Management

Authorized Federal Employees = 1,460
FY 2017 Budget Request = $6.119 Billion
Headed By: Political Appointee /Senate Confirmed

The Office of Environmental Management (EM) is responsible for the safe cleanup of radioactive and chemical waste resulting from Manhattan Project and Cold War activities. DOE has been working for over 25 years to clean up the radioactive and chemical contamination left by five decades of weapons production and energy research. While much has been completed, some of the highest risk and most technically complex work remains. The challenges include designing, building, starting up, and operating complex, hazardous, and unique nuclear facilities. Successful cleanup depends on overcoming technical, quality assurance, schedule, regulatory, and management challenges.

EM continues to pursue its cleanup objectives safely within a framework of regulatory compliance commitments and best practices. The rationale for cleanup prioritization is generally based on achieving the highest risk reduction benefit per radioactive content (activities focused on wastes that contain the highest concentrations of radionuclides and sites with the highest radionuclide contamination).

Hearings and Appeals

Authorized Federal Employees = 22
FY 2017 Budget Request = $5.9 Million
Headed By: Career Employee

The Office of Hearings and Appeals (HG) is the quasi-judicial arm of DOE for conducting hearings and issuing initial Departmental decisions with respect to adjudicative proceedings the Secretary has delegated to HG. Specifically, HG conducts security clearance eligibility and whistleblower hearings, and adjudicates appeals of Freedom of Information Act (FOIA) and other determinations reached by DOE officials. In addition, HG rules upon applications for exception and petitions for special redress filed by firms seeking relief from generally applicable requirements of a DOE rule, regulation, or order.

Human Capital Management

Authorized Federal Employees = 146
FY 2017 Budget Request = $25.4 Million
Headed By: Career Employee

The Office of the Chief Human Capital Officer (HC) is responsible for the recruitment, development, and retention of a highly skilled, efficient workforce. The Chief Human Capital Officer (CHCO) advises and assists agency officials in carrying out Departmental responsibilities of selecting, developing, training, and managing a high-quality federal workforce in accordance with merit-system principles. The CHCO also serves as the chief policy advisor on all human capital management activities and issues.

Laboratory Operations Board

Authorized Federal Employees = 3
FY 2017 Budget Request = $843 Thousand
Headed By: Political Appointee

The Laboratory Operations Board (LOB) is a key part of the Department's effort to strengthen the partnership between DOE and its National Laboratories. Working in coordination with the Laboratory Policy Council, the LOB provides the primary enterprise-wide forum (including senior Federal and laboratory employees) for addressing operational and management improvements in areas that impact the National Laboratories.

Legacy Management

Authorized Federal Employees = 64
FY 2017 Budget Request = $154.3 Million
Headed By: Career Employee

The Office of Legacy Management (LM) fulfills DOE's post-closure site responsibilities and ensures the future protection of human health and the environment. The creation of LM allowed the Department to recognize and separate long-term surveillance and maintenance from cleanup project schedules and missions in order to demonstrate its commitment to long-term care of sites that no longer have on-going missions. LM has control and custody of legacy land, structures, and facilities, and is responsible for maintaining them at levels suitable for their long-term use.

LM is also responsible for leading the Department's efforts to implement the Manhattan Project National Historical Park, authorized by Congress in December 2014, and formally established on November 10, 2015, with the signing of a memorandum of agreement between the Secretary of Energy and the Secretary of the Interior.

Management

Authorized Federal Employees = 226
FY 2017 Budget Request = $59.1 Million
Headed By: Career Employee

The Office of Management (MA) is responsible for assuring the effective management and integrity of DOE programs, activities, and resources by developing and implementing Department-wide policies and systems in the areas of aviation, acquisition, asset management, sustainability, conference management, and administrative services. MA fulfills the statutory responsibilities of the Chief Freedom of Information Officer, and the Department's Senior Procurement Executive and Real Property Officer, and is responsible for providing a safe and environmentally secure environment for all Headquarters employees through the deployment of a disciplined Occupant Emergency Plan.

Project Management Oversight and Assessments

Authorized Federal Employees = 34
FY 2017 Budget Request = $18 Million
Headed By: Career Employee

The Office of Project Management Oversight and Assessments (PM) is responsible for providing corporate oversight, managerial leadership, and assistance in the development and implementation of Department-wide policies, procedures, programs, and management systems pertaining to project management, professional development for Federal project managers, and related activities. The office is charged with providing the DOE senior leadership with timely, reliable, and credible information to enable the best informed project execution decisions.

Laboratories at a Glance

The Department of Energy (DOE) is, at its core, a science and technology organization that advances critical missions for the American people: nuclear security; scientific leadership and discovery; clean energy innovation; and energy security. In addition, the Department has resources and expertise for emergency response; technology transfer; and environmental remediation. DOE's National Laboratories are key to mission success across the broad spectrum of the Department's responsibilities, serving the Nation's interests in nuclear security, scientific research and energy innovation and security. Particularly given the need for broad innovation in meeting all of the Department's missions, it is critical that the vitality of the National Laboratories is maintained, that the National Laboratories work as a system such that all of the capabilities can be used most effectively and efficiently, and that the National Laboratories are a valuable partner with the Department in pursuing the solutions to the mission needs.

The 17 DOE National Laboratories comprise the most comprehensive research network of its kind in the world. Each has distinctive capabilities; together, they are greater than the sum of their parts, a critical component in the Nation's R&D enterprise, and an essential link in the Nation's innovation chain. Individually and collectively, and in both the national security and energy spaces, the Laboratories conduct cutting-edge fundamental and applied scientific research, develop technological solutions, and are one of the Nation's most effective "on call" resources for tackling unprecedented challenges—from the need for sustainable energy supplies and understanding climate change, threat of unsecured nuclear materials, to addressing oil spills in coastal regions, to responding to nuclear reactor challenges such as the Fukushima disaster.

Scientific Research

The DOE National Laboratories create knowledge at the scientific frontier and design, construct, and operate major scientific facilities used by over 30,000 university, laboratory and industry researchers annually. Core enabling technologies--such as high-performance computers, models of complex physical systems, and particle accelerators--are continuously pushed to new, cutting-edge capabilities. In addition, the National Laboratories are establishing completely new research directions for the broader scientific community, as exemplified by the launch of the Human Genome Project and subsequent applications of genomics to understand environmental microbiomes and identify organisms that can be used to produce sustainable energy. In turn, these advances have contributed greatly over many decades to ensuring the competitiveness of U.S. industry and of the broader economy. One hundred and fifteen science Nobel Prizes have been directly associated with DOE National Laboratory research.

Nuclear Security

The DOE National Laboratories are critical to maintaining a safe, secure and reliable nuclear weapons stockpile, without underground explosives testing. It has been because of lab ingenuity that DOE has successfully accomplished the Stockpile Stewardship and Management Program for the past 20 years. This has been accomplished through basic and applied scientific research, using unique diagnostic tools, experimental platforms, and modeling and simulation architectures. From some of the world's fastest supercomputers to high-energy-density lasers and experimental testbeds, the nuclear security enterprise delivers innovative and transformative scientific and technical solutions to the global challenges of the 21st Century. In addition to the core competencies required for the nuclear security mission, they also support the Nation's homeland security and intelligence needs.

Sound stewardship of the Laboratories is both a major responsibility of and opportunity for DOE in service of the national interest. Oversight by DOE must be strategically mission-driven; the partnership between the Department and the National Laboratories can collectively support an enterprise-wide approach to help maximize the use of the National Laboratories' unique role in the Nation's innovation ecosystem.

Ames Laboratory

Mission and Overview

Ames Laboratory (Ames) creates materials, inspires minds to solve problems, and addresses global challenges. Removing toxic lead from the environment by inventing lead-free solder; converting crops more efficiently to biodiesel by designing a hybrid catalyst; and innovating a new class of materials with remarkable optical properties by creating unique metamaterials, are just a few examples of the Laboratory's materials that are impacting our world. Ames tightly couples theory, computation and experiments to design new materials; perform synthesis and fabrication of those materials with innovative Ames developed techniques; and execute characterization and testing at our new Sensitive Instrument Facility with world-class characterization equipment. Since its founding in 1947, Ames' culture of interdisciplinary science allows it to seamlessly design, synthesize, and characterize new materials for DOE's Offices of Science; Energy Efficiency and Renewable Energy; and Fossil Energy, and the Advanced Research Project Agency—Energy. Through Strategic Partnership Projects, Ames conducts research for and provides materials to the Department of Defense and U.S. industry. The Laboratory is one of the top DOE national laboratories in converting science into licensed technologies.

The Laboratory's belief in and dedication to its mission naturally inspires its 138 scientists and engineers, and 122 support staff. The Laboratory's mission extends to inspiring minds of undergraduate and graduate students. Educating future scientists and engineers is a key part of its mission; 3,081 Masters and Ph.D. degrees have been awarded to students from Iowa State University, who operates Ames on behalf of the DOE Office of Science, based on their Ames research.

Ames has addressed global challenges by, for example, conducting pioneering research that enables part-per-trillion detection of elements and molecules, and the mapping of the human genome. Today, Ames is addressing the global challenge of critical materials as it leads the Critical Materials Energy Innovation Hub. Ames is also tackling the 100-year old technology of compressed vapor refrigeration to

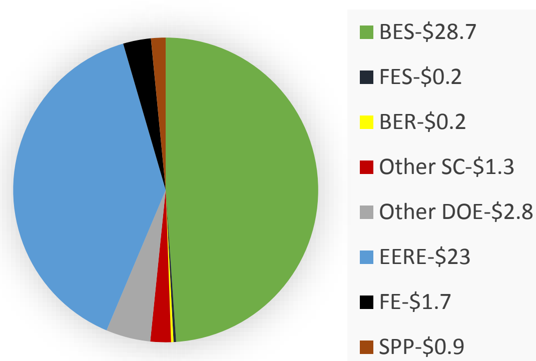
Lab-at-a-Glance

Location: Ames, IA
Type: Single-program Laboratory
Contractor: Iowa State University of Science and Technology
Responsible Site Office: Ames Site Office
Website: www.ameslab.gov
DOE Owner: Office of Science

Physical Assets:
- 10 acres and 13 buildings
- 340,968 GSF in buildings
- Replacement Plant Value: $88.6 M
- 0 GSF in 0 Excess Facilities
- 0 GSF in Leased Facilities

Human Capital:
- 309 Full Time Equivalent Employees (FTEs)
- 73 Joint Faculty
- 43 Postdoctoral Researchers
- 45 Undergraduate Students
- 59 Graduate Students
- 0 Facility Users
- 84 Visiting Scientists

FY 2015 Funding by Source: (Cost in $M**):**



FY 2015 Lab Operating Costs (excluding Recovery Act): $57.0 M
FY 2015 DOE/NNSA Costs: $56.1 M
FY 2015 SPP (Non-DOE/DHS) Costs: $0.9 M
FY 2015 SPP as % Total Lab Operating Costs: 1.6%
FY 2015 DHS Costs: $0.0 M

improve significantly efficiency and reliability, and to remove greenhouse gases from the environment through the CaloriCool™ consortium.

Building on its core capabilities, Ames' vision is to lead the interdisciplinary science of accelerating the design, discovery, and fundamental understanding of advanced energy and chemical conversion materials through technical innovation and excellence in safety, operations, quality, and diversity.

Core Capabilities[1]

- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Applied Materials Science and Engineering

Shared R&D Facilities

- Materials Preparation Center
- Sensitive Instrument Facility
- Powder Synthesis Facility for Additive Manufacturing

[1] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.

Argonne National Laboratory

Mission and Overview

Argonne National Laboratory (ANL) creates knowledge and delivers science-driven innovation that advances American prosperity and security. To further the missions of the Department of Energy (DOE) and other federal agencies, ANL's globally recognized scientists and engineers leverage the Laboratory's unique pairing of world-class user facilities and an integrated computational science community.

Through its broad-based capabilities in the basic and applied sciences and engineering, the Laboratory meets key national needs in science and technology by providing:

- Ground-breaking discovery science that transforms understanding of physical, chemical, mathematical, and biological phenomena;
- Innovative, internationally recognized solutions to critical challenges in energy, transportation, infrastructure, and security; and
- An unmatched portfolio of integrated, on-site experimental and computational capabilities used by both Argonne staff and researchers from around the world, including the:
    - Advanced Photon Source;
    - Argonne Leadership Computing Facility;
    - Center for Nanoscale Materials; and
    - Argonne Tandem Linac Accelerator System.

Multidisciplinary partnerships, both internal and external, are a cornerstone of Argonne's research and development, exemplified by collaborations such as the Joint Center for Energy Storage Research, the Center for Electrochemical Energy Science, and the Midwest Integrated Center for Computational Materials.

ANL leverages its Chicago-area location through joint research institutes with Northwestern University and The University of Chicago, and through partnerships within the Chicago area's rich "innovation ecosystem" that accelerate the transition of Laboratory technology to the marketplace.

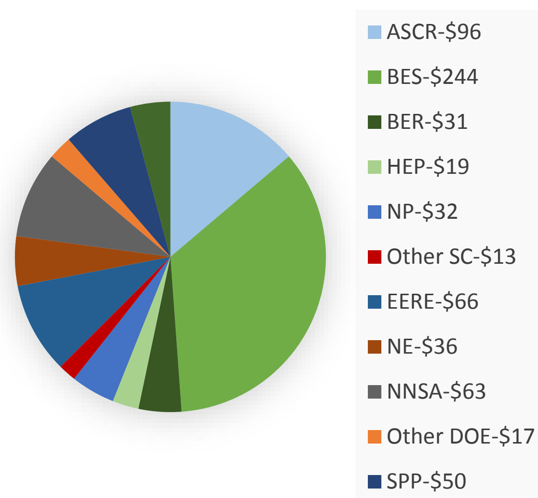
Lab-at-a-Glance

Location: DuPage County, Illinois, outside Chicago
Type: Multi-program laboratory
Contractor: UChicago Argonne LLC
Responsible site office: Argonne Site Office
Website: www.anl.gov
DOE Owner: Office of Science

Physical assets:
- 1,517 acres and 157 buildings
- 5.0 million GSF in buildings
- Replacement plant value: $3.11 B
- 50,779 GSF in 15 excess facilities
- 339,673 GSF in leased facilities

Human capital:
- 3,298 full-time-equivalent employees (FTEs)
- 248 joint faculty
- 315 postdoctoral researchers
- 250 undergraduate students
- 207 graduate students
- 7,186 facility users
- 1,362 visiting scientists

FY15 funding by source (cost data in $ M)



FY15 lab operating costs (excluding Recovery Act): $734.1 M
FY15 DOE/NNSA costs: $617.4 M
FY15 SPP costs (non-DOE/non-DHS): $[illegible] M
FY15 SPP as % total lab operating costs: 12%
FY15 DHS costs: $28.6 M
ARRA costed from DOE sources in FY15: $0.3 M

The University of Chicago has managed ANL on behalf of the DOE since its founding in 1946, guiding the growth of an internationally renowned institution for 70 years.

Core Capabilities[2]

- Accelerator science and technology
- Advanced computer science, visualization, and data
- Applied materials science and engineering
- Applied mathematics
- Biological and bioprocess engineering
- Chemical engineering
- Chemical and molecular science
- Climate change sciences and atmospheric science
- Computational science
- Condensed matter physics and materials science
- Cyber and information sciences
- Decision science and analysis
- Large-Scale User Facilities/Advanced Instrumentation
- Nuclear engineering
- Nuclear physics
- Nuclear and radio chemistry
- Particle physics
- Systems engineering and integration

Scientific User Facilities[3]

- Advanced Photon Source (APS)
- Argonne Leadership Computing Facility (ALCF)
- Center for Nanoscale Materials (CNM)
- Argonne Tandem Linac Accelerator System (ATLAS)
- Atmospheric Radiation Measurement Climate Research Facility (ARM), multi-lab

Shared R&D Facilities

- Transportation Research and Analysis Computing Center

[2] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[3] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Brookhaven National Laboratory

Mission and Overview

Established in 1947, Brookhaven National Laboratory (BNL) originated as a nuclear science facility. Today, BNL is a multi-purpose Laboratory with a primary mission focus in the physical and energy sciences, and additional expertise in biological and climate sciences, energy technologies, and national security. BNL brings strengths and capabilities to the Department of Energy (DOE) laboratory system to produce excellent science and advanced technologies safely, securely, and environmentally responsibly, with the cooperation and involvement of the local, national, and scientific communities.

With a long-standing expertise in accelerator science and technology (S&T), BNL conceptualizes, designs, builds, and operates major scientific facilities available to university, industry, and government researchers, in support of its DOE mission. These facilities serve not only the basic research needs of the DOE, but they reflect BNL and DOE stewardship of national research infrastructure that is made available on a competitive basis to university, industry, and government researchers. The Relativistic Heavy Ion Collider (RHIC) complex, the National Synchrotron Light Source II (NSLS-II), the Center for Functional Nanomaterials (CFN), and the Accelerator Test Facility (ATF) account for the more than2000 scientists peryear served at BNL. In FY 2015, the CFN served 493 users, a record number. To date, seven Nobel Prizes have been awarded for discoveries made at the Laboratory.

BNL's strong partnerships with Stony Brook University (SBU), Battelle Memorial Institute, and the Core Universities[4] are important strategic assets in accomplishing the Lab's missions. Beyond their roles in Brookhaven Science Associates (BSA), which manages the Laboratory on behalf of the DOE Office of Science, Stony Brook and Battelle are key partners in all of BNL's strategic initiatives – from basic research to the commercial deployment of technology – and figure prominently in BNL's energy research and development (R&D) strategy. They also underpin

Lab-at-a-Glance

Location: Upton, NY
Type: Multi-program Laboratory
Contractor: Brookhaven Science Associates
Responsible Site Office: Brookhaven Site Office
Website: http://www.bnl.gov
DOE Owner: Office of Science

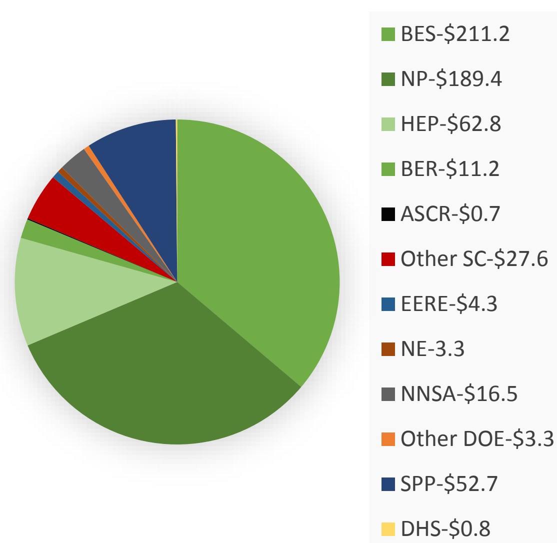
SC Physical Assets:

- 5,322 acres and 312 buildings
- 4.84M GSF in buildings
- Replacement Plant Value: $2.31B (for buildings)
- 57,520 GSF in 11 Excess Facilities
- No Leased Facilities

Human Capital:

- 2,671 Full Time Equivalent Employees (FTEs)
- 24 Joint faculty
- 133 Postdoctoral Researchers
- 256 Undergraduate Students
- 150 Graduate Students
- 2,041 Facility Users
- 2,147 Visiting Scientists (guest researchers & remote users)

FY 2015 Funding by Source: (Cost in $M):



FY 2015 Total Lab Operating Costs (excluding Recovery Act): $584 M
FY 2015 DOE Costs: $530 M
FY 2015 SPP (Non-DOE/Non-DHS) Costs: $53 M
FY 2015 SPP as % Total Lab Operating Costs: 9.0%
FY 2015 DHS Costs: $0.8 M

[4] Columbia, Cornell, Harvard, MIT, Princeton, and Yale

the Lab’s growing partnership in the Northeast, especially with New York State (NYS).

Core Capabilities[5]

- Accelerator Science and Technology
- Advanced Computer Science, Visualization & Data
- Applied Materials Science and Engineering
- Biological Systems Science
- Chemical and Molecular Science
- Chemical Engineering
- Climate Change Sciences and Atmospheric Science
- Condensed Matter Physics and Materials Science
- Large-Scale User Facilities/Advanced Instrumentation
- Nuclear & Radio Chemistry
- Nuclear Physics
- Particle Physics
- Systems Engineering and Integration

Scientific User Facilities[6]

- National Synchrotron Light Source - II (NSLS-II)
- Relativistic Heavy Ion Collider (RHIC)
- Center for Functional Nanomaterials (CFN)
- Accelerator Test Facility (ATF)

[5] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[6] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Fermi National Accelerator Laboratory

Mission and Overview

Fermi National Accelerator Laboratory is America's particle physics and accelerator laboratory. Fermilab's 1,800 employees and more than 2,600 users drive discovery in particle physics by building and operating world-leading accelerator and detector facilities; performing pioneering research with national and global partners; and developing new technologies for science that support U.S. industrial competitiveness.

The laboratory's core capabilities include particle physics; large-scale user facilities and advanced instrumentation; accelerator science and technology; and advanced computer science, visualization, and data. Fermilab's science strategy for the future delivers on the U.S. particle physics community's goals as outlined in the High Energy Physics Advisory Panel (HEPAP) Particle Physics Project Prioritization Panel's 2014 report. The strategy's primary ten-year goal is a world-leading neutrino science program anchored by the Long-Baseline Neutrino Facility (LBNF) and Deep Underground Neutrino Experiment (DUNE), powered by megawatt beams from an upgraded and modernized accelerator complex. The flagship facility comprised of LBNF and DUNE will be the first international mega-science project based at a Department of Energy national laboratory.

Fermilab operates the nation's largest particle accelerator complex, producing the world's most powerful low- and high-energy neutrino beams. It integrates U.S. universities and national laboratories into the global particle physics enterprise through its Large Hadron Collider (LHC) programs; neutrino science and precision science programs; and dark-energy and dark-matter experiments. Large-scale computing facilities drive research in particle physics and other fields of science. The laboratory's R&D infrastructure, as well as its engineering and technical expertise, advance particle accelerator and detector technology for use in science and society. Fermilab's partnerships and technology transitions programs, including the Illinois Accelerator Research Center, will leverage this expertise to apply particle physics technologies to problems of national importance in energy and the environment, national security, and industry.

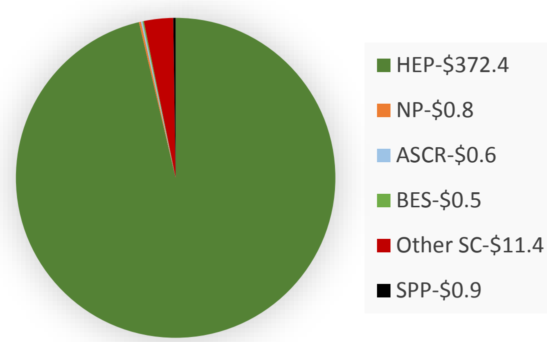
Lab-at-a-Glance

Location: Batavia, Illinois
Type: Single-program laboratory
Contractor: Fermi Research Alliance, LLC
Responsible Site Office: Fermi Site Office
Website: http://www.fnal.gov/
DOE Owner: Office of Science

Physical Assets:
- 6,800 acres and 354 buildings
- 2.4 million GSF in buildings
- Replacement Plant Value: $1,895 M
- 10.8k GSF in 4 Excess Facilities
- 0 GSF in Leased Facilities

Human Capital:
- 1,801 Full Time Equivalent Employees (FTEs)
- 9 Joint Faculty
- 53 Postdoctoral Researchers
- 0 Undergraduate
- 0 Graduate Students
- 2,634 Facility Users
- 19 Visiting Scientists

FY 2015 Funding by Source (Costs in $M):



Total Lab Operating Costs (excluding Recovery Act): $386.7 M
DOE/NNSA Costs: $385.7 M
SPP (Non-DOE/Non-DHS) Costs: $0.93 M
SPP as % Total Lab Operating Costs: 0.2%
DHS Costs: $0

Upgrades to laboratory infrastructure and science and technology facilities will meet the needs of the next generation of researchers.

Fermi Research Alliance (FRA), LLC, manages Fermilab for the DOE Office of Science. FRA is an alliance of the University of Chicago and the Universities Research Association, Inc., a consortium of 89 universities. Fermilab's 6,800-acre site, much of which is open to the public, is located 42 miles west of Chicago in Batavia, Illinois.

Core Capabilities[7]

- Accelerator Science and Technology
- Large-Scale User Facilities/Advanced Instrumentation
- Particle Physics
- Advanced Computer Science, Visualization, and Data.

Scientific User Facilities[8]

- Fermilab Accelerator Complex

[7] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[8] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Idaho National Laboratory

Mission and Overview

The Idaho National Laboratory (INL) missions are to discover, demonstrate, and secure innovative nuclear energy solutions, other clean energy options, and critical infrastructure. The lab will achieve these mission objectives and technical outcomes and execute INL's vision to change the world's energy future and secure our critical infrastructure through:

- Focus on research, development, demonstration, and deployment (RDD&D) on grand challenges in energy and national security;
- Designing, building, and operating world-class and unique research, development, and demonstration (RD&D) infrastructure;
- Working toward creating a global nexus of world-class scientific talent; and
- Building and sustaining global strategic partnerships.

To execute the INL mission, INL integrates and applies distinctive core capabilities and unique RD&D facilities with signature strengths in nuclear energy, clean energy deployment, and modernizing and securing critical infrastructure. The outcome will be transformational innovations in energy and security concepts.

In operation since 1949, INL is the nation's leading RD&D center for nuclear energy, including nuclear nonproliferation, and physical and cyber-based protection of energy systems and critical infrastructure, and integrated energy systems RDD&D. INL is managed and operated by Battelle Energy Alliance, LLC (BEA), a wholly-owned company of Battelle, for the Department of Energy (DOE) since 2005. BEA is a partnership of Battelle; BWX Technologies, Inc.; AECOM; the Electric Power Research Institute (EPRI); the National University Consortium (Massachusetts Institute of Technology, The Ohio State University, North Carolina State University, University of New Mexico, and Oregon State University); and the Idaho University Collaborators (University of Idaho, Idaho State University, and Boise State

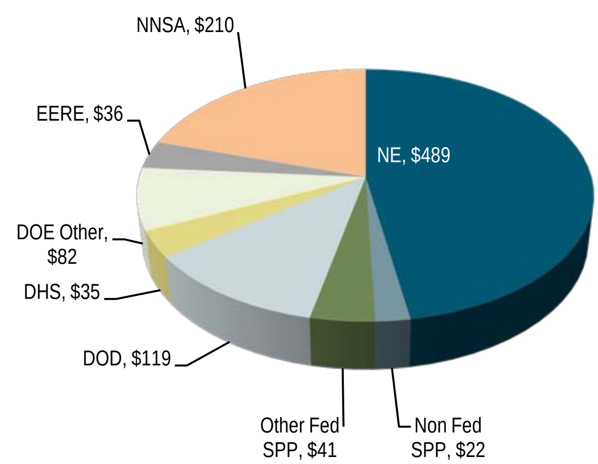
Lab-at-a-Glance

Location: Idaho Falls, ID
Type: Multi-Program Laboratory
Contractor: Battelle Energy Alliance (BEA)
Responsible DOE Site Office: Idaho Operations Office (DOE-ID)
Website: http://www.inl.gov/
DOE Owner: Office of Nuclear Energy

Physical Assets:
- 569,180 acres and 500 real property assets
- 2.3 M gross square footage (GSF) in operating buildings (owned and leased)
- 13.7K GSF in operational standby buildings
- $4.8B in replacement plant value
- 115K GSF in 13 excess facilities
- 1M GSF in leased facilities

Human Capital (period ending 9/30/16):
- 4,272 full-time equivalent (FTE) employees
- 23 joint faculty
- 41 postdoctoral researchers
- 220 undergraduate students
- 86 graduate students
- 72 facility users
- 470 visiting scientists

FY 2016 Total Lab Operating Costs (excluding Recovery Act): $1,034 M



FY 2016 Total DOE/NNSA Costs: $817 M
FY 2016 SPP (Non-DOE/Non-DHS): $182 M
FY 2016 SPP as % Total Lab Operating Costs: 21%
FY 2016 Total DHS costs: $35 M
FY 2016 Recovery Act costed from DOE sources: $0 M

University).

Core Capabilities

- **Advanced Computer Science, Visualization, and Data.** Capability is centered on the Multiphysics Object Oriented Simulation Environment (MOOSE) – an open-source, HPC-based simulation framework – to rapidly create applications for nuclear energy, materials, structural dynamics, multiphase flow, waste management, and geophysics.
- **Applied Materials Science and Engineering.** Integrated set of capabilities for study of nuclear fuels and materials across the continuum, from nano-scale, through proof-of-concept, to actual proof-of-performance.
- **Biological and Bioprocess Engineering.** Capability spans bench-top analysis through scale-up and integration to address challenges in biomass preprocessing solutions, logistics, feedstock supply/specification, supply chain development, and demonstration challenges.
- **Chemical and Molecular Science (emerging).** Capability in understanding, predicting, and controlling physical and chemical transformations, and knowledge of chemical separations, electrochemical separation, separations science, membrane science, radiochemistry, actinide chemistry, catalysis, and trace analytical measurement.
- **Chemical Engineering.** Capabilities related to nuclear fuel separations, radioactive waste treatment, chemical transformation of energy-intensive industrial processes, catalysis, securing supplies of critical energy materials, and the shift to clean transportation.
- **Condensed Matter Physics and Materials Science (emerging).** Capabilities include modeling and measurement of transport and mechanical properties of nuclear fuels.
- **Cyber and Information Sciences.** INL builds economic security through secure, resilient critical infrastructure, advancing nuclear energy security, and providing national security solutions for military, intelligence, and first responders.
- **Decision Science and Analysis.** INL derives knowledge from measured, modeled data sets to further the understanding of resource and technology options; identify and quantify the risks and impacts of current and emerging technologies; and assess the impact of market dynamics, human behavior, regulations, policies, and institutional practices on their decisions.
- **Environmental Subsurface Science.** INL's environmental subsurface science research is focused primarily on developing a predictive understanding of the fate and transport of metal and radionuclide contaminants under natural and far-from-equilibrium conditions, and the geomechanical responses of the subsurface to energy resource extraction and waste storage.
- **Large-Scale User Facilities/Advanced Instrumentation.** Capabilities in nuclear and clean energy and security RDD&D available at INL enable pilot-, engineering-, and prototype-scale testing under normal and abnormal conditions for advancing energy and security technologies.
- **Mechanical Design and Engineering.** INL's capabilities are used for nuclear system design; other energy and industrial processes; and development of technologies for evaluation of materials behavior in support of national defense programs.
- **Nuclear and Radiochemistry**. INL has deep expertise in the unique chemistry and analysis of radioactive decay and transmutation of chemical and material behavior in applications such as energy production, waste management, and nuclear nonproliferation.

- **Nuclear Engineering.** INL's capability spans multiple disciplines required to analyze, design, test, demonstrate, deploy, and operate nuclear systems. INL has capabilities in neutronics; thermal hydraulics; safety; structural design analyses for small- and large-scale experiments; and mechanistic and probabilistic safety analyses, as well as development of nuclear-grade instrumentation, control systems, and destructive and non-destructive detection and safeguards technologies.
- **Power Systems and Electrical Engineering.** Supports clean energy system design, analysis, and integration; state awareness diagnostics, prognostics, and control data analysis; process system state analysis; mitigation of natural and man-made hazards; electrical/economic modeling analysis; and performance design requirements development.
- **Systems Engineering and Integration.** Holistically address problems/challenges in energy and security to enable optimal solutions. These capabilities support design and fabrication activities, experiment design and development, instrumentation controls, data analyses, and quality assurance.

Scientific User and Laboratory Facilities

User Facilities

- The Advanced Test Reactor (ATR)
- Biomass Feedstock National User Facility (BFNUF)

Laboratory Facilities

- Advanced Test Reactor Complex (ATRC)
- Materials and Fuels Complex (MFC)
- The Hot Fuel Examination Facility (HFEF)
- The Space and Security Power Systems Facility
- Irradiated Materials Characterization Laboratory
- Critical Infrastructure Test Range Complex (CITRC)/Powergrid Test Bed/Water Security Test Bed
- Center for Advanced Energy Studies
- Transient Reactor Test Facility (TREAT)
- Energy Innovation Laboratory
- Energy Systems Laboratory
- National Security Test Range
- Wireless Test Bed
- Radiological Response Training Range
- Unmanned Aerial Systems Range
- Radiological & Environmental Sciences Laboratory (RESL), Government Owned, Government Operated Laboratory

Los Alamos National Laboratory

Mission and Overview

Los Alamos National Laboratory (LANL) is a premier national security science laboratory whose primary mission is supporting the strategic nuclear deterrent. This mission includes ensuring the safety and reliability of the U.S. deterrent, and providing nonproliferation and counterproliferation solutions.

Weapons Program. LANL supports national priorities for ensuring the safety, security, and reliability of the stockpile, and relies on the unique science capabilities developed through the Stockpile Stewardship Program. LANL is the designer of and is responsible for the majority of the nation's nuclear weapons stockpile. It also serves as NNSA's Center of Excellence for plutonium, and provides essential uranium research and development, while providing NNSA's plutonium and detonator manufacturing capability.

Global Security Program. LANL supports the nonproliferation and counterproliferation missions and emerging threats to national security. LANL is a primary source of technical intelligence on foreign nuclear programs, supports reducing the threat from weapons of mass destruction (including unconventional weapons and Emergency Response), and supports international efforts in nonproliferation. LANL works in space surveillance capabilities; operates the nation's only criticality experimental facility; works on emerging threats, including the strengthening of the national infrastructure against attack via cyber, surveillance, and security countermeasures; and supports war fighter needs.

Science, Technology and Engineering Program. LANL serves the nation, conducting long-term, national security-inspired innovation, enabling transformational mission impacts. Energy security is explicitly a national security mission, and LANL has identified three themes—sustainable nuclear energy, mitigating impacts of energy demand growth, and materials and concepts for clean energy—that underpin the priorities for its vital

Lab-at-a-Glance

Location: Los Alamos, New Mexico
Type: Multidisciplinary National Security Laboratory
Contract Operator: Los Alamos National Security, LLC
Responsible Site Office: NNSA Los Alamos Field Office; DOE-EM Los Alamos
Website: http://www.lanl.gov
DOE Owner: National Nuclear Security Administration (NNSA)
Physical Assets:

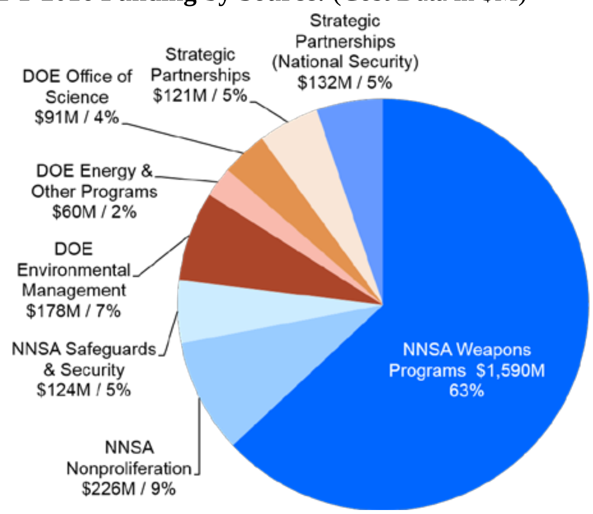
- 36 square miles of DOE-owned property
- More than 1,000 buildings
  - 47 technical areas
  - 8.2 million square feet under roof
- Replacement value: $14.2 billion

Human Capital:

- 11,100 employees

- LANS, LLC	7,800
- Guard Force	300
- Support Contractors	400
- Students	1,300
- Craft (union)	950
- Post Docs	350

FY 2016 Funding by Source: (Cost Data in $M)



FY 2016 Funding– $2.52 billion
63% NNSA Weapons Programs
9% NNSA Nonproliferation
5% NNSA Safeguards & Security
7% DOE Environmental Management
2% DOE Energy & Other Programs
4% DOE Office of Science
5% Strategic Partnerships
5% Strategic Partnerships (National Security)

mission in energy security.

LANL also has a mission to complete the cleanup of legacy contamination and waste safely, efficiently, and with full transparency.

Core Capabilities

- National Security Science
- Weapons Design and Engineering
- Plutonium Research, Development and Manufacturing
- Research-Driven Supercomputing
- Broader National Security Missions

Major Laboratory Facilities

- Plutonium Facility Complex (TA-55)
- Nicholas Metropolis Center for Modeling and Simulation
- Dual Axis Radiographic Hydrodynamic Test Facility (DARHT)
- Los Alamos Neutron Science Center (LANSCE)
- Center for Integrated Nanotechnologies (CINT)
- National High Magnetic Field Laboratory (NHMFL)
- Waste Handling Facilities

Lawrence Berkeley National Laboratory

Mission and Overview

Established in 1931, Lawrence Berkeley National Laboratory (LBNL) plays an important and distinctive role within DOE's network of great national laboratories. From discovery science to mission-driven basic research, LBNL develops open science and technology solutions for the benefit of the nation.

LBNL specializes in integrative science and technology, leveraging our core strengths in materials and chemistry; physics; biology and environmental science; and mathematics and computing to conduct cross-cutting forefront research. With its expertise in multi-disciplinary team science, LBNL creates and operates advanced S&T tools that are closely linked to its research programs and are widely used by the broad national research community. LBNL delivers high-impact contributions for DOE science, sustainable energy technology, and policy.

The sense of public spirit and sharing runs deep within the organization to extend and integrate science that fulfills DOE's missions and benefits the world. LBNL collaborates with national labs and other institutions through partnerships, user facilities, and data networks. Each year, LBNL's five national user facilities serve 10,000 researchers, one third of all national lab users. Finally, the Lab's Energy Sciences network (ESnet) provides powerful data connectivity for the entire DOE system.

LBNL is operated by the University of California on behalf of the DOE Office of Science. LBNL's close relationship with the University of California brings the intellectual capital of the university's faculty, postdocs, and students to bear on the pursuit of DOE's missions. The Lab's scientific strength is enhanced by its open programs and culture; integrative science and technology; and emphasis on collaboration with the national and global scientific community – sharing its world class user facilities, research and expertise to solve the challenges that define our time.

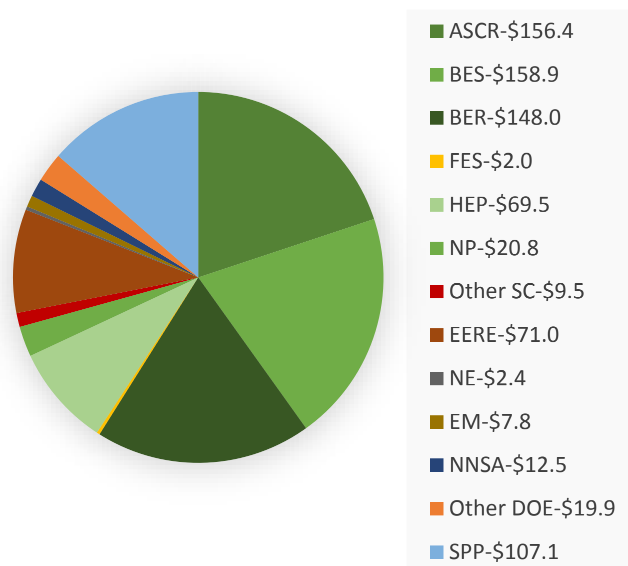
Lab-at-a-Glance

Location: Berkeley, California
Type: Multi-program laboratory
Contract Operator: University of California **Responsible Field Office:** Berkeley Site Office
Web site: http://www.lbl.gov/
DOE Owner: Office of Science

Physical Assets:
- 202 acres; 97 bldgs and 27 trailers
- 1.98M gsf in bldgs
- Replacement plant value: $1.348 B
- 55,756 gsf in 6 excess bldgs,1 excess trailer
- 339,258 gsf in leased facilities

Human Capital:
- 3,304 FTE
- 1,549 Scientists and Engineers
- 245 Joint faculty
- 476 Postdoctoral researchers
- 330 Graduate students
- 149 Undergraduates
- 10,798 Facility users
- 2,170 Visiting scientists and engineers

FY15 Funding by Source (Cost Data in $M):



FY15 Total Lab Operating Costs (excl. ARRA): $786 M
FY15 Total DOE/NNSA Costs: $790.1 M
FY15 SPP (non-DOE/Non-DHS) Costs: $103.5 M
FY15 SPP as % Total Lab Operating Costs: 13.6%
FY15 Total DHS Costs: $3.6 M
ARRA costed from DOE sources FY15: $4.8 M

Core Capabilities[9]

- Accelerator Science and Technology
- Advanced Computer Science, Visualization and Data
- Applied Materials Science and Engineering
- Applied Mathematics
- Biological and Bioprocess Engineering
- Biological Systems Science
- Chemical Engineering
- Chemical and Molecular Science
- Climate Change Science and Atmospheric Science
- Computational Science
- Condensed Matter Physics and Materials Science
- Cyber and Information Sciences
- Decision Science and Analysis
- Earth Systems Science and Engineering
- Environmental Subsurface Science
- Large Scale User Facilities/Advanced Instrumentation
- Mechanical Design and Engineering
- Nuclear Physics
- Nuclear and Radio Chemistry
- Particle Physics
- Power Systems and Electrical Engineering
- Systems Engineering and Integration

Scientific User Facilities[10]

- The Advanced Light Source (ALS)
- The Molecular Foundry
- The DOE Joint Genome Institute (JGI)
- The National Energy Research Scientific Computing Center (NERSC)
- The Energy Sciences Network (ESnet)

Shared R&D Facilities

- Advanced Biofuels Process Demonstration Unit
- FLEXLAB

[9] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[10] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Lawrence Livermore National Laboratory

Mission and Overview

Science and technology on a mission is the hallmark of the Lawrence Livermore National Laboratory (LLNL). LLNL was founded in 1952, and develops and applies world-class science, technology, and engineering (ST&E) to ensure the safety, security, and reliability of the nation's nuclear deterrent. LLNL also applies ST&E to confront dangers that threaten national security and global stability, ranging from nuclear proliferation and terrorism, to energy shortages and climate change. Using a multidisciplinary approach that encompasses all disciplines of science and engineering, and employs unmatched facilities, LLNL pushes the boundaries to provide breakthroughs for counter-terrorism and nonproliferation; defense and intelligence; and energy and environmental security.

LLNL mission areas include:

- **Biosecurity**. Distinguished track record in developing, deploying, and delivering advanced biodefense capabilities.
- **Counterterrorism**. Preventing and mitigating potentially catastrophic incidents involving chemical, biological, radiological, nuclear, or high-explosive materials.
- **Defense**. Supporting the Department of Defense in preeminent innovative science and technology.
- **Energy**. Advancing the nation's security through the production, development, and deployment of energy resources and technology, and reducing environmental impacts.
- **Intelligence**. Providing timely, informed analytic and operational support, and unique science and technology support to a wide range of sponsors.
- **Nonproliferation**. A national resource for addressing nonproliferation challenges, noteworthy for developing innovative technical solutions.
- **Science**. Delivering scientific discoveries that position Lawrence Livermore researchers to

Lab-at-a-Glance

Location: Livermore, California
Type: Multidisciplinary National Security Laboratory
Contract Operator: Lawrence Livermore National Security, LLC
Responsible Site Office: NNSA Livermore Field Office
Website: http://www.llnl.gov
DOE Owner: National Nuclear Security Administration

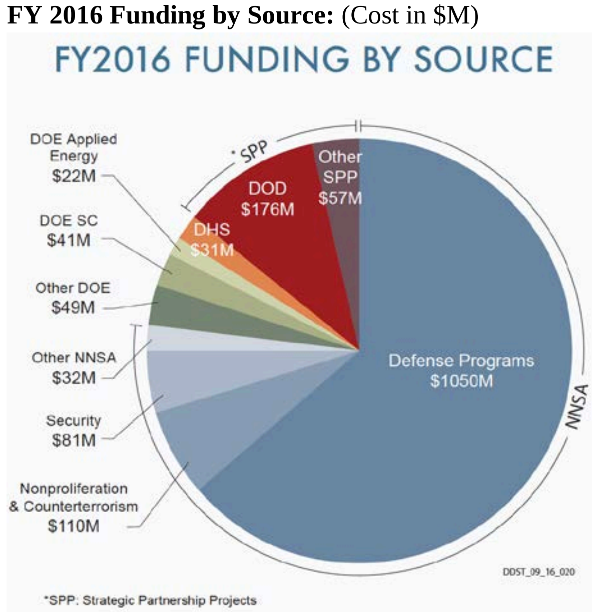
Physical Assets:

- 7,700 acres (owned) and 535 buildings/trailers
- 6.4 million GSF in active buildings
- 0.8 million GSF in 142 non-operational buildings
- 24 thousand GSF leased
- Replacement plant value: $6.8 billion

Human Capital:

- 5,800 LLNS employees
- 24 joint faculty
- 228 postdoctoral researchers
- 574 undergraduate interns
- 49 graduate students
- 408 Academic Cooperation Program students
- 1,046 visiting scientists
- 4,300 facility users

FY 2016 Funding by Source: (Cost in $M)



FY 2016 Total Lab Operating Costs (excluding Recovery Act): $1.69 B
FY 2016 Total DOE Costs: $1.42 B
FY 2016 SPP (Non-DOE/Non-DHS): $240 M
FY 2016 SPP as % Total Lab Operating Costs: 14%
FY 2016 Total DHS costs: $34 M

solve pressing national security challenges.
- **Weapons**. Ensuring the safety, security, and reliability of the nuclear deterrent.

Lawrence Livermore National Security, LLC has managed the Lab since 2007.

Core Capabilities

- Advanced Materials and Manufacturing
- Bioscience and Bioengineering
- Earth and Atmospheric Sciences
- High-Energy-Density Science
- High-Performance Computing, Simulation, and Data Science
- Lasers and Optical Science and Technology
- Nuclear, Chemical, and Isotopic Science and Technology
- All Source Intelligence Analysis
- Nuclear Weapons Design
- Safety, Risk, and Vulnerability Analysis

Major Laboratory Facilities

- National Ignition Facility
- Livermore Computing Complex
- National Atmospheric Release Advisory Center
- High Explosives Applications Facility
- Contained Firing Facility
- Forensic Science Center
- Center for Micro and Nanotechnology
- Center for Bioengineering
- Jupiter Laser Facility
- Center for Accelerator Mass Spectrometry

National Energy Technology Laboratory

Mission and Overview

NETL's mission and vision is to lead the nation and world in the discovery, integration, and demonstration of the science and technologies that will continue to ensure the nation's energy security, while protecting the environment for future generations. NETL supports the Department's mission by:

- Maintaining nationally-recognized technical capabilities in areas critical to the discovery, development, and deployment of affordable, sustainable fossil energy technologies and systems.
- Collaborating with partners in industry, academia, and other national and international research organizations to nurture emerging fossil energy technologies across the full breadth of the maturation cycle, from discovery, through development, to commercial-scale demonstration and deployment.
- Continuing active engagement in the national and international clean energy conversation, and to be poised to recognize, and react to, emerging opportunities to enable transformational clean energy ideas.

NETL is staffed with Federal scientists and engineers and operates under a Government-owned, Government-operated (GOGO) model. NETL is the Department's only GOGO National Laboratory, providing the DOE with a flexible means of partnering for technology success.

For more than a century, NETL has played a significant role in ensuring domestic energy security through its focus on the safe, affordable, and increasingly sustainable production and use of the Nation's fossil energy resources. Beginning in 1910 as a U.S. Department of the Interior Bureau of Mines laboratory in Pittsburgh, Pennsylvania, dedicated to coal and coal mine safety, NETL has expanded over the years to include other Bureau of Mines sites in Morgantown, West Virginia; Bartlesville, Oklahoma; and Albany, Oregon, adding technical breadth and capability relevant to the DOE mission. NETL was designated a DOE

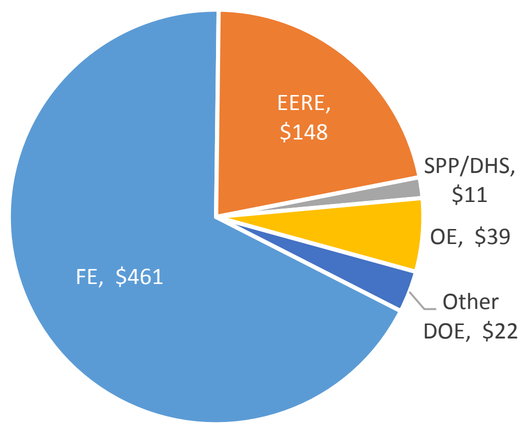
Lab-at-a-Glance

Location: Pittsburgh, Pennsylvania; Morgantown, West Virginia; Albany, Oregon; Sugar Land, Texas; Anchorage, Alaska
Type: Single-Program Laboratory
Operator: Government-owned, Government-operated
Website: http://www.netl.doe.gov
DOE Owner: Office of Fossil Energy

Physical Assets:
- 242 acres and 109 buildings
- 1,157,849 Gross Square Footage (GSF) in buildings
- Replacement Plant Value: $596.9 million
- 39,120 GSF in 8 excess facilities
- 14,259 GSF in leased facilities

Human Capital (period ending 9/30/15):
- 1,609 Full-Time Equivalent Employees (FTEs)
- 47 Joint Faculty
- 94 Postdoctoral Researchers
- 12 Undergraduate Students
- 50 Graduate Students
- 916 Technology Development Partner Institutions (Active Awards)

FY 2015 Funding by Source: (Cost in $M)



FY 2015 Total Lab Operating Costs (excluding Recovery Act): $234 M
FY 2015 Total DOE Costs: $670 M, of which
NETL in-house Research: $143 M
FY 2015 SPP (Non-DOE/Non-DHS): $11 M
FY 2015 SPP as % Total Lab Operating Costs: 4.7%
FY 2015 Total DHS costs: $0.0
FY2015 Active Research, Development, Demonstration, and Deployment (DOE + Cost Share): $13 Billion

National Laboratory in 1999.

NETL's core competencies, expertise, and mission-unique facilities have delivered innovative technology solutions to some of the nation's greatest energy and environmental challenges.

Core Capabilities

- **Applied Materials Science and Engineering**. Computational materials engineering, functional, and structural materials development, and materials characterization science. NETL is internationally recognized for its competency in the design, development, and deployment of advanced structural materials and tailored functional materials for use in energy-applications and extreme service environments, with a focus on the delivery of industrially-relevant, impactful material solutions.
- **Chemical Engineering.** Multi-phase flow science, thermal sciences, and reaction engineering. NETL leverages the concept of "simulation-based engineering," closely integrated with focused experimentation. Working with models appropriate for analyses at relevant scales, supported by experiments producing data at those scales, researchers significantly accelerate the rate of discovery and maturation.
- **Decision Science and Analysis**. Process systems engineering research, broad energy systems, and market analysis. NETL develops and utilizes a variety of multi-scale computational tools and approaches to support decision-making and provide in-depth, objective analyses. NETL assesses and forecasts technical, economic, and environmental risks and focuses technology investment decisions in areas to achieve the greatest advances in efficiency, performance, cost, and life-cycle emissions.
- **Environmental Subsurface Science.** Geology and geospatial science; biochemistry and water; and geophysics and field monitoring. NETL monitors, analyzes, and predicts the physical, chemical, and biological structure and function of complex subsurface environments, from the field-scale down to the molecular level. These multi-scale assessments enable accurate analyses of the occurrence and distribution of *in situ* resources, and predictions of the performance of engineered natural systems over a range of time- and space-scales. Through leadership of the National Risk Assessment Partnership (NRAP), NETL has generated computational tools for assessing risk and quantifying uncertainty associated with long-term, geologic carbon storage.
- **Systems Engineering and Integration**. Capability is critical for managing the costs and risks of its R&D portfolio, and for efficiently maturing technology deployment across multiple technology readiness levels. NETL's unique model, which combines scientific and technical expertise with project management proficiency and a systems engineering capability, guides new concepts through discovery and lab-scale demonstration, translating them into investment pathways leading to the deployment of commercial-scale technologies.

Laboratory Facilities

- Alloy Fabrication Laboratory
- Analytical Laboratories
- Chemical Looping Reactor
- Engineered Natural Systems Laboratory
- Fuels Processing Laboratory
- Geological Services Laboratory
- High Bay Reaction Chemistry and Engineering Laboratory
- High Pressure Combustion Research Facility

- High-Pressure Immersion and Reactive Transport Laboratory
- Hybrid Performance Laboratory
- Mechanical Testing Laboratory
- Polymer Synthesis Laboratory
- Severe Environmental Corrosion Erosion Facility
- NETL High Performance Computing Center – Supercomputer
- Solid Oxide Fuel Cell Experimental Laboratory
- Surface Science Laboratory
- Thermogravimetric Analysis Laboratory
- Water Tunnel Facility

National Renewable Energy Laboratory

Mission and Overview

From breakthroughs in fundamental science, to new clean energy technologies to integrated energy systems, National Renewable Energy Laboratory (NREL) researchers are transforming the way the nation and the world use energy.

Founded in 1977 as the Solar Energy Research Institute (SERI), NREL is the only federal laboratory solely dedicated to the research, development, commercialization, and deployment of renewable energy and energy efficiency technologies.

NREL's research has been instrumental in enabling the emergence of a national and global renewable energy industry, particularly in solar, wind, and biofuels.

- Solar research yielded advances in thin-film PV materials and high-efficiency, multi-junction solar cells helped launch several successful companies and helped make solar photovoltaics one of the fastest-growing energy sectors.
- Wind turbine design codes; innovations in components and blades; and capabilities in validating performance of prototype blades and turbines have supported the wind industry in lowering the cost of electricity to 4-7 cents per kilowatt hour (kWh).
- Research in biofuels led to a greater understanding of photosynthetic systems for hydrogen, fuel, and chemical production as well as genetic and pathway engineering of micro-organisms. Knowledge and know-how supported the emergence of the first integrated biorefineries in the United States.

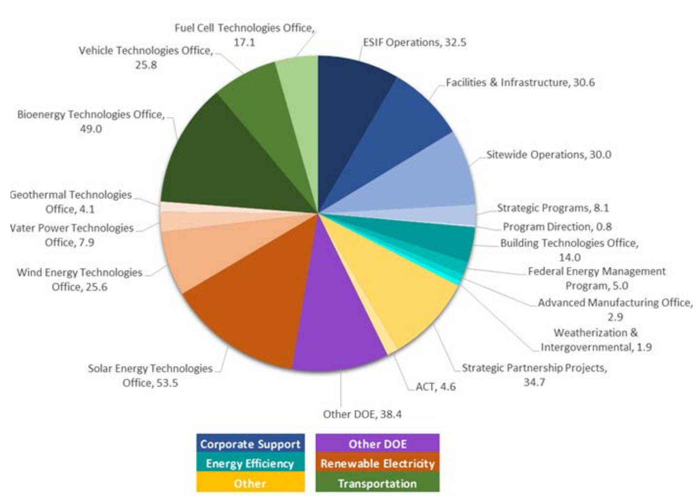
Lab-at-a-Glance

Location: Golden, Colorado
Type: Single-Program Laboratory
Contract Operator: Alliance for Sustainable Energy, LLC
Responsible Site Office: Golden Field Office
Website: http://www.nrel.gov
DOE Owner: Office of Energy Efficiency and Renewable Energy

Physical Assets:
- 628.7 acres, 60 buildings, and four trailers (owned)
- 1,160,647 GSF in buildings/trailers (owned)
- Replacement Plant Value: $517,639 M
- 0 GSF in 0 excess facilities
- 182,827 GSF in leased facilities (five buildings, whole or partial)

Human Capital (period ending 9/30/16):
- 1,597 full-time equivalent employees
- 1,703 employee count (full and part time)
- 6 joint appointments
- 82 postdoctoral researchers
- 45 undergraduate students
- 41 graduate students
- 18 facility users
- 3 visiting scientists

FY 2016 Funding by Source ($387M Total Costs)



FY2016 Total Lab Operating Costs: $387M
FY2016 Total DOE Costs: $348M
FY2016 SPP (Non-DOE/Non-DHS): $39M
FY2016 SPP as % Total Lab Operating Costs: 10%
FY2016 Total DHS Costs: $597K

Market maturity and technology scale up led NREL to add systems integration research to its portfolio with an initial focus on the important topic of grid integration.

NREL continues to lead the national laboratory system in partnerships through which NREL innovations and knowledge are transferred to the market.

The agreements reached at the Conference of the Parties (COP) 21 in Paris highlight the significant transformation required to achieve the long-term vision of keeping the global temperature rise this century well below 2 degrees Celsius, and drive efforts to limit the temperature increase even further to 1.5 degrees Celsius above pre-industrial levels. This will require market uptake of clean energy technologies at an unprecedented pace and scale, and new system operating strategies.

The Alliance for Sustainable Energy manages NREL under a performance-based contract to the U.S. Department of Energy (DOE) Office of Energy Efficiency and Renewable Energy (EERE).

Core Capabilities

- Applied Materials Science and Engineering
- Biological/Bioprocess Science and Engineering
- Chemical Engineering
- Chemical and Molecular Science
- Decision Science and Analysis
- Mechanical Design and Engineering
- Power Systems and Electrical Engineering
- Systems Engineering and Integration

Scientific Test and User Facilities

- Battery Thermal and Life Test Facility
- Distributed Energy Resources Test Facility
- Dynamometer Test Facilities
- Energy Systems Integration Facility
- Integrated Biorefinery Research Facility
- Magnetic Resonance Facility
- Research Support Facility
- Thermal Test Facility

Oak Ridge National Laboratory

Mission and Overview

The mission of Oak Ridge National Laboratory (ORNL), the largest multi-program science and energy laboratory of the US Department of Energy (DOE), is to deliver scientific discoveries and technical breakthroughs that will accelerate the development and deployment of solutions in clean energy and global security, thus creating economic opportunity for the nation.

Located near Oak Ridge, Tennessee, ORNL was established in 1943 as part of the Manhattan Project. After pioneering plutonium production and separation, the Laboratory focused on nuclear energy, later expanding to address other energy sources and their impacts. Today, signature strengths in materials; neutron science; nuclear science and engineering; and high-performance computing (HPC) underpin a broad set of core capabilities focused on DOE mission needs. ORNL is operated by UT-Battelle, LLC, for the DOE Office of Science (SC).

ORNL manages one of the nation's most comprehensive materials programs, integrating basic and applied research and development (R&D) to deliver advanced materials for energy applications. Two of the world's most powerful neutron science facilities—the Spallation Neutron Source (SNS) and the High Flux Isotope Reactor (HFIR)—offer unmatched capabilities for understanding materials structure and dynamics, bio-logical systems, and fundamental neutron physics. Unique resources for nuclear science and technology (S&T) are exploited to expand nuclear power, enhance national security, and produce isotopes. Leadership-class computers—including the 27 petaflops (PF) Titan, flagship system of the Oak Ridge Leadership Computing Facility (OLCF)—accelerate scientific discovery and innovation across ORNL's R&D portfolio, which comprises a diverse set of programs linked by an urgent focus on clean energy and global security challenges.

Partnerships leverage other major investments in research infrastructure [e.g., the Center for Nanophase Materials Sciences (CNMS), the

Lab-at-a-Glance

Location: Oak Ridge, TN
Type: Multi-program laboratory
Contractor: UT-Battelle, LLC
Responsible Field Office: ORNL Site Office
Web site: http://www.ornl.gov/
DOE Owner: Office of Science

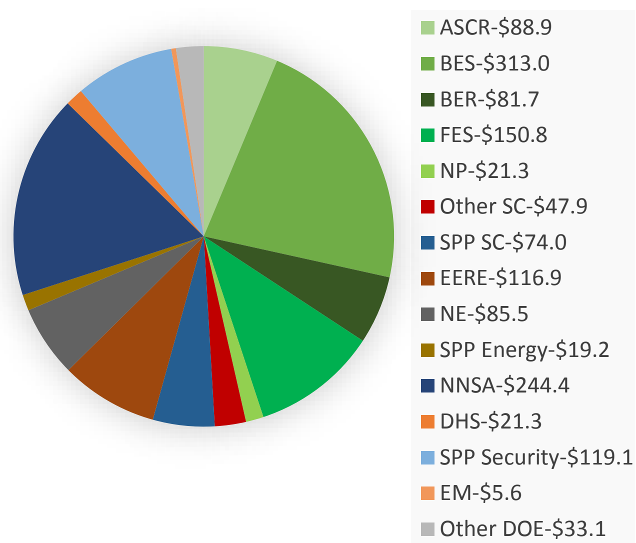
Physical Assets:

- 4,470 acres and 308 buildings
- 4.4M GSF in active operational buildings
- Replacement Plant Value: $6.4 B
- 0.207M GSF in 26 Excess Facilities
- 1M GSF in Leased Facilities

Human Capital:

- 4,628 full-time equivalent (FTE) employees
- 155 joint faculty
- 328 postdoctoral researchers
- 252 undergraduate students
- 283 graduate students
- 2,899 facility users
- 1,728 visiting scientists

FY 2015 Funding by Source: (Cost Data in $M)



FY 2015 Lab Operating Costs (excluding Recovery Act): $1,412.1 M
FY 2015 DOE/NNSA Costs: $1,145.5.1 M
FY 2015 SPP (Non-DOE/DHS) Costs: $212.2 M
FY 2015 SPP as % Total Lab Operating Costs: 15.0%
FY 2015 Total DHS Costs: $21.3 M

Manufacturing Demonstration Facility (MDF), the Carbon Fiber Technology Facility (CFTF), and nuclear and radiological facilities]. ORNL leads several S&T collaborations for DOE – including two Energy Frontier Research Centers (EFRCs), the BioEnergy Science Center (BESC), the Next-Generation Ecosystem Experiments–Arctic (NGEE-Arctic), and the Consortium for Advanced Simulation of Light Water Reactors (CASL) – and it is a founding partner of the Institute for Advanced Composites Manufacturing Innovation (IACMI). ORNL also manages the US contributions to the ITER Project and the Exascale Computing Project (ECP) for DOE's Office of Sciences (SC).

Core Capabilities[11]

- Accelerator Science and Technology
- Advanced Computer Science, Visualization, and Data
- Applied Materials Science and Engineering
- Applied Mathematics
- Biological and Bioprocess Engineering
- Biological Systems Science
- Chemical Engineering
- Chemical and Molecular Science
- Climate Change Science and Atmospheric Science
- Computational Science
- Condensed Matter Physics and Materials Science
- Cyber and Information Sciences
- Decision Science and Analysis
- Earth Systems Science and Engineering
- Environmental Subsurface Science
- Large Scale User Facilities/Advanced Instrumentation
- Mechanical Design and Engineering
- Nuclear Engineering
- Nuclear Physics
- Nuclear and Radio Chemistry
- Plasma and Fusion Energy Sciences
- Power Systems and Electrical Engineering
- Systems Engineering and Integration

Scientific User Facilities[12]

- Spallation Neutron Source (SNS)
- High Flux Isotope Reactor (HFIR)
- Oak Ridge Leadership Computing Facility (OLCF)

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[11] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[12] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

- Center for Nanophase Materials Sciences (CNMS)

Shared R&D Facilities

- Building Technologies Research and Integration Center
- Carbon Fiber Technology Facility
- Center for Structural Molecular Biology
- Manufacturing Demonstration Facility
- National Transportation Research Center

Pacific Northwest National Laboratory

Mission and Overview

Pacific Northwest National Laboratory (PNNL) is a multidisciplinary national laboratory advancing the frontiers of science and technology (S&T) in areas that inspire and enable the world to live prosperously, safely, and securely. Located in Richland, WA, PNNL is one of 10 United States (U.S.) Department of Energy (DOE), Office of Science (SC) national laboratories. Operated by Battelle Memorial Institute, PNNL had 4,377 staff members and total costs of $875M during fiscal year (FY) 2015.

Since 1965, PNNL has made significant S&T discoveries that have benefitted the nation. These include major advances in our scientific understanding of changes in frequency and intensity of climate events, which help us prepare for droughts, floods, and other extreme conditions. In the area of energy, PNNL has developed advanced computing tools that analyze grid congestion faster and more accurately, saving utilities millions of dollars. The Laboratory has also developed a new organic aqueous flow battery that uses water-based liquid electrolytes, and is 60 percent less expensive than current flow batteries. Research in national security has resulted in the development of low-cost attachments to a mobile platform, enabling detection of infectious pathogens in the field.

Several major research and development (R&D) facilities enable mission accomplishment. On behalf of DOE-SC's Office of Biological and Environmental Research (BER), PNNL operates the Environmental Molecular Sciences Laboratory (EMSL), and provides technical and operational leadership to the Atmospheric Radiation Measurement Climate Research Facility (ARM). The Radiochemical Processing Laboratory (RPL) is a Hazard Category II non-reactor nuclear facility that provides PNNL with a core capability in Applied Nuclear Science and Technology, furthering innovative radiological material processes and solutions for the environmental, nuclear energy, and national security research. PNNL operates DOE's only

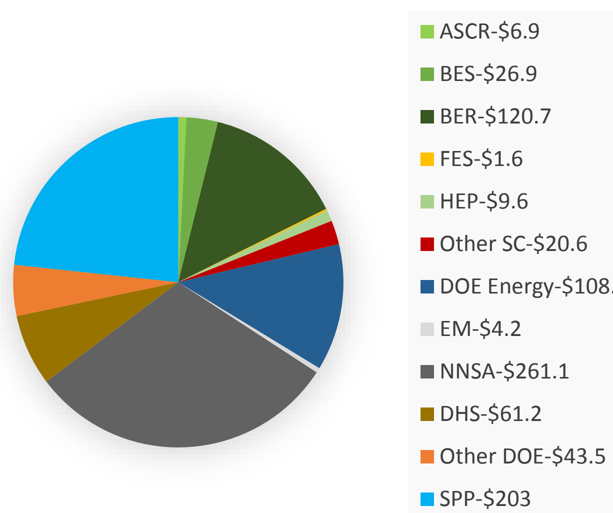
Lab-at-a-Glance

Location: Richland, Washington
Type: Multi-program laboratory
Contract Operator: Battelle Memorial Institute
Responsible Site Office: Pacific Northwest Site Office
Website: http://www.pnnl.gov
DOE Owner: Office of Science

Physical Assets
- 379 acres DOE; 203 acres Battelle, including 39 in Sequim, Washington
- 21 DOE Buildings, 78 total buildings
- 861,547 gross square feet (gsf)
- Replacement Plant Value: $459.8 M
- 956,713 gsf in 26 leased facilities or third-party agreements
- 486,260 gsf in 31 Battelle facilities and 23 OSFs
- 2,304,520 gsf total buildings and trailers

Human Capital
- 4,061 Full-time Equivalents (FTEs); 4,377 Staff Members
- 12 Joint Appointments
- 244 Postdoctoral Researchers
- 218 Undergraduate Students
- 207 Graduate Students
- 1,915 Facility Users (715 EMSL; 1,200 ARM Climate Research Facility)
- 104 Visiting Scientists (EMSL)

FY15 Funding by Source (Cost data in $M)



FY15 Total Lab Operating Costs (excluding Recovery Act): $874,976 M
FY15 Total DOE/NNSA Costs: $609,805 M
FY15 SPP (Non-DOE/Non-DHS) Costs: $203,944 M
FY15 SPP % of Total Laboratory Operating Costs: 23.3%
FY15 Total DHS Costs: $61,218 M
Recovery Act Costed from DOE Sources in FY15:$2.26 M

facility for marine sciences in Sequim, WA, building upon a rich history of research related to marine and coastal resources, environmental chemistry, water resources modeling, ecotoxicology, biotechnology, and national security. PNNL also has satellite offices in Seattle, WA; Portland, OR; and College Park, MD.

Core Capabilities[13]

- Large-Scale User Facilities/Advanced Instrumentation
- Advanced Computer Science, Visualization, and Data
- Applied Materials Science and Engineering
- Applied Mathematics
- Biological and Bioprocess Engineering
- Biological Systems Science
- Chemical and Molecular Sciences
- Chemical Engineering
- Climate Change Science and Atmospheric Science
- Computational Science
- Condensed Matter Physics and Materials Science
- Cyber and Information Sciences
- Decision Science and Analysis
- Earth Systems Science and Engineering
- Environmental Subsurface Science
- Nuclear and Radio Chemistry
- Nuclear Engineering
- Power Systems and Electrical Engineering
- Systems Engineering and Integration

Scientific User Facilities[14]

- Environmental Molecular Sciences Laboratory (EMSL)
- Atmospheric Radiation Measurement Climate Research Facility (ARM), multi-lab

Shared R&D Facilities

- Applied Process Engineering Laboratory
- Bioproducts, Sciences, and Engineering Laboratory
- Marine Sciences Laboratory (Sequim, WA)
- Systems Engineering Building, includes the Electricity Infrastructure Operations Center

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[13] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[14] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Princeton Plasma Physics Laboratory

Mission and Overview

The Princeton Plasma Physics Laboratory (PPPL) is a collaborative national center for plasma and fusion energy sciences. It is the only Department of Energy (DOE) Laboratory devoted to these areas, and it is the lead U.S. institution investigating the science of magnetic fusion energy.

PPPL has two, coupled missions. First, PPPL develops the scientific knowledge to realize fusion energy as a clean, safe, and abundant energy source for all nations. Plasma is a hot, ionized gas that produces fusion energy under appropriate conditions of temperature, density, and confinement. The Laboratory has been a leader in developing the physics of high temperature plasmas needed for fusion. PPPL will continue to solve plasma physics problems crucial to fusion energy, as well as contribute to solutions of key engineering science challenges associated with the material structure that surrounds the hot plasma. The second mission is to develop plasma science over its broad range of physics challenges and applications. Modern plasma physics began with the advent of the world fusion program, and continues to lead to new discoveries in the nonlinear dynamics of this complex state of matter. The vast applications range from scientific (e.g., plasmas in the cosmos) to technological (e.g., plasma-aided manufacturing).

For over six decades, PPPL has been a leader in magnetic confinement experiments and theory. PPPL is a partner in the U.S. Contributions to the ITER Project, and leads multi-institutional collaborative work on the National Spherical Torus Experiment - Upgrade. The Laboratory hosts smaller experimental facilities used by multi-institutional research teams, and collaborates strongly by sending scientists, engineers, and specialized equipment to other fusion research facilities in the U.S. and abroad. To support these activities, the Laboratory maintains nationally leading programs in plasma theory and computation, plasma science and technology, and graduate education.

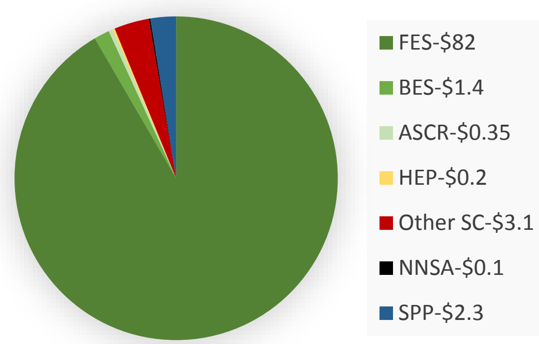
Lab-at-a-Glance

Location: Princeton, NJ
Type: Single-program Laboratory
Contract Operator: Princeton University
Responsible Field Office: Princeton Site Office
Website: http://www.pppl.gov/
DOE Owner: Office of Science

Physical Assets:
- 90.7 acres; 30 buildings
- 765K GSF in Active Operational Buildings
- Replacement Plant Value: $660 M (total)
- Deferred Maintenance: $108 M
- Asset Condition Index: 0.84
- Asset Utilization Index: >95%

Human Capital:
- 462 Full Time Employees
- 5 Joint Faculty
- 12 Postdoctoral Researchers
- 40 Graduate students
- ~350 Visiting Scientists

FY 2015 DOE Funding by Source (Cost in $M):



FY15 Total Lab Operating Costs: $90.0 M
FY15 Total DOE/NNSA Costs: $87.7 M
FY15 SPP (Non-DOE/Non DHS) Costs: $2.3 M
FY15 SPP as % Total Lab Operating Costs: 2.6%
FY15 Total DHS Costs: $ 0

Core Capabilities[15]

- Plasma and Fusion Energy Sciences
- Large Scale User Facilities/Advanced Instrumentation
- Mechanical Design and Engineering
- Power Systems and Electrical Engineering
- Systems Engineering and Integration

Scientific User Facilities[16]

- National Spherical Torus Experiment (NSTX)

[15] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[16] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Sandia National Laboratories

Mission and Overview

Sandia National Laboratories (SNL) – one of three National Nuclear Security Administration (NNSA) laboratories entrusted with responsibility for stockpile stewardship and annual assessment of the nation's nuclear deterrent – maintains capabilities in the areas of global nuclear security; cyber security; energy and climate; advanced defense products; chemical and biological defense; and space innovation. An interdependence between Sandia's core nuclear weapons mission and work in other areas enables SNL to achieve greater impact.

SNL's origin is rooted in the effort to develop the first atomic bombs; however, keeping the U.S. nuclear stockpile safe, secure, and reliable is a major part of Sandia's current work as a multidisciplinary, national security and engineering laboratory. SNL's role has evolved to address the complex threats facing the U.S. through research and development in:

- **Nuclear Weapons**. Supporting U.S. deterrence policy by helping sustain a safe, secure, and reliable nuclear arsenal;
- **Defense Systems and Assessments**. Supplying new innovative capabilities to U.S. defense and national security communities;
- **Energy and Climate**. Ensuring a secure and sustainable energy future; and
- **International, Homeland and Nuclear Security.** Providing technologies to prevent, counter, and respond to nuclear proliferation and other weapons of mass destruction.

SNL's science, technology and engineering foundations enable its unique mission. Highly specialized research staff is at the forefront of innovation, collaborating with universities and companies, and performing multidisciplinary science and engineering research with significant impact on U.S. security.

Lab-at-a-Glance

Location: Albuquerque, NM; Livermore, CA; Tonopah, NV; Amarillo, TX; Carlsbad, NM; Kauai, HI
Type: Multidisciplinary National Security Laboratory
Contract Operator: Sandia Corp., a wholly owned subsidiary of Lockheed Martin Corp.
Responsible Site Office: NNSA Sandia Field Office
Website: http://www.sandia.gov
DOE Owner: National Nuclear Security Administration

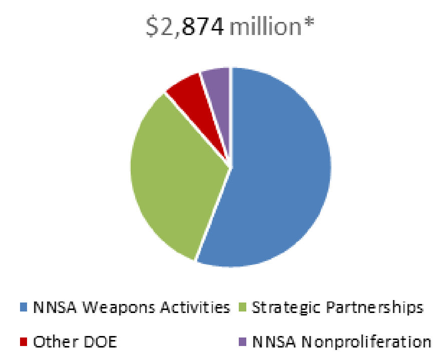
Physical Assets:

- 193,502 acres and 1,029 Buildings/trailers (all sites)
- 7,536,661 GSF in buildings and trailers
- Replacement plant value (includes structures): $6.7 B
- 1.8M GSF in laboratory space
- 1.3M GSF in office space

Human Capital (period ending 8/26/16):

- 10,610 full-time equivalent employees (12,177 total)
- 6 joint faculty
- 220 postdoctoral researchers
- 442 undergraduate students
- 310 graduate students

FY 2016 Funding by Source: (Cost in $M)



FY 2016 Total Lab Operating Costs (excluding Recovery Act): $2,874 M
FY 2016 Total DOE/NNSA Costs: $1,843 M
FY 2016 SPP (Non-DOE/Non-DHS): $1,031 M
FY 2016 SPP as % Total Lab Operating Costs: 35.9%

Core Capabilities

- Cyber Technology
- High-Reliability Engineering

- Micro and Nano Devices and Systems
- Modeling and Simulation and Experiment
- Natural and Engineered Materials
- Pathfinder Engineered Systems
- Reverse Engineering
- Safety, Risk, and Vulnerability Analysis
- Sensors and sensing systems
- Radiation-Hardened and Trusted Microelectronics Development and Production

Major Laboratory Facilities

- Advanced Power Sources Laboratory
- Combustion Research Facility
- Design, Evaluation, and Test Technology Facility
- Distributed Energy Technology Laboratory
- Engineering Sciences Experimental Facilities
- Explosive Components Facility
- Explosive Technology Group
- Geomechanics Laboratory
- Ion Beam Laboratory
- Materials Science and Engineering Center
- Mechanical Test and Evaluation Facility
- Microsystems and Engineering Sciences Applications (MESA)
- National Solar Thermal Test Facility
- Nuclear Energy Safety Technologies (NEST)
- Nuclear Facilities Resource Center (NUFAC)
- Photovoltaic Laboratories
- Pulsed-Power and Systems Validation Facility
- Primary Standards Laboratory
- Radiation Detection Materials Characterization Laboratory
- Shock Thermodynamic Applied Research Facility (STAR)
- Weapon and Force Protection Center

SLAC National Accelerator Laboratory

Mission and Overview

SLAC National Accelerator Laboratory (SLAC) pursues transformative research on some of the most important scientific questions and technology challenges within the mission of the Department of Energy (DOE) using unique cutting-edge accelerator facilities and world-leading light sources. Founded in 1962 with a 2-mile-long linear accelerator used for revolutionary high energy physics experiments, SLAC has evolved into a multi-program laboratory whose mission leverages our intellectual capital, unique relationship with Stanford University (Stanford) and location within Silicon Valley to:

- Innovate, develop, and operate world-leading accelerators, light sources, and scientific tools;
- Deliver transformative chemical, materials, biological, and fusion energy science enabled by our unique facilities, and define their direction;
- Perform use-inspired and translational research in energy; and
- Define and pursue a frontier program in particle physics and cosmology.

SLAC draws more than 4,000 researchers from around the world to use facilities and participate in laboratory-hosted science programs each year. SLAC operates two leading X-ray scientific user facilities – the Linac Coherent Light Source (LCLS) and the Stanford Synchrotron Radiation Light source (SSRL) – as well as the Facility for Advanced Accelerator Experimental Tests (FACET), a unique research and development (R&D) facility opened in 2012 for research on next-generation accelerator concepts. SLAC also runs the Instrument Science and Operations Center for the Fermi Gamma-ray Space Telescope (FGST), a joint DOE-National Aeronautics and Space Administration (NASA)

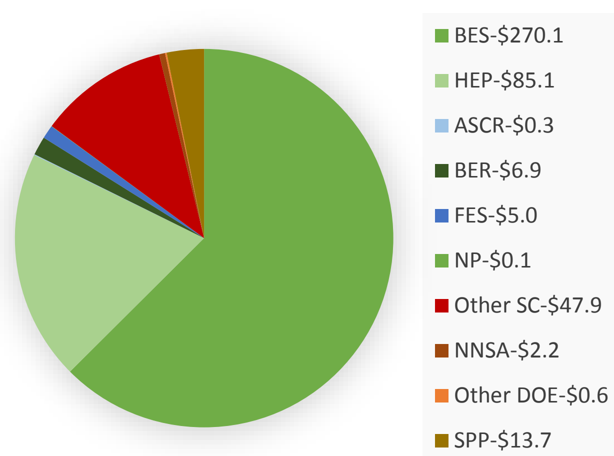
Lab-at-a-Glance

Location: Menlo Park, CA
Type: Multi-program Laboratory
Contractor: Stanford University
Responsible Site Office: SLAC Site Office
Website: www.slac.stanford.edu
DOE Owner: Office of Science

Physical Assets:
- 426 acres, 140 buildings and 35 trailers
- 1.559M GSF in buildings
- Replacement Plant Value: $1.459 B
- 2,662 GSF in 2 Excess Facilities
- 654 GSF in 1 Leased Trailer

Human Capital:
- 1,452 Full Time Equivalent Employees (FTEs)
- 55 Faculty
- 119 Postdoctoral Researchers
- 0 Undergraduate Students
- 167 Graduate Students
- 2737 Facility Users
- 47 Visiting Scientists

FY 2015 Funding by Source (Cost in $M)**:**



FY 2015 Lab Operating Costs (excluding Recovery Act): $429.6 M
FY 2015 DOE Costs: $430.2 M
FY 2015 SPP (Non-DOE/Non-DHS) Costs: $13.7 M
FY 2015 SPP as % Total Lab Operating Costs: 3.2%
FY 2015 DHS Costs: N/A

mission that launched in 2008, and is leading the DOE contributions to the construction and operation of the Large Synoptic Survey Telescope (LSST).

Since LCLS began operations in 2009, it has redefined the frontiers of X-ray science as an unprecedented source of ultrashort, ultrabright pulses of coherent X-rays. The recent demonstration of hard and soft X-ray self-seeding and other advanced techniques has further enhanced the unique capabilities of this facility. Breakthrough scientific results achieved at LCLS have garnered worldwide attention and prompted construction of similar facilities around the world. Work is well underway on an upgrade, LCLS-II, which will provide a much higher repetition rate, increasing the number of experiments run each year, and an expanded range of X-ray wavelengths, adding important new capabilities to keep the U.S. in an internationally leading position.

SLAC is operated by Stanford for DOE's Office of Science SC). Four Nobel Prizes have been awarded for research done at SLAC.

Core Capabilities[17]

- Large-Scale User Facilities/Advanced Instrumentation
- Condensed Matter Physics and Materials Science
- Chemical and Molecular Science
- Plasma and Fusion Energy Science
- Accelerator Science and Technology
- Particle Physics

Scientific User Facilities[18]

- Stanford Synchrotron Radiation Lightsource (SSRL)
- Linac Coherent Light Source (LCLS)
- Facility for Advanced Accelerator Experimental Tests (FACET)

[17] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[18] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Savannah River National Laboratory

Mission and Overview

The Savannah River National Laboratory (SRNL) is operated by the Office of Environmental Management (EM) and supports DOE's critical missions.

The global industrial manufacturing sector is undergoing a transformation driven by a need to dramatically reduce capital and operating cost; improve worker safety; and better protect the environment. Revolutionary new technologies – including automation, modular processes, computational modeling, and virtual reality – are allowing the industrial sector to re-think almost every aspect of how work is done.

SRNL is charged by the Department with applying its advanced manufacturing expertise in developing and adapting the best science and technology to address the chemical and materials manufacturing needs of DOE and NNSA. SRNL serves as a central resource for chemical manufacturing innovation for such national missions as the processing of Cold War legacy waste, securing proliferant materials, production of specialized isotopes, and assessing the actions of potential enemies.

Environmental Management

SRNL's principal mission for EM is to apply its scientific and technical competencies to help achieve the Nation's legacy nuclear waste cleanup objectives. The cleanup of the most difficult and high-risk cold-war legacy waste sites lie ahead, representing some of the most complex and technically challenging clean-up efforts anywhere in the world. This mission spans the DOE complex and includes 16 sites that remain the focus of ongoing cleanup efforts. The scope of the cleanup work is staggering. Over $150B has been spent to date in pursuit of the Cleanup from the Cold War; estimates for completion of the work are on the order of $200-300B over many decades.

Lab-at-a-Glance

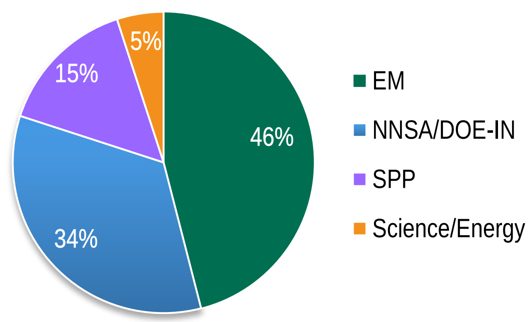
Location: Aiken, South Carolina
Type: Multi-Program Laboratory
Contract Operator: Savannah River Nuclear Solutions, LLC
Responsible Site Office: Savannah River Office
Website: http://www.srnl.doe.gov
DOE Owner: Office of Environmental Management
Physical Assets:

- SRNL Main Technical Area: 39 acres and 54 buildings
- 829,800 GSF in buildings
- Replacement plant value: $1.3B
- 14,950 GSF in 9 excess facilities
- 58,850 GSF in leased facilities

Human Capital (period ending 9/30/15):

- 1000 full-time equivalent employees
- 20 postdoctoral researchers
- 45 undergraduate students
- 2 visiting scientists

FY 2015 Funding by Source:



FY 2015 Total Lab Operating Costs (excluding Recovery Act): $211.2 M
FY 2015 Total DOE Costs: $181.3 M
FY 2015 Total Non-DOE Funding: $29.9 M
FY 2015 Breakout of Non-DOE Major Funding Organizations: DHS, DOD, FBI, and Other government agencies

As the recent Secretary of Energy Advisory Board (SEAB) Task Force on EM Technology Development pointed out, advances in science and technology will be critical to success in the remaining EM mission. Both the report of the SEAB Task Force and the Interim Report of the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL) highlighted concerns about the alignment between the EM mission and the science and technology needs that support the mission. To effectively impact the EM mission, science and technology advances must be conceived and developed with a clear understanding of challenges and environment of the cleanup mission. SRNL provides the experience, understanding, and demonstrated capability for innovation needed to help EM address these challenges.

SRNL has an important and strategic role in achieving DOE-EM's objectives at SRS and the other cleanup sites. SRNL's innovations from putting science to work for DOE-EM over the past five years have improved approaches to manufacturing stable waste forms; remediating contaminated soil and ground water; and decommissioning contaminated facilities. These advanced manufacturing efforts have saved the Nation over $5 billion and shortened the cleanup life cycle by many years.

National Security

SRNL plays an equally important role in supporting the NNSA in maintaining a safe, secure, and reliable nuclear deterrent for our Nation's defense. Tritium is a critical component of the Nation's defense systems and must be continually replenished in order to meet the needs of the national nuclear deterrent. SRNL is the only technology provider for SRS tritium processing and gas transfer system loading and testing. For this critical mission, SRNL is responsible for developing, validating, and implementing nuclear chemical processing and purification approaches to meet current and future tritium stockpile needs; assessing and working with the Design Agencies to ensure the functional capability of new gas transfer systems; and evaluating the condition and operational capability of gas transfer systems currently in our Nation's nuclear stockpile. The Laboratory's application of advanced manufacturing techniques to this mission have been used to shrink the tritium isotope separations footprint by half; dramatically reduce worker and environmental exposure; and significantly improve tritium reservoir reliability. With the 12-year half-life of tritium, SRNL's competency is of critical importance to the effectiveness of the U.S. nuclear stockpile. The US cannot have a reliable nuclear deterrent without SRNL.

SRNL also supports a wide range of national defense, homeland security, remote detection, and nuclear material management initiatives, including national leadership roles in the following specific areas:

- SRNL personnel and facilities provide critical components in the Nation's nonproliferation efforts to prevent the spread of nuclear weapons and other weapons of mass destruction. Savannah River programs reduce the global nuclear threat through mission critical R&D activities; securing and repatriating vulnerable nuclear materials worldwide; technology export control; and policy support.
- The extensive nuclear materials processing experience and environmental monitoring expertise at SRNL provide the foundation for a wide variety of programs supporting the national intelligence community.

The nuclear-based scientific and engineering competencies that SRNL maintains for its principal DOE-EM and NNSA missions also provide unique value to a wider range of government and private-sector programs associated with enhancing environmental sustainability, increasing national security, and advancing the Nation's clean energy objectives. In fulfilling its charter as a Federally Funded Research and Development Center, SRNL works strategically with a broad set of government and private-sector partners to fully understand their needs. This deep understanding of mission needs allows the Laboratory to devise innovative solutions that provide enhanced value to the Nation, while leveraging DOE's investment in the foundational competencies of SRNL.

Core Capabilities

Integrated Capabilities

- Nuclear Chemical Process Development
- High Fidelity Nuclear Materials Measurement

- Waste Form Development and Engineering
- Nuclear Materials Packaging and Transportation
- Environmental Modeling and Risk Assessment
- Gas Processing, Storage and Engineering

Discipline-Level Capabilities

- Actinide Science and Radiochemistry
- Separations Science and Engineering
- Materials Science and Engineering
- Integrated Chemical Process Development
- Specialty Equipment Design and Engineering
- Environmental Science and Engineering
- Systems Integration and Enterprise Modeling
- Simulation Based Science and Engineering

Scientific User and Laboratory Facilities

- High and Intermediate Level Shielded Cells
- High Pressure Laboratory
- Primary Standards Laboratory
- Gamma Irradiation Facility
- Waste Treatment Laboratories
- Rapid Fabrication Facility
- Ultra Low-Level Underground Counting Facility
- Glovebox Facilities
- Remote Systems Laboratory
- Engineering Development Laboratory
- Metal Hydride Laboratories
- Atmospheric Technologies Center
- Law Enforcement Support Center – Southeast Region
- Glassblowing and Apparatus Development Laboratory
- Aiken County Technology Laboratory
- Applied Research Center: Hydrogen Technology Research Laboratory; and Energy Materials Research Laboratory
- F/H Laboratory
- Health Physics Instrument Calibration Laboratory

Thomas Jefferson National Accelerator Laboratory

Mission and Overview

The Thomas Jefferson National Accelerator Facility (TJNAF), located in Newport News, Virginia, is a laboratory operated by Jefferson Science Associates, LLC, for the Department of Energy's (DOE) Office of Science (SC). The primary mission of the laboratory is to explore the fundamental nature of confined states of quarks and gluons, including the nucleons that comprise the mass of the visible universe. TJNAF also is a world-leader in the development of the superconducting radio-frequency (SRF) technology utilized for the Continuous Electron Beam Accelerator Facility (CEBAF). This technology is the basis for an increasing array of applications at TJNAF, other DOE labs, and in the international scientific community. The expertise developed in building and operating CEBAF and its experimental equipment has facilitated an upgrade that doubled the maximum beam energy (to 12 GeV (billion electron volts)) and provided a unique facility for nuclear physics research that will ensure continued world leadership in this field for several decades. The upgraded facility is in the commissioning phase and will begin research operations in the near future.

TJNAF has an international scientific user community of 1,510 researchers whose work has resulted in scientific data from 178 full and 10 partial experiments; 380 Physics Letters and Physical Review Letters publications; and 1,292 publications in other refereed journals to-date at the end of FY 2015. Collectively, there have been more than 113,000 citations for work done at TJNAF.

Research at TJNAF and CEBAF also contributes to thesis research material for about one-third of all U.S. Ph.D.'s awarded annually in Nuclear Physics (27 in FY 2015; 531 to-date; and 195 more in progress). TJNAF's outstanding science education programs for K-12 students, undergraduates, and teachers build critical knowledge and skills in the physical sciences that are needed to solve many of the nation's future challenges.

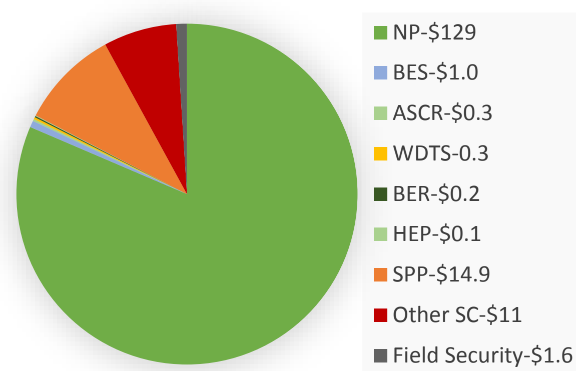
Lab-at-a-Glance

Location: Newport News, Virginia
Type: Program-Dedicated, Single-purpose lab
Contract Operator: Jefferson Science Associates, LLC
Responsible Site Office: Thomas Jefferson Site Office
Website: http://www.jlab.org
DOE Owner: Office of Science

Physical Assets:
- 169 acres and 66 buildings and 4 trailers
- 876,084 GSF in buildings
- Replacement Plant Value (RPV): $397 M
- 0 GSF in Excess Facilities
- 74,736 GSF in Leased Facilities

Human Capital (period ending 9/30/15):
- 686 FTEs
- 24 Joint faculty
- 21 Postdoctoral Researchers
- 7 Undergraduate and 37 Graduate students
- 1,510 Facility Users
- 1,346 Visiting Scientists

FY 2015 Funding by Source: (Cost Data in $M)



FY 2015 Total Lab Operating Costs (excluding Recovery Act): $157.8 M
FY 2015 Total DOE Costs: $142.9 M
FY 2015 SPP (Non-DOE/Non-DHS): $14.9 M
FY 2015 SPP as % Total Lab Operating Costs: 9.4%
FY 2015 Total DHS costs: $0.0

Core Capabilities[19]

- Nuclear Physics
- Accelerator Science and Technology
- Large Scale User Facilities/Advanced Instrumentation

Scientific User Facilities[20]

- Continuous Electron Beam Accelerator Facility (CEBAF)

[19] Explanations of the Core Capabilities are located on the SC Laboratory Planning Process web page.
[20] SC designates scientific user facilities according to its policies and guidelines described on the SC facilities web page.

Crosscutting Boards and Councils

The Secretary of Energy has made several organizational changes, including consolidating the mission support functions of the Department to improve the effectiveness and efficiency of Departmental operations, and bringing together the management of the science and energy programs to improve the integration of these areas. In addition, the Secretary established a system of advisory councils to improve coordination of issues that cut across Departmental organizational lines. These councils of advisors provide enterprise-wide advice and analysis on issues ranging from management of the national laboratories to cyber security to nuclear policy.

The Secretary also engaged the directors of the national laboratories regarding the Department's mission and sought external advice from the Secretary of Energy Advisory Board (SEAB) on a number of important issues. These measures to improve internal coordination and reaching out for expert external advice have resulted in a robust examination of issues, and ensured a broader base of information and analysis from which to make informed decisions. The following are a listing of Departmental boards and councils.

Secretary of Energy Advisory Board

The Secretary of Energy Advisory Board (SEAB) is an external Federal Advisory Committee that provides the Secretary with timely, balanced, external advice on issues concerning the Department. The Board is subject to the Federal Advisory Committee Act and the recommendations of the Board are advisory. At the start of his term, DOE Secretary (Moniz) reactivated and restructured SEAB with four standing sub-committees to address each of the major Departmental mission areas: science, energy, nuclear security, and environmental management. Comprised of technologists, business executives, academics, and former government officials, SEAB provides advice and recommendations to the Secretary of Energy on the Department's basic and applied research and development activities; economic and national security policy; educational issues; operational issues; and any other activities and operations of the Department of Energy as the Secretary may direct. The Board conducts much of its work through ad-hoc task forces, comprised of SEAB members and outside experts. Task Force charges, membership, and reports are posted on the SEAB website (http://www.energy.gov/seab/secretary-energy-advisory-board).

Since September 2013, the Board has met quarterly, alternating locations between DOE Headquarters in Washington, DC and National Laboratories. To date, SEAB has steered twelve task forces and developed ten reports outlining their findings and recommendations to the Secretary. In addition to the studies undertaken by the SEAB task forces, the Board has offered advice at the request of the Secretary on a number of other issues of importance to the Department. SEAB's advice has been shared throughout the Department with the relevant Program Offices.

SEAB task forces have focused on:

- the National Laboratories (providing recommendations to improve the health and management of the labs);
- a nuclear power initiative in the period 2030 to 2050 where one or many nuclear technologies have reached technical and commercial maturity;

- opportunities and barriers for science and technology development for environmental cleanup;
- the mission and national capabilities related to next generation high performance computing;
- how FracFocus 2.0 houses the information federal and state regulatory agencies require with regard to disclosure of the chemical composition of fluids used in hydraulic fracturing;
- the management and early progress of the new management and funding mechanisms in the Department – Energy Frontier Research Centers (EFRCs), Energy Innovation Hubs (Hubs), Bioenergy Research Centers (BRCs), and the Advanced Research Projects Agency-Energy (ARPA-E);
- the crucial formative state of the Quadrennial Energy Review (QER) process;
- future areas of emphasis for the Department's nuclear nonproliferation activities;
- a framework for DOE's pre-commercial methane hydrate research effort;
- Federal energy management supported by DOE's Federal Energy Management Program;
- new areas for research by DOE investigators that could advance the pace of progress in biomedical sciences, and new mechanisms for conducting research in coordination with scientists from other organizations; and
- a framework for a Department of Energy Research, Development, and Demonstration program on CO_2 utilization technologies that have the potential to reduce CO_2 emissions and/or introduce negative emissions at the gigatonne scale.

National Laboratories

A key priority of the Department has been to strengthen the critical relationship with National Laboratories. DOE's National Laboratories are key to mission success across the broad spectrum of DOE's responsibilities. The National Laboratories comprise the most comprehensive research network of its kind in the world, and they are essential links in the Nation's innovation chain.

The DOE National Laboratory system consists of 17 laboratories, each with a core mission and core programmatic sponsor at DOE. Of the 17 laboratories, 16 are operated through Management and Operating (M&O) contracts. Some National Laboratories are focused on a single DOE program, while others have a core program that is strengthened by work performed for other DOE programs and sometimes for other government entities (such as Department of Defense or Department of Homeland Security) or private sector partners. DOE uses its laboratories to support and develop its priorities in program areas, and also develops and executes cross-cutting programs across the laboratories.

A number of external commissions – including the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL), the SEAB Task Force on the National Laboratories, and the Augustine-Mies report on NNSA – have found that the Department's oversight of its National Laboratories has grown increasingly transactional rather than strategically mission-driven. One critical element to address these concerns are two joint Federal-Laboratory bodies that provide the leadership and enterprise-wide coordination to effectuate this commitment to a partnership model: the Laboratory Policy Council (LPC) and the Laboratory Operations Board (LOB).

Laboratory Policy Council. The Secretary established the Laboratory Policy Council (LPC) in July 2013 to provide a forum to include the National Laboratories in strategic discussions of DOE's policy and program planning process, and for DOE to provide strategic guidance on National Laboratory activities. The LPC is chaired by the Secretary and comprised of senior DOE leadership and the National Laboratories Directors' Council (NLDC) Executive Committee. The LPC convenes three times a year and serves as an important forum for exploring emerging proposals related to new research directions, building human capacity, and improving communications, and discussing progress and guidance on initiatives, such as technology transition pilots and emergency response.

Discussions within the LPC have focused on crosscutting Departmental initiatives, DOE-lab studies by external bodies, management challenges, research areas, and workforce and leadership diversity. Specifically, one of the research issues raised in the LPC – technology development for environmental management – led the Secretary to charge the SEAB to conduct a study, which in turn provided a foundation for a larger budget request, a new technology development office as part of the restructuring of the EM organization, and increased collaborative activities around environmental cleanup with universities, industry, and government. A second idea raised in the LPC was for a new program to address the need for more leaders in energy with a broader view of the DOE enterprise and focus on current energy, national security, and scientific challenges. The new Energy Sciences Leadership Group (ESLG) assembles emerging leaders from the DOE's National Laboratories and academic partners to discuss and analyze current scientific and energy challenges. The LPC was also a forum for the Labs as Network communications piece, developed by the Labs to describe and illustrate how the National Laboratories operate as a network, often in partnership with universities and industry, to tackle large scale challenges and opportunities.

Laboratory Operations Board. The Laboratory Operations Board (LOB) was chartered in October 2013 with a charge "to strengthen and enhance the partnership between the Department and the National Laboratories, and to improve management and performance in order to more effectively and efficiently execute the missions of the Department and the National Laboratories." The LOB holds monthly video teleconference meetings, and meets in person quarterly. The LOB is chaired by the Under Secretary for Management and Performance, managed by a LOB Director, and its membership includes: the Chief Operating Officers (COO) of the programs with laboratories; the Deputy Under Secretary for Science and Energy; two representatives from the laboratory COO and Chief Research Officer groups; the Director of the Office of Management; a representative from the Field Office Managers; and a representative from the laboratory M&O contractor group.

One of the LOB's early efforts illustrates the enterprise-wide impact of the group: the LOB led a first-ever enterprise wide assessment of general purpose infrastructure across all 17 National Laboratories and NNSA sites and plants, using newly-established metrics to provide a uniform assessment of infrastructure such as utilities, HVAC systems, and office buildings. This initiative provided the basis for an additional $106 million requested by DOE, and funded by Congress in the Fiscal Year (FY) 2016 appropriations, targeted for general purpose infrastructure projects. In addition, the Secretary directed that each program's annual proposed investments in infrastructure should halt the growth of deferred maintenance. Since then, the LOB has led DOE on other operations and management issues such as: leading the Department's implementation of its response to the recommendations from the CRENEL commission; overseeing major changes to the Department's Directives process, which is responsible for Departmental Orders; and piloting a new Leadership Development Rotational Program that offers DOE Federal and laboratory mid-level and senior employees opportunities to rotate to laboratory or Federal sites.

The LPC and LOB have proven to be successful partnership forums for raising issues and assessing solutions by engaging relevant stakeholders. In reviewing the DOE-laboratory relationship, the CRENEL Commission's October 2015 report recognized that:

> *"there is significant improvement being made in this area under the current Secretary and directors of the National Laboratories, and wishes to support these and other steps in this direction. In particular, reactivating the National Laboratory Directors Council was a very positive step, which has resulted in much more open and effective collaboration between DOE and its laboratories in areas such as strategic planning and overall management. Likewise, reactivating the Laboratory Operations Board and other forums for collaboration of various groups within DOE and the laboratories is having very positive results. It is important that these continue."*

Energy Council

The Energy Council, chaired by the Secretary, serves as a forum for Department-wide consideration of energy issues – a tool to work across the diverse DOE mission areas and promote coordination across program offices. The Council, made up of senior leaders from across the Department's energy programs, provides advice to and receives direction from the Secretary and Deputy Secretary on issues of Department-wide applicability, including but not limited to strategic directions in energy policy; Department-wide energy RDD&D portfolio; coordination of strategies to address issues that may have cross-Departmental implications, including development of energy markets and business models; state, local, and tribal engagement and energy policy development; geopolitics of energy and the implications for the Department; and energy infrastructure, security, and resilience. The Energy Council meets monthly or as called by the Secretary. An Executive Committee of the Council sets the agenda.

The Energy Council has served as a forum for discussions focused on:

- identifying strategies for modernizing transmission networks;
- developing a more systematic approach to how DOE interacts with state, local, regional, and tribal governments, particularly as it relates to energy and climate policy;
- highlighting the growing importance of energy-water issues and DOE's role;
- expanding capital and lowering the cost of energy technology;
- safeguarding infrastructure against specific cyber, physical, and climate-related threats;
- examining the implications of nuclear power plant retirements;
- achieving the President's goal of doubling energy productivity by 2030;
- planning future policy for low-growth energy markets;

- establishing models for STEM-related workforce development programs;
- preparing the Quadrennial Technology Review;
- looking at the impact that low oil prices will have on the LNG market;
- improving international cooperation with regard to data sharing and environmental protection in the Arctic;
- reporting on and exploring next steps for DOE international activities related to the Road to Paris, Energy Ministerial, and COP21;
- exploring what an integrated program on smart cities might look like;
- reducing GHG emissions in coordination with the Climate Action Plan;
- understanding the implications of Mission Innovation for the Department;
- sharing the results of some of the Department's crosscutting activities; and
- discussing the baseline analyses prepared as part of the Quadrennial Energy Review.

Each of these discussions served to inform Departmental leadership beyond the Offices and individuals directly responsible for the activity; and provide an opportunity for broader input, increased coordination, and additional support for timely and important Departmental objectives.

Workforce and Job Creation

Jobs Strategy Council. The Jobs Strategy Council (JSC) is a cross-cutting initiative that integrates the research, technology, and economic resources of the Department to respond to the economic and workforce development needs of the energy industry. The mission of the JSC is to accelerate the growth of and access to jobs in all sectors of the United States energy economy. Made up of senior leaders from across the Department, the Council reports to the Secretary and Deputy Secretary. The Council is chaired by the Secretary or his/her designee.

The JSC's activities are concentrated in three areas: (1) energy and employment data collection; (2) workforce development activities in energy and advanced manufacturing technologies; and (3) integrating DOE technical assistance programs with state, local, and regional energy and economic development planning and implementation.

The JSC is responsible for conducting an annual national supplemental survey of employers in energy, energy efficiency, manufacturing, and transportation industries, and issuing the U.S. Energy and Employment Report (USEER), which tracks the relationship between energy technologies and employment growth in these key sectors of the U.S. economy.

The JSC also administers the Energy and Advanced Manufacturing Workforce Initiative composed of DOE Program Offices, the National Lab Directors Council (NLDC) Committee on Workforce Development, and five other federal agencies: the Departments of Labor, Education, Commerce, and Defense, and the National Science Foundation. This initiative is charged with coordinating the workforce development activities of these partners with a particular focus on the community college system and disadvantaged communities. It also sponsors a monthly Workforce Development Forum inside DOE for DOE Program Offices and Laboratories.

Lastly, the JSC administers cross-cutting energy and manufacturing-related technical assistance programs through place-based initiatives with state, local, and regional partners and NGO's designed to maximize job creation while creating replicable models. Examples include projects to model 21st Century infrastructure with the City of Pittsburgh; low income solar financing with the City of Baltimore and the Maryland Clean Energy Center; energy and manufacturing with the City of Brownsville, Texas; development of an energy blueprint with the State of Montana; and energy modeling with a group of national labor organizations.

Security

NNSA and other elements of DOE work together on matters of national and international importance through structures such as the emergency incident management council, the nuclear policy council, and the cyber council. In addition to these formal structures, many working groups also address national security issues that cut across multiple programs, such as the Plutonium Disposition Working Group and the Nuclear Enterprise Assurance Working Group.

Nuclear Policy Council. The Nuclear Policy Council, chaired by the Secretary, serves as a forum for Department-wide consideration of cross-cutting nuclear issues. The Council, made up of senior leaders from across the Department, advises, and receives direction from the Secretary and Deputy Secretary of Energy on key nuclear policy topics that transcend individual DOE program offices. The Council provides a means to address a range of cross-cutting nuclear issues – including nuclear energy, nuclear waste, and nuclear proliferation or nuclear terrorism – that the Secretary or Deputy Secretary have identified as priority matters requiring special attention or coordination. The Council was established in part to address a recommendation by SEAB that the Department should *"ensure the effectiveness of an organizational structure that provides for integration within DOE of all aspects of nuclear policy (including nuclear weapons, nuclear nonproliferation, nuclear energy, nuclear waste, emergency response, and nuclear counter-terrorism)."* The Council meets quarterly or as needed at the discretion of the Chair or Vice Chair.

The Nuclear Policy Council has examined and assessed issues such as: future domestic uranium enrichment requirements for defense, naval propulsion, and civil nuclear needs; interdependencies among DOE programs in managing nuclear materials and waste; advancing public understanding of the 20 year success of the DOE science, computation, and defense programs validating the nuclear stockpile without nuclear testing; the future DOE R&D roadmap to bolster verification of the Iran nuclear deal; the role of the DOE small modular reactors program in addressing civil nuclear, nonproliferation, and climate needs; the implications of the spread and operation of spent fuel reprocessing facilities in Asia for longer term US security interests; and future DOE nuclear expertise requirements.

Emergency and Incident Management Council. In July 2015, Secretary Moniz approved the charter for the Emergency and Incident Management Council (EIMC), which provides senior leadership oversight of DOE's emergency management preparation, response, and recovery activities. The Council, chaired by the Deputy Secretary, serves as the primary strategic coordination mechanism for senior Department leadership during significant emergencies that require the coordinated efforts of several DOE sites or programs.

Over the past year, the Department's senior leadership has used the EIMC to strengthen the DOE emergency management program. For instance, the Council oversaw the development of the

Unified Command Structure (UCS), which was created in 2015 to increase cooperation and coordination across the Department for the full spectrum of "all-hazard" emergencies. In addition, the EIMC is currently overseeing the creation of a Consolidated Emergency Operation Center (CEOC) that will allow the UCS to operate in a single facility and eliminate DOE's fragmented emergency operations center system. The new center will provide a unified, inclusive, and effective emergency management enterprise consistent with best practices in the Federal Government.

The EIMC has also been a key part of the Department's enterprise-wide exercise program. In addition to providing senior leadership guidance and strategic direction for this program, the Council has actually participated in multiple exercises that were designed to test and evaluate DOE's capabilities for responding and recovering from emergencies. Most notably, the EIMC provided strategic direction to the UCS during the Department's Clear Path IV exercise in April 2016. This exercise was Department's first cross-subsector, functional exercise since the creation of the UCS and involved nearly 200 participants from Federal, state, and local government as well as the electric, oil, and natural gas industries. Most importantly, it stressed and tested how the DOE team would respond to a catastrophic disaster with widespread impacts to energy infrastructure.

Cyber Council. The Cyber Council, chaired by the Deputy Secretary, is the principal forum for coordination of cyber-related activities across the Department and serves as an advisory body to the Deputy Secretary. DOE is engaged in three categories of cyber-related activities: (1) protecting the DOE enterprise – including government-owned, contractor-operated sites and facilities – from a range of cyber threats that can adversely impact mission capabilities; (2) bolstering the US Government's capabilities to address cyber threats; and (3) supporting energy sector efforts to strengthen cybersecurity. Membership includes senior leadership with responsibilities for cyber security. The Council meets every six weeks or as required by the Chair. The Cyber Steering Committee helps the Deputy Secretary set the agenda and prioritize the issues facing the Council.

The Council streamlined cyber governance for the department, and made the Council membership fully inclusive of all DOE entities. The Council oversaw the development of the DOE Cyber Strategy and its implementation, furthered Federal Information Technology Acquisition Reform Act implementation, and accelerated implementation of key cybersecurity measures resulting from lessons learned from the 2015 Office of Personnel Management breach. The Council also guided the evolution of department cyber operations centers to create the Integrated Joint Cybersecurity Coordination Center, which provides a collaborative, intelligence-driven, distributed approach to cybersecurity operations and response that engages DOE's full capabilities.

Security Committee. In an effort to enhance DOE's approach to security, the Secretary established the Security Committee, comprised of Chief Security Officers (CSO) across DOE. The Security Committee identifies corporate security strategies, guides security policy development, and provides a forum for cross-organizational issues. The Committee oversaw the development of a Design Basis Threat policy, further refining previous threat assessment processes. The Committee also provides guidance for security of special nuclear material, including addressing aging security infrastructure, and material control and accountability. The Committee has also led the department's efforts to develop counter-unmanned-aerial system security policies and pursue special airspace designations and engagement authorities to best protect DOE assets.

Risk, Management, and Operations

Energy Systems Acquisition and Advisory Board. The Energy Systems Acquisition Advisory Board supports the Department's strategic objective of achieving and maintaining excellence in project management; advises the Secretary on enterprise-wide project management policy and issues; and assists on critical decision milestones for Major System Projects. As part of the Secretary's and Deputy Secretary's ongoing efforts to improve the management of DOE's projects, the ESAAB has been revitalized and transitioned from a static, procedural process to an active and dynamic body. The ESAAB now convenes at least quarterly, or as regularly as required to perform its functions, and reviews all capital asset projects with a total project cost of $100 million or greater, instead of just those with a project cost of $750 million or greater as previously required. The Board is chaired by the Deputy Secretary and includes the DOE Under Secretaries, General Counsel, Chief Financial Officer, and Director of the Loan Program Office, among others.

The ESAAB recently reviewed projects with critical decisions including: the Marine Terminal Enhancements for the Strategic Petroleum Reserve; the River Corridor Closure Project; the Waste Treatment and Immobilization Plant; and the Salt Waste Processing Facility. In addition, the ESAAB has focused on those projects at risk of not meeting their performance baselines, and has been discussing project management and project execution across the Department.

Project Risk Management Committee. An integral part of the improved ESAAB is the support it receives from a committee established at the end of 2014 called the Project Management Risk Committee (PMRC). The PMRC provides enterprise-wide project management risk assessment and expert advice to the Secretary, the Deputy Secretary in her role as the Chief Executive for Project Management, Departmental Project Management Executives, and the ESAAB. The PMRC reviews capital asset projects with a total project cost of $100 million or greater, as well as projects less than $100 million total project costs at the risk of not meeting their performance baseline upon request. The PMRC meets weekly and is chaired by the Associate Deputy Secretary.

The PMRC has helped the Secretary and Deputy Secretary make fundamental changes to the way in which the Department manages projects. The PMRC led the recent update of the DOE's project management order (DOE Order 413.3B). The changes include following GAO's cost estimating best practices and analysis of alternatives best practices; ensuring completion of 90 percent of the design for large nuclear projects before construction begins; and ensuring high levels of technology readiness before establishing the cost and schedule baseline for large projects. The changes are helping DOE manage a diverse project portfolio, including some of the largest, most complex, and technically challenging projects in the public or private sector.

Credit Review Board. The Credit Review Board (CRB), chaired by the Deputy Secretary, ensures full consideration of credit management, debt collection, and policy issues by interested and affected persons inside and outside of DOE. The CRB makes recommendations to the Secretary prior to his granting final approval for any conditional commitment for a loan guarantee or loan, and participates in the oversight of the Loan Programs portfolio. The Loan Programs Office provides staff support to the CRB. The Department's Office of Loan Programs is responsible for day-to-day operation of the activities of the Loan Programs, including the review and evaluation of applications; the negotiation of terms and conditions of loans and loan guarantees; the monitoring and administration of Loan Programs portfolios; and the adoption of policies and procedures for the Loan Programs. The CRB meets at least quarterly, or as determined by the Chair.

Risk and Portfolio Monitoring Committee. The Risk and Portfolio Monitoring Committee (RPMC) plays a broad role in oversight of portfolio management, together with the LPO Director of the Portfolio Management Division (DPMD), to ensure that the Executive Director, the CRB, and the Secretary are appropriately informed regarding the portfolio as a whole, including significant or material actions or events affecting individual portfolio assets. The RPMC meets bi-weekly and is chaired by the Director of Risk Management in the Loan Programs Office. The RPMC is comprised of members from the Loan Program Office, Office of the Secretary, Office of the Chief Financial Officer, Office of General Counsel, and Office of Energy Policy and Systems Analysis

The RPMC reviews the status of projects in the LPO portfolio. During the bi-weekly meetings, LPO makes informational updates to RPMC members and shares proposed actions to be taken on specific projects. At the conclusion of meetings, as required, RPMC members vote on whether to undertake actions on specific projects.

Enterprise Risk Management Working Group. The Enterprise Risk Management (ERM) Working Group advises DOE leadership in the development and communication of a DOE ERM framework to identify and manage risks at the enterprise level across the DOE complex. The ERM Working Group supports the Department's new requirements detailed in OMB Circular A-123, *Management's Responsibility for Enterprise Risk Management and Internal Control*. The ERM Working Group is chaired by the Associate Deputy Secretary who also serves as the Department's Chief Risk Officer. Members include representatives from the Under Secretaries; the Office of the Chief Financial Officer; the federal site and field offices; the national laboratories; plants; and others.

The ERM Working Group is currently developing an ERM framework, common risk terminology, a risk profile template, and a methodology for identifying and analyzing risk.

DOE Operations Committee. The DOE Operations Committee, chaired by the Deputy Under Secretary for Management and Performance, meets on a weekly basis to better enable the Department to provide cross-agency operational leadership. The Committee was established to: assure coordination of Department-wide management initiatives at the Deputy Under Secretary level; resolve issues in executive correspondence, Departmental directives, and other cross-departmental materials; and provide operational guidance and direction on other matters as assigned or otherwise required. Committee membership includes the Deputy Under Secretary for Science and Energy, the Deputy Under Secretary for Nuclear Security, the Chief Financial Officer, and Chiefs of Staff for the Secretary and Deputy Secretary.

Since established, the Operations Committee has overseen a restructuring of the Department's directives and requirements processes and the Department's implementation of the Federal Information Technology Acquisition Reform Act. The Committee has also examined specific strategic budget issues and reviewed material related to Departmental transition efforts. The Chair of the DOE Operations Committee works closely with the Deputy Secretary as the Chief Operating Officer of the Department.

Federal Workforce

This section provides data on DOE's federal employee workforce by program and by site, and information on union membership.

DOE's Federal Human Capital Management programs and policies aim to create a Department-wide high-performance culture and attract, motivate, and retain a highly skilled and diverse workforce capable of meeting the challenges of the 21^{st} Century.

The Department requires a highly technical and specialized workforce to accomplish its scientific and technological missions. There is increasing competition for individuals with the knowledge, skills, and competencies that the Department needs. As a result, recruitment and retention of critical staff is more difficult. The Department continues to explore the use of corporate recruitment and retention strategies, especially through the use of recruitment, retention, relocation, and student loan incentives.

Throughout this section, tables are used to provide the on board count of federal employees by Headquarters office and field sites; pie charts are used to display federal workforce information on gender, race, education, occupational series, scientific and technical occupations, and age; and graphs are used to display some retirement projections. Finally, the last section provides information on union representation at DOE.

Federal Employee Staffing Levels

The following table displays the number of DOE employees on board at the end of FY 2016. The data is displayed by reporting organization, referred to as Program Secretarial Offices (PSO).

Staffing Analysis Tables. As depicted in the tables below, DOE had a total of 13,709 federal employees on-board as of the end of FY 2016, excluding FERC.

Department of Energy	
Departmental Staff and Support Offices	1,597
Under Secretary for Management and Performance	2,188
Under Secretary for Science and Energy	2,929
Under Secretary for Nuclear Security	2,388
Power Marketing Administrations	4,607
DOE TOTAL	**13,709**
FERC*	1,519
TOTAL	**15,228**

*Note: FERC was created as an independent regulatory agency through the Department of Energy Organization Act of 1977. In performance of this function, the employees of FERC are not responsible or subject to the supervision, management, or direction of any office or employee of any part of the Department of Energy. The management and execution of resources are maintained separately by each organization. As such, FERC employees are not included in any representation of the DOE workforce.

Departmental Staff and Support Offices		
HQ	Office of the Secretary	33
HQ	Secretary's Advisory Board	15
HQ	ARPA-E	48
HQ	Chief Financial Officer	168
HQ	Loan Programs Office	92
HQ	Congressional & Intergovernmental Affairs	30
HQ	Energy Information Admin	325
HQ	*HQ SSC*	3
HQ	General Counsel	179
HQ/Field	Inspector General	283
HQ	Intelligence and Counterintelligence	188
HQ	International Affairs	65
HQ	Energy Policy & Systems Analysis	58
HQ	Public Affairs	24
HQ	Small & Disadvantaged Bus Utilization	11
HQ	Enterprise Assessments	75
	Sub-Total SSO	***1,597***

Under Secretary for Management and Performance		
HQ	Environmental Management	291
HQ	*HC SSC*	*28*
Field	Carlsbad Field Office	63
Field	Consolidated Business Center	160
Field	EM Los Alamos	19
Field	Portsmouth & Paducah	57
Field	Richland Operations Office	259
Field	Office River Protection	138
Field	Savannah River Operations	270
Field	EM-Oak Ridge Site	77
HQ	Legacy Management	54
HQ	Management	219
HQ	Office of Human Capital Officer	134
HQ	*WCF05W*	*14*
HQ	*HC-Experts*	*1*
HQ	*AR Recovery Act*	*1*
HQ	Chief Information Officer	104
HQ	Economic Impact and Diversity	22
HQ	Hearings and Appeals	20
HQ	Environment, Health, Safety & Security	228
HQ	Office Project Mgt. Oversight & Assessment	29
	Sub-Total USM&P	***2,188***

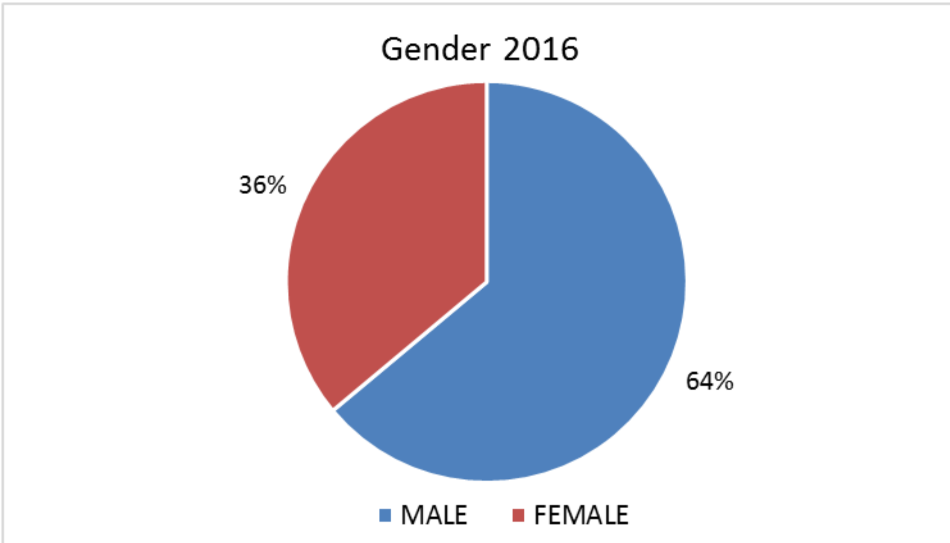
Under Secretary for Science and Energy		
HQ	Office of Science	520
HQ	*HC SSC*	*26*
Field	Chicago Office	153
Field	Ames Site Office	4
Field	Argonne Site Office	27
Field	Berkeley Site Office	18
Field	Brookhaven Site Office	23
Field	Fermi Site Office	16
Field	Pacific Northwest Site Office	36
Field	Princeton Site Office	13
Field	SLAC Site Office	12
Field	Oak Ridge Office	166
Field	Thomas Jefferson Site Office	11
Field	ORNL Site Office	37
HQ	Technology Transitions	6
HQ	Electricity Delivery and Energy Reliability	96
HQ	Energy Efficiency and Renewable Energy	453
HQ	*HC SSC*	*12*
Field	Golden Field Office	*144*
HQ	Fossil Energy	130
HQ	*HC SSC*	13
Field	Nat'l Energy Tech Lab	520
Field	Strategic Petroleum Reserve	83
HQ	*HC SSC*	*3*
HQ	Nuclear Energy	159
HQ	*HC SSC*	*6*
Field	Idaho Ops Office	223
Field	NE-Oak Ridge Site	6
HQ	Indian Energy Policy and Programs	6
HQ	Office of Planning and Mgt. Oversight	7
	Sub-Total USS&E	***2,929***

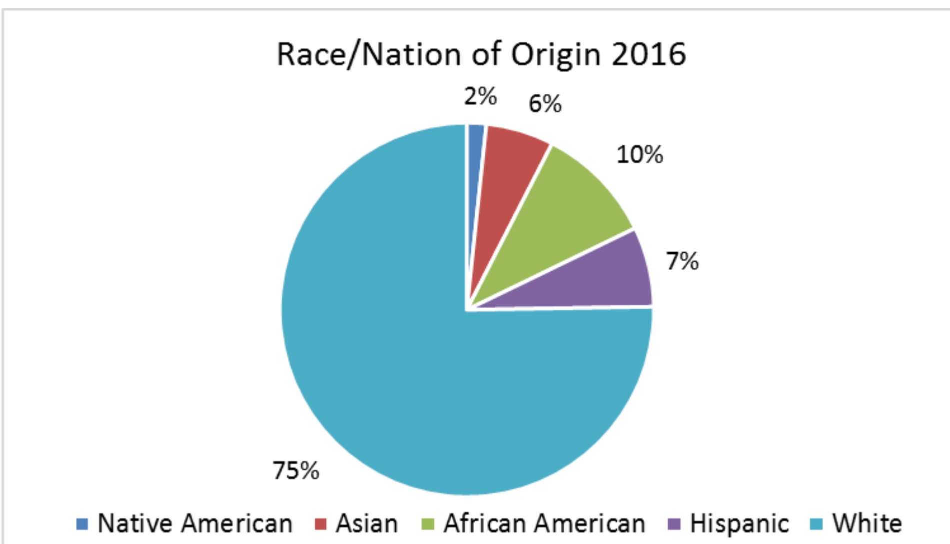
Under Secretary for Nuclear Security		
HQ	NNSA – Office of Administrator	32
Field	Emergency Operations	48
HQ	Def Nuclear Security	82
HQ	Counter-Terrorism	48
HQ	External Affairs	13
HQ	General Counsel	40
HQ	Acquisition and Project Mgt.	163
HQ	Management and Budget	203
HQ	Info Mgt. and Chief Information	32
HQ	Safety, Infrastructure and Operations	99
HQ	Deputy Admin for DP	708
Field	NNSA Production Office	127
Field	Sandia Site Office	83
Field	Kansas City Site Office	38
Field	Los Alamos Site Office	79
Field	Nevada Site Office	75
Field	Livermore Site Office	74
Field	Savannah River Site Office	26
HQ	Deputy Admin for NN	182
HQ	DA for Naval Reactors	127
Field	NR Lab Research Center	109
	Sub-Total for NNSA	***2,388***
Power Marketing Administrations		
Field	Bonneville Power Administration	2,923
Field	Southeastern Power Administration	36
Field	Southwestern Power Administration	170
Field	Western Area Power Administration	1,478
	Sub-Total PMAs	***4,607***

Federal Employee Demographics and Skills

Gender and Race. The charts below show the diversity and gender make-up of DOE's federal workforce in FY 2016. The gender profile in FY 2016 indicates that 64% of the workforce is male and 36% female.

DOE Federal Workforce: Gender and Race

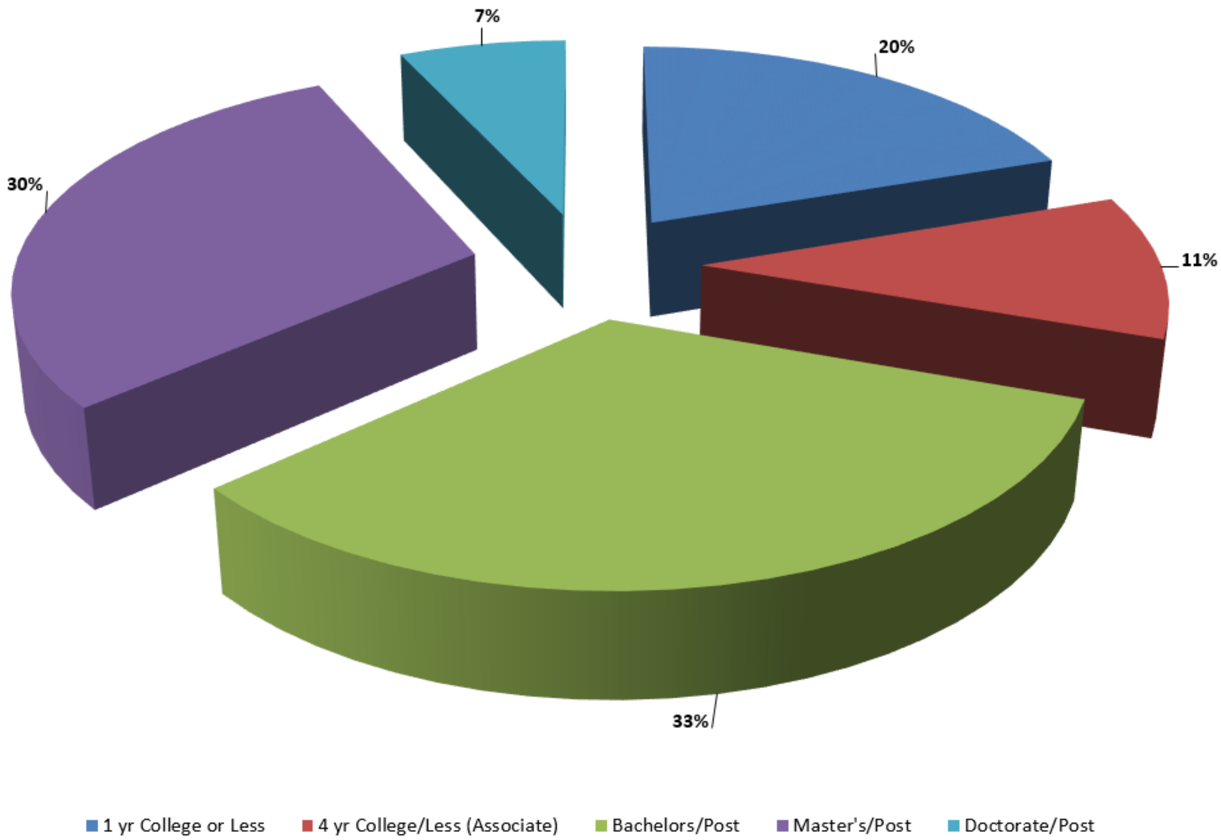




Federal Employee Demographics and Skills (continued)

Education. The chart below indicates a highly educated DOE workforce with most (70%) of DOE employees having earned a Bachelor's Degree or higher. This is not unexpected in a science and technology agency.

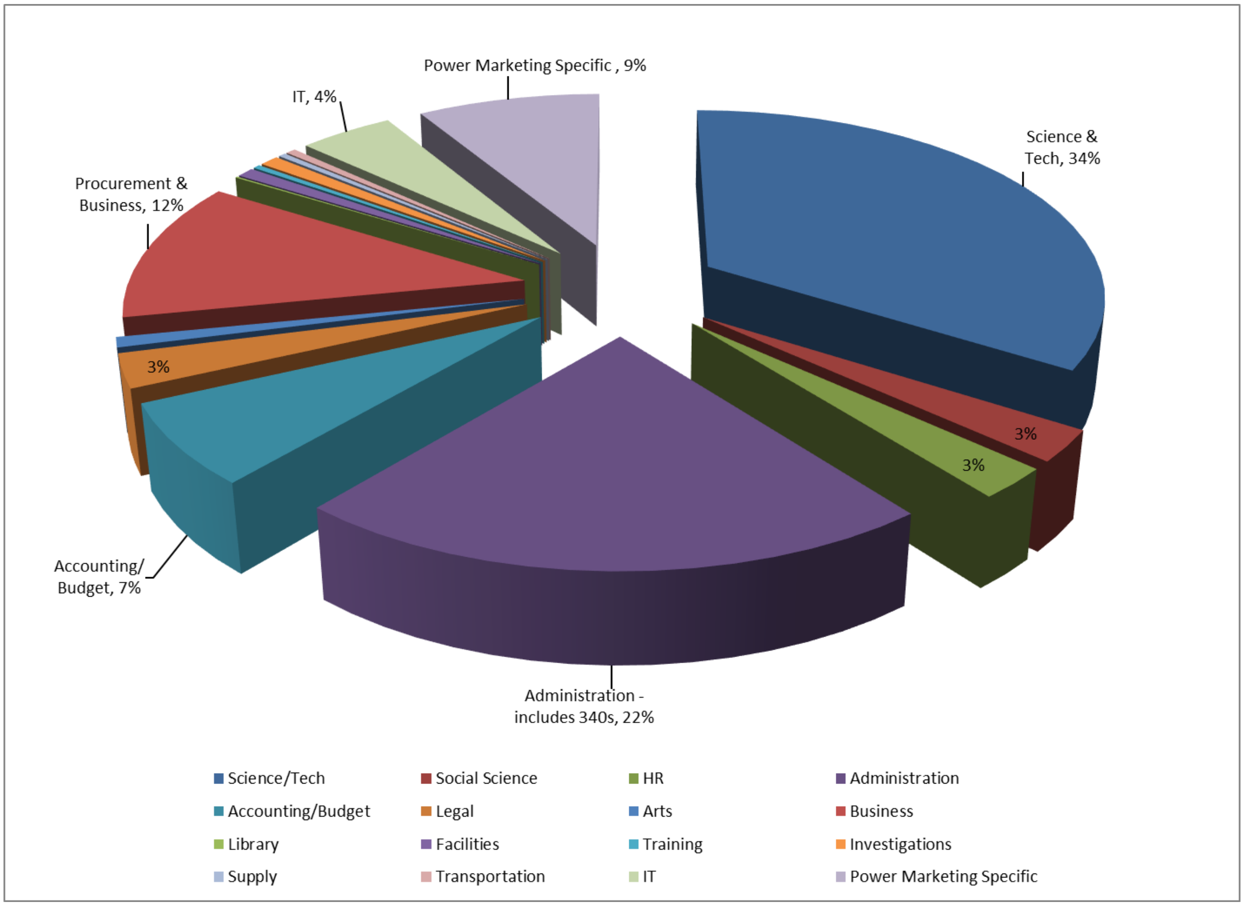
DOE Federal Workforce: Education
(as of August 2016)



Federal Employee Demographics and Skills (continued)

Occupational Mix. The chart below displays the occupational makeup of DOE's federal workforce. The slices are groupings of different categories of occupations, called Occupational Series (OS). The three largest occupational series include: scientific and technical (34%); administration (22%); and procurement and business (12%).

DOE Federal Workforce: 2016 Occupational Series Mix



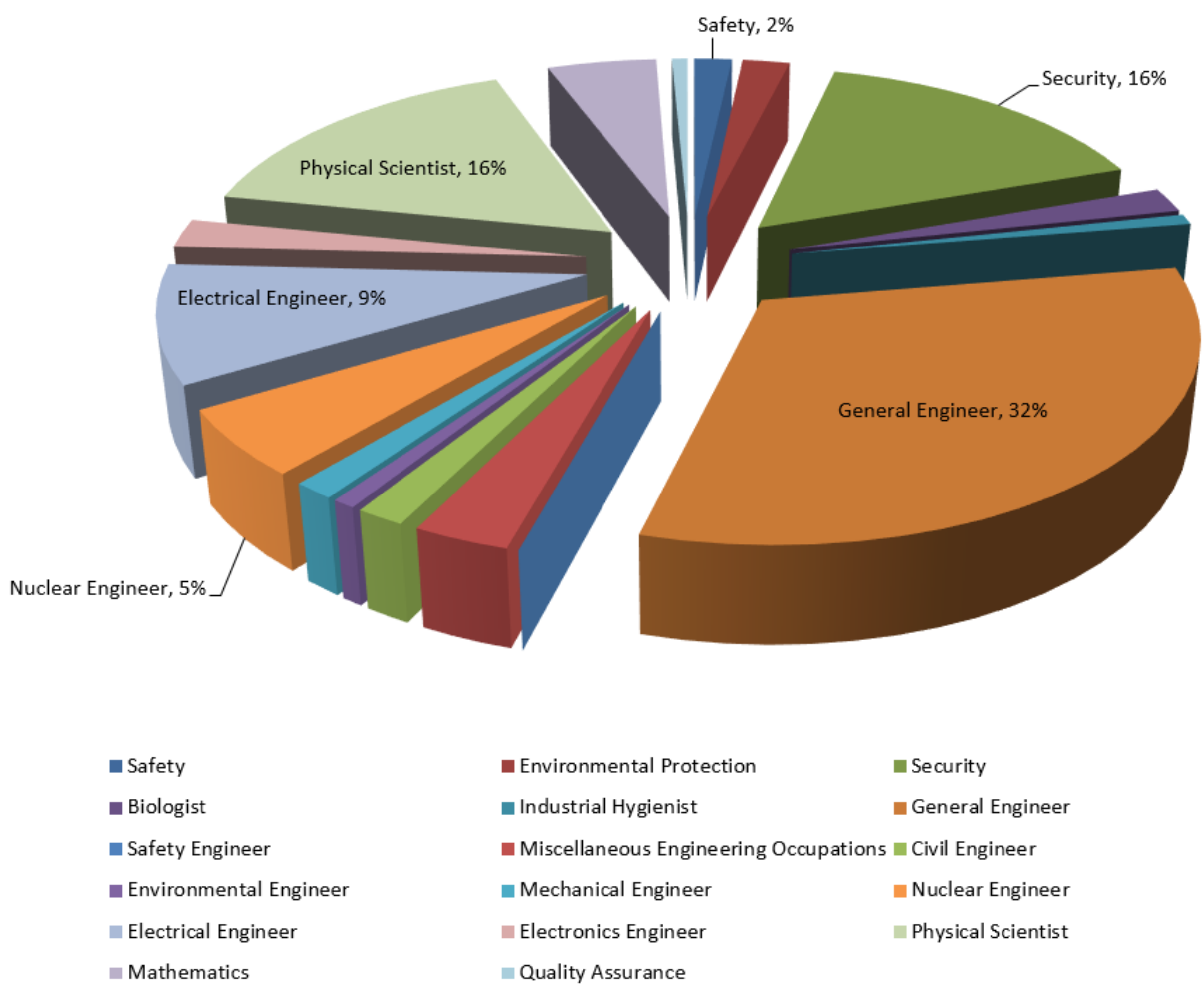
Federal Employee Demographics and Skills (continued)

Scientific and Technical Workforce Breakdown. As indicated in the chart above, DOE's scientific and technical workforce makes up 34% of DOE's total workforce. A breakdown of this workforce is shown in the chart below.

The scientific and technical workforce is defined by the following categories: Engineering; Physical Science; Safety and Occupational Health Management; Safety Technicians; Environmental Protection Specialists; Fire Protection and Fire Prevention Specialists; Industrial Hygienists; Environmental Health Technicians; Quality Assurance Specialists; and all Excepted Service Employees (Pay Plan EK) hired under the National Defense Authorization Act.

The chart below shows that General Engineers, Electrical Engineers, and Nuclear Engineers together make up roughly half of DOE's federal scientific and technical workforce. Several other engineering series have small populations (miscellaneous, civil, electronic, and safety), and when combined with general, electrical, and nuclear engineers, the engineering category makes up roughly two thirds of the DOE scientific and technical workforce.

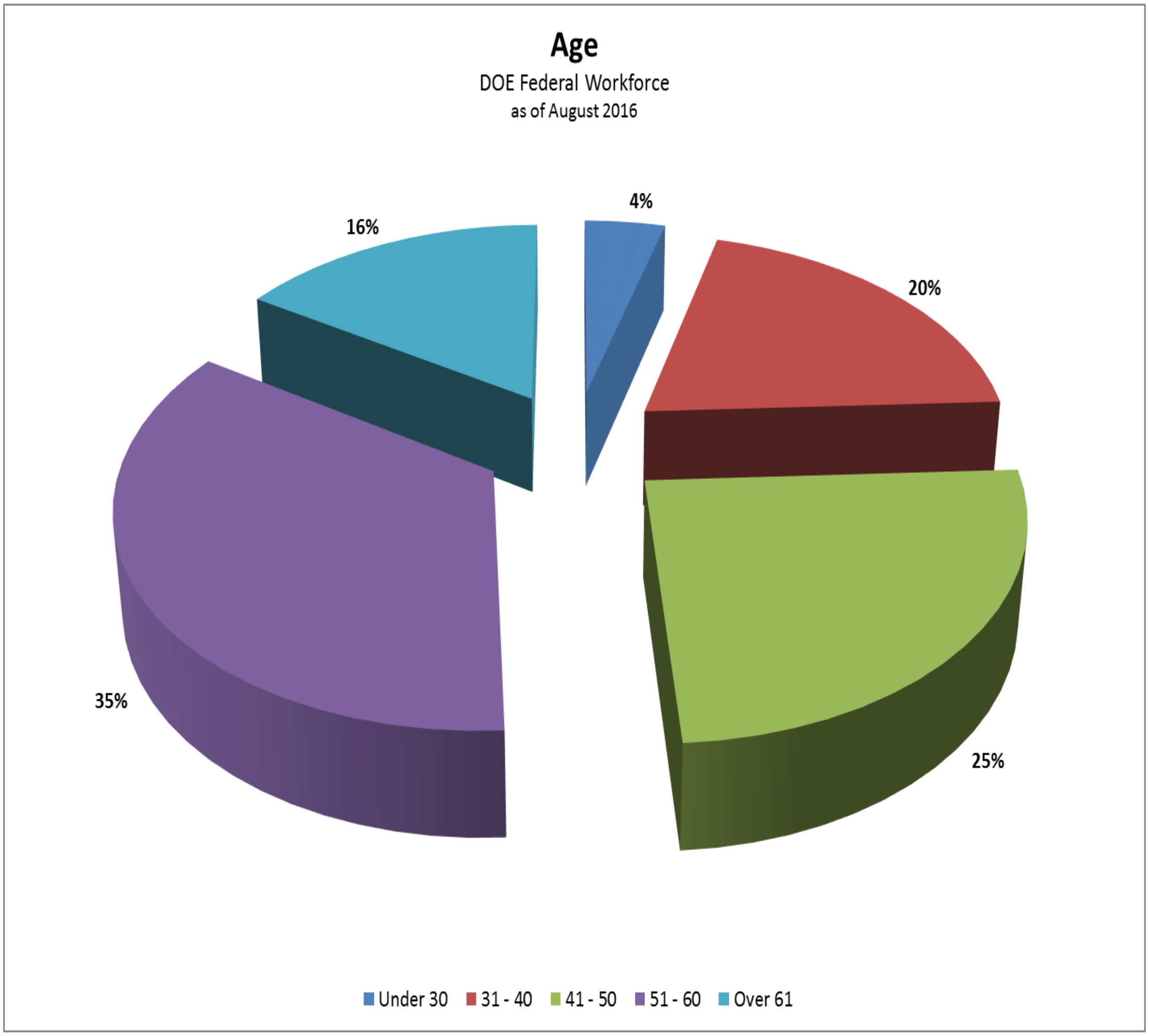
DOE Federal Workforce: 2016 Scientific and Technical Occupations



Federal Employee Staffing Retirement

Age. DOE's federal workforce is aging. The chart below displays the current age distribution of DOE's federal workforce. Over the last five years, DOE's average age has increased slightly to just over 49 due to slight increases in the population of employees ages 31–40 and older than 61.

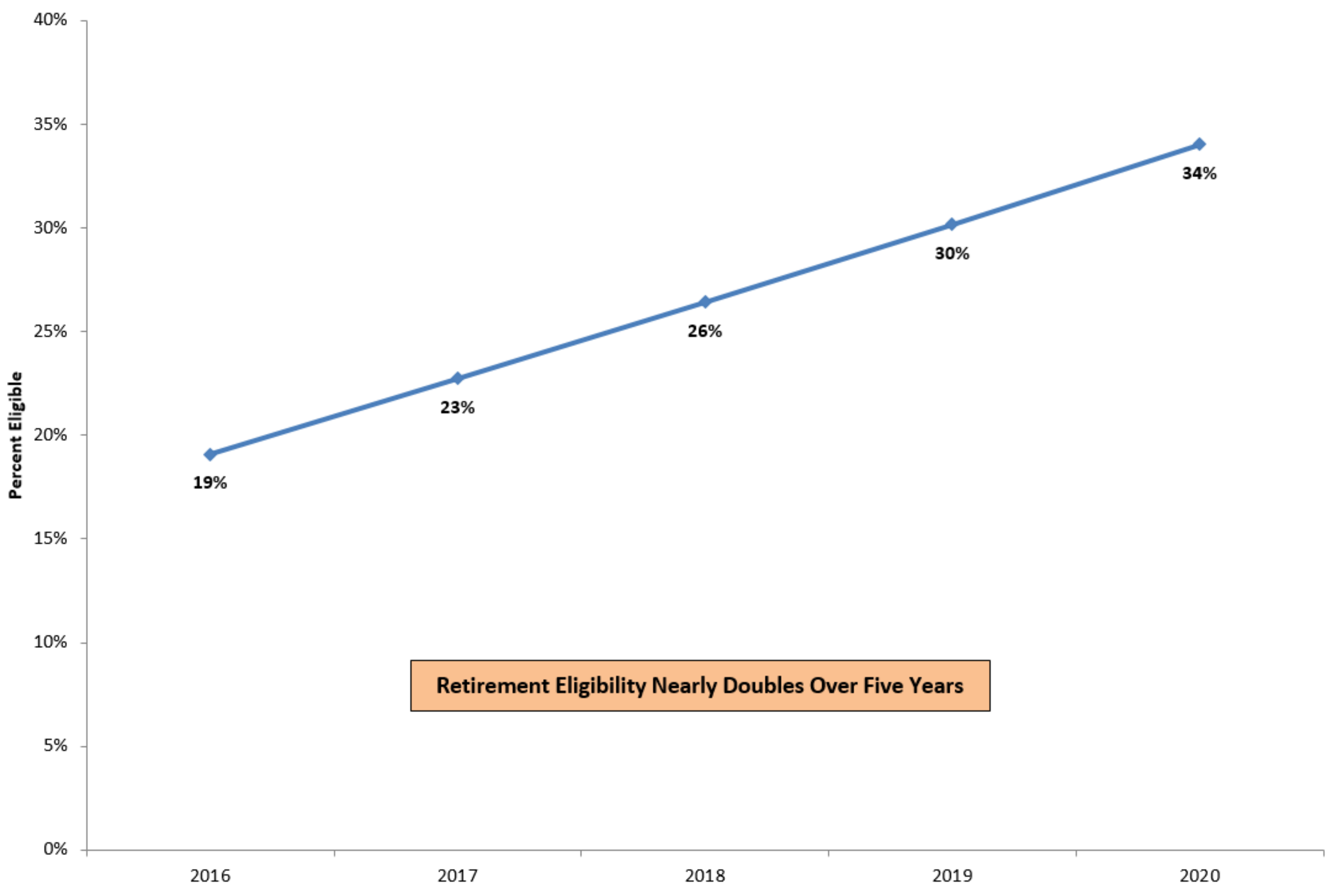
DOE Federal Workforce: Age Distribution



Federal Employee Staffing Retirement (continued)

Retirement Eligibility. The Department's retirement eligibility forecast, coupled with the aging workforce, presents a significant human capital challenge. The chart below shows the percentage of the present population that will be eligible to retire over the next four years. This is simply an eligibility chart, not a prediction of what will happen. However, this chart indicates that over one-third (34%) of the current federal employee population will be eligible to retire by the end of 2020.

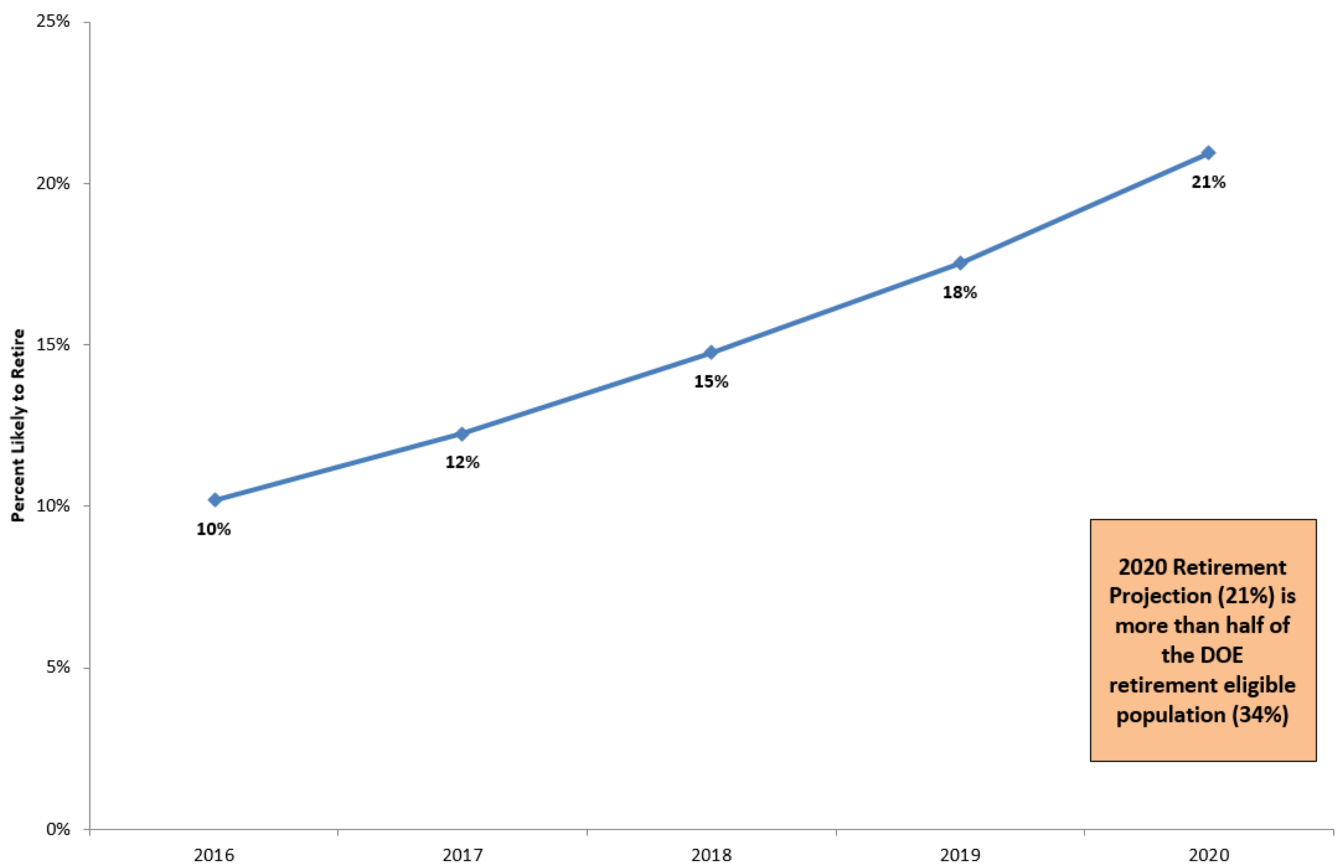
DOE Federal Workforce: Voluntary Retirement Eligibility



Federal Employee Staffing Retirement (continued)

Retirement Projections. Based on historical data of when employees retire, DOE has determined that, on average, employees retire about 3.5 years after they have become eligible. This analysis has implications for DOE's projected retirement losses. The chart below shows a projection of 10 percent of the workforce actually retiring as opposed to 19 percent eligible in FY 2016, and a projection of 21 percent retiring in FY 2020 as opposed to eligible retirements of 34 percent.

DOE Federal Workforce: Retirement Projections
(with more than 3.5 years of Retirement Deferment)



Federal Employee Unions

Overview

Bargaining unit employees are employees of the Agency not excluded by statute (e.g. managers, supervisors or confidential employees), who are entitled to representation by a recognized labor organization and are covered by a collective bargaining agreement. Bargaining unit employees may elect to pay dues or not pay dues. About 6,300 DOE employees, located at eight sites Department-wide, are included in bargaining units.

The Collective Bargaining Agreement (CBA) is the written document incorporating the agreed-to conditions of employment affecting bargaining unit employees. Conditions of employment subject to bargaining include, but are not limited to, personnel policies, practices, and matters such as hours of work, leave administration, performance management, awards, merit promotions, hours of work, and discipline.

The union has an obligation to represent all bargaining unit employees whether they pay dues or not. Representation includes collective bargaining, grievances, formal meetings, responses to proposed disciplinary actions, and third party representation.

The union has a right to be present and invited to comment or speak during formal meetings with bargaining unit employees. Generally, a meeting is considered to be formal when held with a supervisor or higher level manager; has a scheduled time and place; an established agenda; is mandatory; may have a note taker; and discusses changes in personnel policies and procedures, and other conditions of employment. It does not include an operational staff meeting.

Bargaining unit employees are entitled to representation during investigatory meetings or interviews. Known as *Weingarten Rights*, the employee may request union representation during any examination by an Agency representative in connection with an investigation if the employee reasonably believes that the examination may result in disciplinary action against the employee. In accordance with the CBA, DOE HQ bargaining unit employees who may be subject to discipline as a result of the investigation will be apprised of their *Weingarten Rights* at the beginning of the investigatory interview.

Department of Energy Headquarters, Labor Relations

The National Treasury Employees Union (NTEU) is the most visible union due to its location at headquarters. However, The American Federation of Government Employees (AFGE) is the largest union within the Department; AFGE is located at most of DOE's field sites. The NTEU has had bargaining recognition with DOE Headquarters (HQ) since 1979. Anthony Reardon is the current National President of NTEU. Rich Oztel is the NTEU national representative for the NTEU HQ Chapters. There are two NTEU Chapters: Chapter 213 (covers bargaining unit employees in Washington D.C.); and Chapter 228 covers bargaining unit employees in Germantown, MD. Below is a list of all federal labor unions within DOE.

BONNEVILLE POWER ADMINISTRATION

- Columbia Power Trades Council (CPTC)
- International Brotherhood of Electrical Workers (IBEW), Local 125 (Portland, OR)
- International Association of Machinists and Aerospace Workers (IAMAW), District Lodge 24 (Portland, OR)

- International Brotherhood of Painters and Allied Trades (Painters), Painters District Council 55, Local 360 (Portland, OR)
- International Union of Operating Engineers, Local 701 (Gladstone, OR)
- Sheet Metal Workers International Association, Local 16 (Portland, OR)
- United Association of Journeymen & Apprentices of the Plumbing & Pipefitting Industry of the United States and Canada, Local 290 (Tualatin, OR)
- International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America, Local 58 (Vancouver, WA)
- Laborers International Union of North America (LIUNA), Local 335 (Vancouver, WA)
- American Federation of Government Employees (AFGE), Local 928 (Portland, OR)

NATIONAL ENERGY TECHNOLOGY LABORATORY

- American Federation of Government Employees (AFGE), Local 1995 (Morgantown, WV)
- American Federation of Government Employees (AFGE), Local 1916 (Pittsburgh, PA)
- American Federation of Government Employees (AFGE) Local 1104 (Albany, OR)

HEADQUARTERS, DEPARTMENT OF ENERGY

- NTEU, Local 213 (Washington, DC)
- NTEU, Local 228 (Germantown, MD)

IDAHO OPERATIONS OFFICE

- International Federation of Professional and Technical Engineers (IFPTE), Local 94 (Idaho, ID)

OAK RIDGE OFFICE

- Office of Professional Employees International Union (AFL-CIO), Local 2001 (Oak Ridge, TN)

RICHLAND OPERATIONS OFFICE

- American Federation of Government Employees (AFGE), Local 788

SOUTHWESTERN POWER ADMINISTRATION

- International Brotherhood of Electrical Workers (IBEW), Local 1002 (Tulsa, OK)

WESTERN AREA POWER ADMINISTRATION

- American Federation of Government Employees (AFGE), Locals 3824 (Loveland, CO) & Local 3807 (Watertown, SD)
- International Brotherhood of Electrical Workers (IBEW-GCC-1), Locals 640 (Phoenix, AZ), 1245 (Folsom, CA), 1795 (Loveland, CO), 1959 (Sioux Falls, SD), & 2159 (Montrose, CO)

DOE Employee Engagement

Most Improved Agency – Team Win

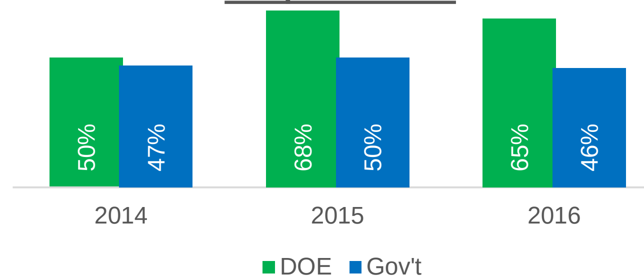
- 15% increase in response rate
- 52% increase in breakout reports
- 12% increase in belief survey results will be used (had lowest score in Government)
- 7% increase in engagement
- 8% increase in global satisfaction

Key Success Factors

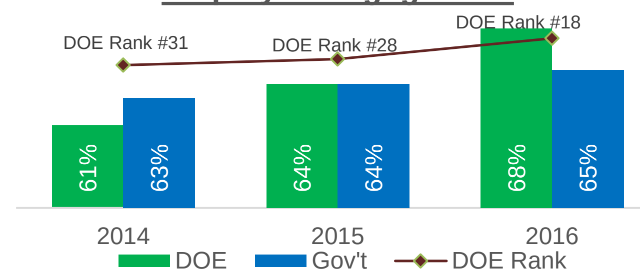
- Leadership attention and accountability for engagement
- Engagement action plans and leadership communication
- Strong data analysis and engagement-aligned services
- Labor Management Forum and employee resource group collaboration
- Employee-driven Workplace Improvement Networks

Team Goal – Top 5 in 5 Years

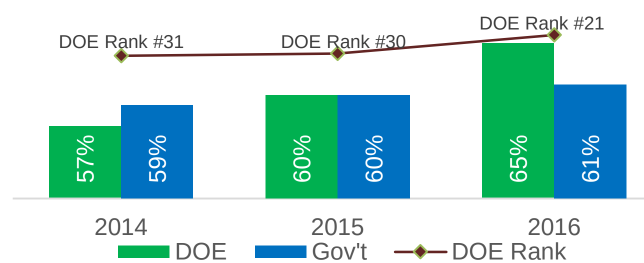
Response Rate



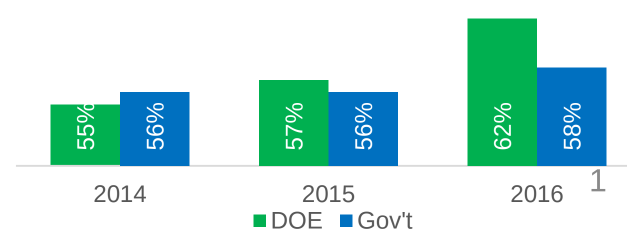
Employee Engagement



Global Satisfaction



New IQ



DOE Laboratory and Contractor Staffing

There are far more DOE contractor employees than federal employees throughout the DOE complex. Contractor employees are critical for carrying out the diverse array of energy programs at DOE's nationwide complex of headquarters and field organizations, national laboratories, power marketing administrations, and special purpose offices, and its vast array of energy programs. The chart below displays the number of DOE contractor employees as of the end of FY 2015 by program and by site.

PROGRAM HEADCOUNTS BY END OF FY 2015								
SITE	EM	NE	SC	EERE	NNSA*	OTHER DOE**	NON-DOE***	TOTAL
Ames Lab			261	32		14	3	**310**
Argonne National Lab	19	163	1,875	326	245	108	537	**3,273**
Bechtel Marine Prop (PA/NY/ID) - NRLFO****					5,073			**5,073**
Brookhaven National Lab		7	2,575	12	28	40	145	**2,807**
East Tennessee Tech Prk	677							**677**
Fermi National Accelerator Lab			1,803					**1,803**
Hanford Site (ORP)	4,943							**4,943**
Hanford Site (RL)	3,826							**3,826**
Idaho National Lab	4	2,468	23	162	221	33	984	**3,895**
Idaho Site	1,754							**1,754**
Jefferson National Laboratory			661			44	29	**734**
Kansas City Plant					2,224		350	**2,574**
Lawrence Berkeley Natl Lab			3,155					**3,155**
Lawrence Livermore Natl Lab					4,028	416	968	**5,412**
Los Alamos National Lab	340				6,668	926	779	**8,713**
National Renewable Energy Lab			39	1,622		9	76	**1,746**
Nevada National Security Site					1,853	250	323	**2,426**
Oak Ridge Complex-Wide*****	70		134					**204**
Oak Ridge Institute for Science & Education	8	2	107	13	96	85	294	**605**
Oak Ridge National Lab	23	199	2,720	384	357	256	694	**4,633**
Pacific Northwest National Lab-OR	258	97	1,054	460	908	479	1,121	**4,377**
Paducah Site	1,113							**1,113**
Pantex and Y-12					7,692	16	152	**7,860**
Portsmouth	1,840							**1,840**
Princeton Plasma Physics Lab			530					**530**
Sandia National Labs					6,789	805	3,765	**11,359**
Savannah River Site	5,656				1,642	3,602	734	**11,634**
SLAC National Laboratory			1,488					**1,488**
Strategic Petroleum Reserves						526		**526**
Waste Isolation Pilot Plant - Carlsbad	764							**764**
West Valley Demonstration Project - EMCBC	200							**200**
TOTAL	**21,495**	**2,936**	**16,425**	**3,011**	**37,824**	**7,609**	**10,954**	**100,254**

Note:

* NNSA – Includes Program Direction, Naval Reactors, Weapons Activities, Defense Nuclear Proliferation and DNN Construction.

** Other DOE – Includes but not limited to; Fossil Energy, Electricity Delivery & Energy Reliability, Advanced Research Projects Agency, Environmental, Health, Safety and Security, Energy and Threat, and Office of the Chief Financial Officer.

*** Non-DOE – Includes Strategic Partnership Projects (formerly "Work for Others") which is work performed for non-DOE entities by DOE/NNSA personnel and/or their respective contractor personnel or the use of DOE/NNSA facilities for work that is not directly funded by DOE/NNSA appropriations.

**** NRLFO – Naval Reactors Laboratory Field Office.

***** Oak Ridge Complex-wide – National Strategic Protective Services, LLC (Protective force operations and management).

The National Nuclear Security Administration (NNSA) employed the highest number of contractor employees, totaling 37,824. The Office of Environmental Management (EM) and the Office of Science (SC) employed the second and third highest number of contractor employees, totaling 21,495 and 16,425, respectively. Non-DOE organizations also employ a large number of contractor employees at DOE's national laboratories. These contractor employees perform work for entities other than DOE, including work for other federal agencies, such as the Department of Defense (DOD) and the Department of Homeland Security (DHS).

Geographically, the Oak Ridge, Tennessee facilities – which include large EM cleanup projects and a national laboratory, as well as the Y-12 National Security Complex – employs the largest number of contractor employees. The Oak Ridge facilities had a total of 13,979 contractor employees at the end of FY 2015. The Hanford area of Washington State, which also has a national laboratory and large EM cleanup projects, has the second largest number of contractor employees. This area, which includes the Hanford Site, the Office of River Protection, and the Pacific Northwest National Laboratory, employed 13,146 contractor employees at the end of FY 2015.

CONTRACT MANAGEMENT

DOE CONTRACT MANAGEMENT

DOE primarily accomplishes its work in the field through contracts. This section describes unique aspects of DOE's history and strategies with managing its most complex contracts. DOE contracts run the gamut from providing routine supplies and services to the production of nuclear weapons, environmental remediation, construction and operation of one-of-a-kind chemical processing facilities, and acquisition of world class scientific research and development.

In carrying out its mission, DOE manages a vast array of scientific, energy, and nuclear programs and a nationwide complex of headquarters and field organizations, national laboratories, power marketing administrations, and special purpose offices. Contracting is critical to DOE's mission accomplishment. In FY 2015, annual procurement obligations represented 94% of DOE's total budget. Detailed information on DOE's prime award spending can be found on USASpending.gov, including instrument type, number and total obligations.

DOE Management and Operating (M&O) Contracts and Federally Funded Research and Development Center (FFRDC) Contracts

The most unique aspect of the Department's contracting is its use of Management and Operating (M&O) contracts. M&O contracts provide for the management of Government-owned, contractor operated scientific, engineering, and production facilities. Under this form of contracting, for-profit and not for-profit organizations, including academic institutions, manage DOE's research and development laboratories, nuclear weapons laboratories, strategic petroleum reserves, environmental remediation and clean-up, the production and dismantlement of nuclear weapons, and nuclear waste management operations.

M&O contracts are defined as agreements under which the Government contracts for the operation, maintenance, or support, on its behalf, of a Government-owned or -controlled research, development, special production, or testing establishment wholly or principally devoted to one or more major programs of the contracting Federal agency. The M&O form of contract was originally developed by the Manhattan Project and the subsequent Atomic Energy Commission in order to ensure Government control of the production of fissionable materials while obtaining the benefits of the private sector's management expertise and resources. M&O contracts have a separate regulatory base and are characterized both by their purpose and by the special relationship created between Government and contractor (much closer than the traditional "arms-length" contracting relationship). The work performed under an M&O contract is closely related to DOE's mission and is of a long-term and continuing nature.

The number of DOE M&O contracts has declined from 41 in 1994 to 22 today. Today, most of DOE's M&O contracts are for the management and operation of nuclear weapons production plants and the operation of national laboratories that have also been designated as FFRDCs. FFRDC's enable agencies to use private sector resources to accomplish tasks that are integral to their mission and operations. They are sponsored under a broad charter by a Government agency in order to meet special, long-term research and development needs that cannot be met as effectively with in-house or contractor resources. In order to fulfill their mission, FFRDCs have access beyond the normal contractual relationship to Government and supplier data, employees, and facilities. Additionally, FFRDCs must receive at least 70 percent of their financial support from the Government.

The M&O contract model aligns well with the FFRDC model. Both models envision a close, long-term relationship devoted to sponsoring cutting-edge research that is directed by the Government. Over DOE's history, the Government has received remarkable benefits from the world class research and the innovative technical accomplishments of the national laboratories and M&O contractors. The DOE national laboratory system represents the most comprehensive research system of its kind in the world and is responsible for performing research and development for which there is a strong public and national purpose. The M&O contract model, central to the laboratories' operation, furthers DOE's ability to deliver world class research and the innovative technical accomplishments necessary to accomplish its missions. As a testament to the ongoing success of the FFRDC M&O contract model, DOE laboratories have produced more than 60 Nobel Laureates and hundreds of R&D awards.

Prior to 1996, the Department did not regularly conduct competitions for the vast majority of its M&O contracts and was perceived by some as having a poor record of competition. However, beginning in late 1996, DOE established a preference for competition following the statutory and regulatory framework established for M&O contracts. In addition to the standard federal statutes regulations governing competition of contracts, the federal regulations governing M&O contracts require the Government to consider the incumbent contractor's technical and cost performance, whether there is an expectation of meaningful improvement in performance, the potential impact of a change in contractors on program needs, including safety and national defense, and whether it is likely that qualified offerors will compete for the contract. DOE recognizes a preference for full and open competition, and exercises on a case-by case basis, the authorities available to the Secretary under the Competition in Contracting Act, and the federal regulations to non-competitively extend an M&O contract when the extension is justified. The regulatory framework governing M&O contracts and FFRDC's has long recognized the unique nature of these contracts and it provides the necessary criteria for the Agency to make an informed decision as to whether to extend or compete an M&O contract prior to its expiration. DOE has an excellent record of competing its contracts, including M&O contracts. In FY 2015, the Department was among the leaders in the federal government in competition, competing 92% of its contracting dollars.

DOE's M&O contractors are motivated in a variety of ways, depending on the nature of the firm, the Government's requirement, or other specific circumstances. No single method applies to all contractors. The goal of the Department is to obtain maximum return from its contractors by offering a rational mix of integrated, fair, and challenging incentives to its contractors. Accordingly, DOE utilizes the full range of performance incentives, both monetary and non-monetary, always seeking to link them with clearly defined performance objectives and measures. For example, DOE utilizes Award Term incentives in many of its competitively awarded Office of Science (SC) and National Nuclear Security Administration (NNSA) sponsored national laboratory contracts, in addition to a small performance fee, to incentivize performance. Award term provides extended performance periods rather than using a large fee or profit as an incentive. By DOE policy, award term is not used in the M&O contracts that are non-competitively extended by the Secretary. Extending the term of performance, with a small performance fee, for the contractors that deliver excellent performance in supporting SC and NNSA initiatives at these laboratories has been a successful incentive. Below is a list of DOE's M&O contracts with their associated FY 2015 obligations.

Sponsor	DOE Site/Facility	M&O Contractor	Award Date	Contract End Date	Ultimate Potential Contract End Date *	FY 2015 Obligations
EE **	National Renewable Energy Laboratory	Alliance for Sustainable Energy	7/29/2008	9/30/2018	9/30/2018	$349,134,810
EM	Waste Isolation Pilot Plant	Nuclear Waste Partnership LLC	4/20/2012	9/30/2017	9/30/2022	$254,778,156
EM **	Savannah River Site (includes Savannah River National Laboratory)	Savannah River Nuclear Solutions, LLC	1/10/2008	9/30/2016	7/31/2018	$897,374,547
FE	Strategic Petroleum Reserve	Fluor Federal Petroleum Operations	4/1/2014	3/31/2019	3/31/2024	$117,078,000
NE **	Idaho National Laboratory	Battelle Energy Alliance LLC	11/9/2004	9/30/2019	9/30/2019	$860,410,525
NNSA	NNSA Production Office Pantex Plant and Y-12 National Security Complex	Consolidated Nuclear Security LLC	3/3/2014	6/30/2019	6/30/2024	$1,650,773,284
NNSA	National Security Complete (formerly Kansas City Plant)	Honeywell Federal Manufacturing & Technologies LLC	10/1/2010	9/30/2015	9/30/2015	$769,632,359
			7/9/2015	9/30/2020	9/30/2025	$500,000
NNSA **	Lawrence Livermore National Laboratory	Lawrence Livermore National Security, LLC	10/1/2007	9/30/2019	9/30/2026	$1,519,527,621
NNSA **	Los Alamos National Laboratory	Los Alamos National Security, LLC	6/1/2006	9/30/2017	9/30/2023	$2,114,820,173
NNSA	Nevada National Security Site	National Security Technologies, LLC	3/28/2006	9/30/2016	9/30/2016	$526,112,166
NNSA **	Sandia National Laboratories	Sandia Corporation	10/15/1993	4/30/2017	4/30/2017	$2,850,636,027
NNSA / NR	Bettis/Knolls Atomic Power Laboratory	Bechtel Marine Propulsion	9/18/2008	9/30/2018	9/30/2018	$1,096,980,807
SC **	Ames Laboratory	Iowa State University	12/4/2006	12/31/2016	12/31/2026	$54,399,746
SC	Argonne National Laboratory	University of Chicago Argonne, LLC	7/31/2006	9/30/2016	9/30/2026	$719,749,703
SC **	Brookhaven National Laboratory	Brookhaven Science Associates, LLC	1/5/1998	1/4/2015	1/4/2015	($213,342,891)
			12/22/2014	1/4/2020	1/4/2035	$743,774,675
SC **	Fermi National Accelerator Laboratory	Fermi Research Alliance, LLC	11/1/2006	12/31/2016	12/31/2025	$374,825,700

Sponsor	DOE Site/Facility	M&O Contractor	Award Date	Contract End Date	Ultimate Potential Contract End Date *	FY 2015 Obligations
SC **	Lawrence Berkeley National Laboratory	The Regents of the University of California	4/19/2005	5/31/2020	5/31/2025	$778,417,215
SC **	Oak Ridge National Laboratory	UT-Battelle, LLC	10/18/1999	3/31/2020	3/31/2020	$1,400,296,259
SC **	Pacific Northwest National Laboratory	Battelle Memorial Institute	12/30/2002	9/30/2022	9/30/2022	$852,029,671
SC **	Princeton Plasma Physics Laboratory	The Trustees of Princeton University	4/1/2009	3/31/2018	3/31/2019	$95,528,733
SC **	SLAC National Accelerator Laboratory	Stanford University	1/25/1981	9/30/2017	9/30/2017	$475,561,902
SC **	Thomas Jefferson National Accelerator	Jefferson Science Associates, LLC	4/14/2006	5/31/2016	5/31/2025	$153,452,476
Total						**$18,442,451,664**

*Ultimate Potential Contract End Date – the date the contract is scheduled to be completed inclusive of all options and/or award term incentives.

**Federally Funded Research and Development Centers (FFRDCs)

In FY 2015, a new M&O contract was competitively awarded to Brookhaven Science Associates, LLC, for the Brookhaven National Lab (SC).

In addition, a competitively awarded successor contract for the management and operation of the National Security Complex (formerly known as the Kansas City Plant) was completed. The award, valued at approximately $8.3 billion, was made to the Honeywell Federal Manufacturing & Technologies LLC.

A competitive process is currently underway for a contract valued at approximately $5 billion over 10 years to manage and operate the Nevada National Security Site. Award of a new contract is anticipated in Fiscal Year 2017.

NNSA issued a competitive solicitation for the management and operation of Sandia National Laboratory in May 2016, with an anticipated award in Fiscal Year 2017.

DOE released a solicitation in June 2016 for the continued operation of the Savannah River Site (EM), with award of a contract anticipated in the spring of 2018. A decision on whether to compete the action is expected to be made by early FY 2017.

Acquisition planning for a competitive solicitation for the management and operation of the NNSA Los Alamos National Laboratory is currently underway; the contract is scheduled to end on September 30, 2018. For Idaho National Laboratory, the new M&O and FFRDC authorizations must be executed prior to the expiration of the current contract in September 2019.

DOE Non-M&O Major Site and Facility Management, Environmental Remediation, and Decontamination and Decommissioning Contracts

In addition to its M&O contracts, DOE manages other types of complex major site and facility management, environmental restoration and remediation, decontamination and decommissioning, and major chemical processing facility construction contracts. The non-M&O contracts evolved from former M&O contracts due to changes in the missions of the sites, for example from nuclear weapons production to environmental remediation and clean-up. With this change, there was a transition in the focus of the sites from a long-term continuing production mission to one of environmental management, and for some sites the major focus became decontamination, decommissioning, and site closure. The optimum contract model for incentivizing performance changed with the evolution of the EM mission. DOE issued contracts designed to incentivized shorter term mission objectives such as construction milestones, processing and disposition of waste, decontamination and decommissioning of buildings and facilities, and other near term mission objectives. Below is the list of non-M&O major site and facility contracts and construction projects with their associated FY 2015 obligations:

Sponsor	DOE Site/Facility	FMC Contractor	Award Date	Contract End Date	Ultimate Potential Contract End Date	FY 2015 Obligations
EM	East Tennessee Technology Park	URS/CH2m Hill Oak Ridge (UCOR), LLC	4/29/2011	7/31/2016	7/31/2020	$287,279,970
EM	Waste Treatment Plant (Hanford)	Bechtel National Inc.	12/11/2000	8/15/2019	8/15/2019	$631,714,197
EM	Tank Operations Contract (ORP)	Washington River Protection Solutions, LLC	5/29/2008	9/30/2016	9/30/2018	$565,875,594
EM	Idaho Cleanup Core Project at Idaho National Laboratory	CH2M-WG Idaho LLC	3/23/2005	9/30/2015	9/30/2015	$264,891,926
		Fluor Idaho, LLC	6/1/2016	5/31/2021	5/31/2021	N/A
EM	Portsmouth Infrastructure Support Services	Wastren EnergX Mission Support LLC	12/22/2009	7/25/2015	7/25/2015	$28,631,434
		Portsmouth Mission Alliance, LLC	1/15/2016	2/24/2018	4/24/2019	N/A
EM	West Valley Demonstration Project	CH2M Hill Babcock & Wilcox (B&W) West Valley, LLC	7/1/2011	4/8/2019	4/8/2019	$62,252,000
EM	Paducah Deactivation	Fluor Federal Services, Inc.	7/21/2014	7/22/2017	7/22/2017	$133,327,350
EM	Paducah Infrastructure Support Services	Swift & Staley, Inc. (SSI)	11/5/2009	6/29/2015	6/29/2015	$28,620,465
			6/17/2015	11/30/2018	9/30/2020	$7,755,000
EM	River Corridor Closure (Hanford)	Washington Closure Hanford LLC	3/23/2005	9/30/2016	9/30/2016	$230,043,305
EM	Plateau Remediation (Hanford)	CH2m Hill Plateau Remediation	6/19/2008	9/30/2018	9/30/2018	$437,043,706
EM	Mission Support (Hanford)	Mission Support Alliance LLC	4/28/2009	5/25/2017	5/25/2019	$283,923,876

Sponsor	DOE Site/Facility	FMC Contractor	Award Date	Contract End Date	Ultimate Potential Contract End Date	FY 2015 Obligations
EM	Savannah River Liquid Waste Disposition	Savannah River Remediation LLC	7/1/2009	6/30/2017	6/30/2017	$417,422,351
EM	Portsmouth D&D	Fluor-Babcock & Wilcox (B&W) Portsmouth LLC	8/16/2010	9/28/2018	3/28/2021	$164,774,914
EM	Los Alamos Legacy Cleanup	Los Alamos National Security, LLC	9/23/2015	9/30/2016	9/30/2017	$12,698,039
EM	Salt Waste Processing Facility (SWPF)	Parsons, Government Services	9/17/2002	12/31/2016	12/31/2016	$126,423,592
SC	Oak Ridge Institute for Science and Education (ORISE)	Oak Ridge Associated Universities, Inc.	12/21/2005	12/31/2015	12/31/2015	$245,572,596
			3/10/2016	9/30/2020	9/30/2020	N/A
NNSA	Mixed Oxide (MOX) Fuel Fabrication and Reactor Irradiation Services	CB&I AREVA MOX Services, LLC	3/15/1999	10/14/2016	10/14/2016	$312,968,973
Total						**$4,241,219,288**

During FY 2015 and 2016, five major site and facility contracts were awarded; four through competition and one as a sole source. These contracts work in support of the Office of Science mission at Oak Ridge and the Office of Environmental Management's mission at the Paducah, Portsmouth, and Idaho sites, as well as at the Los Alamos National Lab. The Los Alamos National Lab remediation contract was issued as a sole source award for a period of two years; a solicitation for continued remediation efforts is currently under development and is expected to be released by the end of FY 2016. The Paducah Infrastructure Support contract was awarded in June 2015 to Swift and Staley, Inc. and is for $231,446,409 over five years (through September 2020). The Portsmouth Infrastructure Support contract was awarded to Portsmouth Mission Alliance, LLC in January 2016 and is for $139,785,264 over three years. The Idaho Clean-up Core contract was awarded in June 2016 for $1,402,952,255 over five years. The Oak Ridge Institute for Science and Education contract was awarded in March 2016 for $1,392,273,986 over five years.

Major DOE Contract Actions to Occur in Fiscal Year 2017

Program Office	Description	FY 2017 Target Date
EE	Award new Multiple Award Contract for the Federal Energy Management Program	2nd Quarter
EE	Award modification for five-year extension of the M&O contract supporting the National Renewable Energy Laboratory	4th Quarter
EM	Determine whether to exercise one-year option period on M&O contract supporting the Waste Isolation Pilot Plant.	4th Quarter
EM	Award new contract for Savannah River Site Liquid Waste processing services	2nd Quarter

EM	Issue solicitation(s) for Savannah River Site M&O competitive follow-on contract(s)	4rd Quarter
EM	Finalize Acquisition Plan for the Central Plateau Operations and Cleanup work at the Hanford, WA site	2nd Quarter
EM	Award new contract for Paducah Site Deactivation and Remediation	4th Quarter
EM	Award new contract for Los Alamos Legacy Cleanup	3rd Quarter
EM	Award modification to revise scope and ceiling value of contract for the Waste Treatment Plant	1st Quarter
IM	Award new contract for Cybersecurity, Operations & Systems Engineering	4th Quarter
NE	Determine whether to extend or re-compete the M&O contract supporting Idaho National Laboratory	1st Quarter
SC	Determine whether to extend or re-compete the M&O contract supporting Princeton Plasma Physics Laboratory	4th Quarter
SC	Award modification for five-year extension of the M&O contract supporting SLAC National Accelerator Laboratory	3rd Quarter

The table above provides information regarding some of the major acquisitions taking place in FY 2017 that may have high visibility, may involve a significant acquisition strategy for an M&O contract, and/or involves an action that will exceed $750 million. Approval has been granted for two M&O contracts in support of EE and SC to be non-competitively extended and associated modifications will be issued in FY 2017, while the acquisition alternatives for three other M&O contracts in support of EM, NE, and SC will undergo review during FY 2017. The review process results in a decision on whether to modify and extend current contracts, or pursue new contracts through a competitive acquisition. The M&O contracts discussed here are in support of the Waste Isolation Pilot Plant, National Renewable Energy Laboratory, Idaho National Laboratory, Princeton Plasma Physics Laboratory, and SLAC National Accelerator Laboratory. There are five non-M&O major contracts scheduled to be awarded in FY 2017 – the Savannah River Site Liquid Waste Processing services contract; the Headquarters Cybersecurity, Operations & Systems Engineering contract; the Paducah Site Deactivation and Remediation contract; the Energy Efficiency and Renewable Energy's Federal Energy Management Program multiple award contract; and the Los Alamos Legacy Cleanup contract. A major modification to the Waste Treatment Plant contract to modify scope and ceiling value of the contract is also anticipated to be accomplished in FY 2017. Finally, solicitation issuance is targeted in FY 2017 to acquire support for services currently provided under the Savannah River Site M&O contract and acquisition planning is under way to acquire support for the Central Plateau Operations and Cleanup requirements at the Hanford site in Washington state.

Major DOE Fiscal Year 2017 Financial Assistance Funding Opportunity Announcements

Program Office	Description	FY 2017 Target Date
FE	Fossil Energy Technologies Directed at Capturing Carbon Dioxide at the Large Pilot Scale	2nd Quarter

EE	Vehicles Technologies Program Wide in support of the EV Everywhere Grand Challenge	1st Quarter
EE	Advanced Manufacturing Office Critical Materials Institute – reduction of reliance on rare earth metals and other critical materials	2nd Quarter
EE	Advanced Manufacturing Office Clean Water Institute – Research, development and demonstration of technologies with the potential to reduce the cost and energy and increase performance of approaches to clean water processing and production	2nd Quarter
EE	Solar Energy Technology Office Consolidating Solar Power Systems Integration	3rd Quarter
NE	Consolidated Innovative Nuclear Research and Development	4th Quarter
SC	Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) FY 2017 Phase II Release 1	1st Quarter
SC	Small Business Innovation Research (SBIR)/Small Business Technology Transfer (STTR) FY 2017 Phase II Release 2	2nd Quarter

The table above provides information regarding some of the major Funding Opportunity Announcements (FOAs) scheduled to be issued in FY 2017 that will exceed $50 million. DOE publishes FOAs to solicit competitive applications for the planned award of Grants, Cooperative Agreements, and Technology Investment Agreements. FOAs may also be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the agency and type of program.

Congressional and Intergovernmental Activities Overview

DOE activities fall within the jurisdiction of several congressional authorization committees and appropriations subcommittees. Each year the Secretary, Deputy Secretary, Under Secretaries, Assistant Secretaries, and other senior Departmental officials interact with congressional committees, starting with briefings and hearings on the President's Budget Request for the Department, and continuing with program and oversight hearings and meetings throughout the year. Senior officials also interact with individual congressional members, and key staff on committees of jurisdiction and from States particularly interested in and/or affected by DOE activities. In addition, the Department has extensive interaction and communication at the State and local government level.

Within the Department, the Assistant Secretary for Congressional and Intergovernmental Affairs (CI) manages overall relations with Members of Congress and supports the Secretary as the chief strategic advisor on all congressional interactions. CI also facilitates the confirmation process of all DOE Senate confirmed officials. The National Nuclear Security Administration (NNSA), in coordination with CI, also provides congressional liaison for its programs. The Chief Financial Officer, in coordination with CI, leads the Department's communication and coordination with the Appropriations Committees. For hearings, Department officials provide written and oral testimony and discuss the Administration's proposed policies and budget, as well as respond in writing to questions for the record (QFRs), which become part of the official hearing record.

The Assistant Secretary for CI also manages the Department's intergovernmental and external affairs relationships including governors of the states and territories; sovereign tribal nations; locally elected officials; community organizations; trade associations; educational institutions; and stakeholder groups with interests in DOE activities. These efforts are also supported through a network of Program Office staff in Headquarters and field locations that maintain regular engagements with state and local elected officials, community organizations, and stakeholder groups with interests in DOE activities.

The following is a listing of the current congressional leadership, congressional committees of jurisdiction, and select intergovernmental organizations.

Congressional Leadership
114th Congress (2015-16)

Senate

Republican Leadership

- Majority Leader Mitch McConnell (KY)
- Majority Whip John Cornyn (TX)

Democratic Leadership

- Minority Leader Harry Reid (NV)
- Minority Whip Dick Durbin (IL)

House of Representatives

Republican Leadership

- Speaker Paul Ryan (WI)
- Majority Leader Kevin McCarthy (CA)
- Majority Whip Steve Scalise (LA)

Democratic Leadership

- Minority Leader Nancy Pelosi (CA)
- Minority Whip Steny Hoyer (MD)
- Assistant Leader James Clyburn (SC)

Senate Congressional Committees of Jurisdiction

114th Congress (2015-16)

<u>Appropriations</u>

Full Committee

- Chairman: Thad Cochran (R-MS)
- Ranking: Barbara Mikulski (D-MD)

Subcommittee:

Energy & Water Development

- Chairman: Lamar Alexander (R-TN)
- Ranking: Dianne Feinstein (D-CA)

General Jurisdiction: Responsible for funding decisions and oversight of federal funds for all DOE programs, including NNSA.

<u>Armed Services</u>

Full Committee

- Chairman: John McCain (R-AZ)
- Ranking: Jack Reed (D-RI)

Subcommittee: Strategic Forces

- Chairman: Jeff Sessions (R-AL)
- Ranking: Joe Donnelly (D-IN

General Jurisdiction: Authorizing of legislation and oversight of programs relating to nuclear weapons, nuclear non-proliferation, environmental management, and other defense or security related activities. DOE programs and offices include the National Nuclear Security Administration; Environmental Management; Legacy Management; Enterprise Assessments; and Environment, Health, Safety and Security.

<u>Energy and Natural Resources</u>

Full Committee

- Chairman: Lisa Murkowski (R-AK)
- Ranking: Maria Cantwell (D-WA)

Subcommittee: Energy

- Chairman: Jim Risch (R-ID)
- Ranking: Joe Manchin III (D-WV)

Other subcommittees with jurisdiction include National Parks, and Water and Power.

General Jurisdiction: Authorizing of legislation and oversight of energy related research and development; DOE National Laboratories; government petroleum and fuel reserves; oil, gas and coal production and distribution; commercial nuclear and nuclear waste policy; energy emergency response; Federal energy conservation programs; global climate change; energy development impacts on water resources; science; loan programs; and other national energy policy matters. Interest generally focuses on non-defense related matters, although jurisdiction may touch upon all matters under the purview of the Secretary of Energy.

<u>Environment and Public Works</u>

Full Committee	**Subcommittee:** **Clean Air & Nuclear Safety**
• Chairman: James Inhofe (R-OK)	• Chairman: Shelley Moore Capito (R-WV)
• Ranking: Barbara Boxer (D-CA)	• Ranking: Thomas Carper (D-DE)

General Jurisdiction: Authorizing of legislation and oversight of environmental policy, non-military environmental regulation, and regulation of nuclear energy (Nuclear Regulatory Commission).

Homeland Security and Governmental Affairs

Full Committee	**Subcommittee: Investigations**
• Chairman: Ron Johnson (R-WI)	• Chairman: Rob Portman (R-OH)
• Ranking: Thomas Carper (D-DE)	• Ranking: Claire McCaskill (D-MO)

Other subcommittees with jurisdiction include Federal Spending Oversight and Emergency Management, and Regulatory Affairs and Federal Management.

General Jurisdiction: Oversight and investigation relating to all governmental agencies.

Other Senate Committees with DOE interests

- Intelligence
- Foreign Relations
- Indian Affairs

House Congressional Committees of Jurisdiction

114th Congress (2015-16)

Appropriations

Full Committee

- Chairman: Hal Rogers (R-KY)
- Ranking: Nita Lowey (D-NY)

Subcommittee:

Energy & Water Development

- Chairman: Mike Simpson (R-ID)
- Ranking: Marcy Kaptur (D-OH)

General Jurisdiction: Responsible for funding decisions and oversight of federal funds for all DOE programs, including NNSA.

Armed Services

Full Committee

- Chairman: Mac Thornberry (R-TX)
- Ranking: Adam Smith (D-WA)

Subcommittee: Strategic Forces

- Chairman: Mike Rogers (R-AL)
- Ranking: Jim Cooper (D-TN)

General Jurisdiction: Authorizing of legislation and oversight of programs relating to nuclear weapons, nuclear non-proliferation, environmental management, and other defense or security related activities. DOE programs and offices include the National Nuclear Security Administration; Environmental Management; Legacy Management; Enterprise Assessments; and Environment, Health Safety and Security.

Energy and Commerce

Full Committee

- Chairman: Fred Upton (R-MI)
- Ranking: Frank Pallone (D-NJ)

Subcommittee: Energy & Power

- Chairman (interim): Pete Olson (R-TX)
- Ranking: Bobby Rush (D-IL)

Subcommittee:

Environment & the Economy

- Chairman: John Shimkus (R-IL)
- Ranking: Paul Tonko (D-NY)

Subcommittee:

Oversight & Investigations

- Chairman: Tim Murphy (R-PA)
- Ranking: Diana DeGette (D-CO)

General Jurisdiction: Authorizing of legislation and oversight of the general management of the Department of Energy and the activities of non-defense programs within the Department, national energy policy, conservation of energy resources, energy information generally, regulation of the domestic nuclear energy industry, and nuclear facilities.

Science, Space, and Technology

Full Committee

- Chairman: Lamar Smith (R-TX)
- Ranking: Eddie Bernice Johnson (D-TX)

Subcommittee: Energy

- Chairman: Randy Weber (R-TX)
- Ranking: Alan Grayson (D-FL)

Subcommittee: Oversight

- Chairman: Barry Loudermilk (R-GA)
- Ranking: Don Beyer (D-VA)

Other subcommittees with jurisdiction include Environment, and Research and Technology.

General Jurisdiction: Authorizing of legislation and oversight of all energy research, development, and demonstration activities; DOE laboratories; commercial application of energy technologies; loan programs; and scientific issues related to environmental policy, including climate change. The Committee exercises expansive oversight jurisdiction.

Oversight and Government Reform

Full Committee

- Chairman: Jason Chaffetz (R-UT)
- Ranking: Elijah Cummings (D-MD)

General Jurisdiction: Oversight and investigation relating to all governmental agencies.

Natural Resources

Full Committee

- Chairman: Rob Bishop (R-UT)
- Ranking: Raul Grijalva (D-AZ)

Subcommittee:

Energy & Mineral Resources

- Chairman: Doug Lamborn (R-CO)
- Ranking: Alan Lowenthal (D-CA)

Other subcommittees with jurisdiction include Water, Power &Oceans, and Oversight and Investigations.

General jurisdiction: Authorizing of legislation and oversight of geothermal resources; conservation of U.S. uranium supply; rights of way over public lands for underground energy-related transportation; generation and marketing of electric power from federal water projects by power marketing authorities (PMAs); and Native American affairs.

<u>Other House Committees with DOE interests</u>

- Intelligence
- Foreign Affairs
- Small Business

Intergovernmental Organizations

"Big Seven"

- National Governors Association (NGA)
- U.S. Conference of Mayors (USCM)
- National Conference of State Legislatures (NCSL)
- Council of State Governments
- National League of Cities (NLC)
- National Association of Counties (NACo)
- International City/County Management Association

Other Intergovernmental Organizations

- Coalition of Northeastern Governors (CONEG)
- Southern Governors Association
- Western Governors Association (WGA)

Energy Specific Intergovernmental Organizations

- Energy Communities Alliance (ECA)
- National Association of Regulatory Utility Commissioners (NARUC)
- National Association of State Energy Officials (NASEO)
- National Association of State Utility Consumer Advocates (NASUCA)
- Southern States Energy Board (SSEB)

Significant External Reports on the Department of Energy and the Department's Reponses

Commission to Review the Effectiveness of the National Energy Laboratories

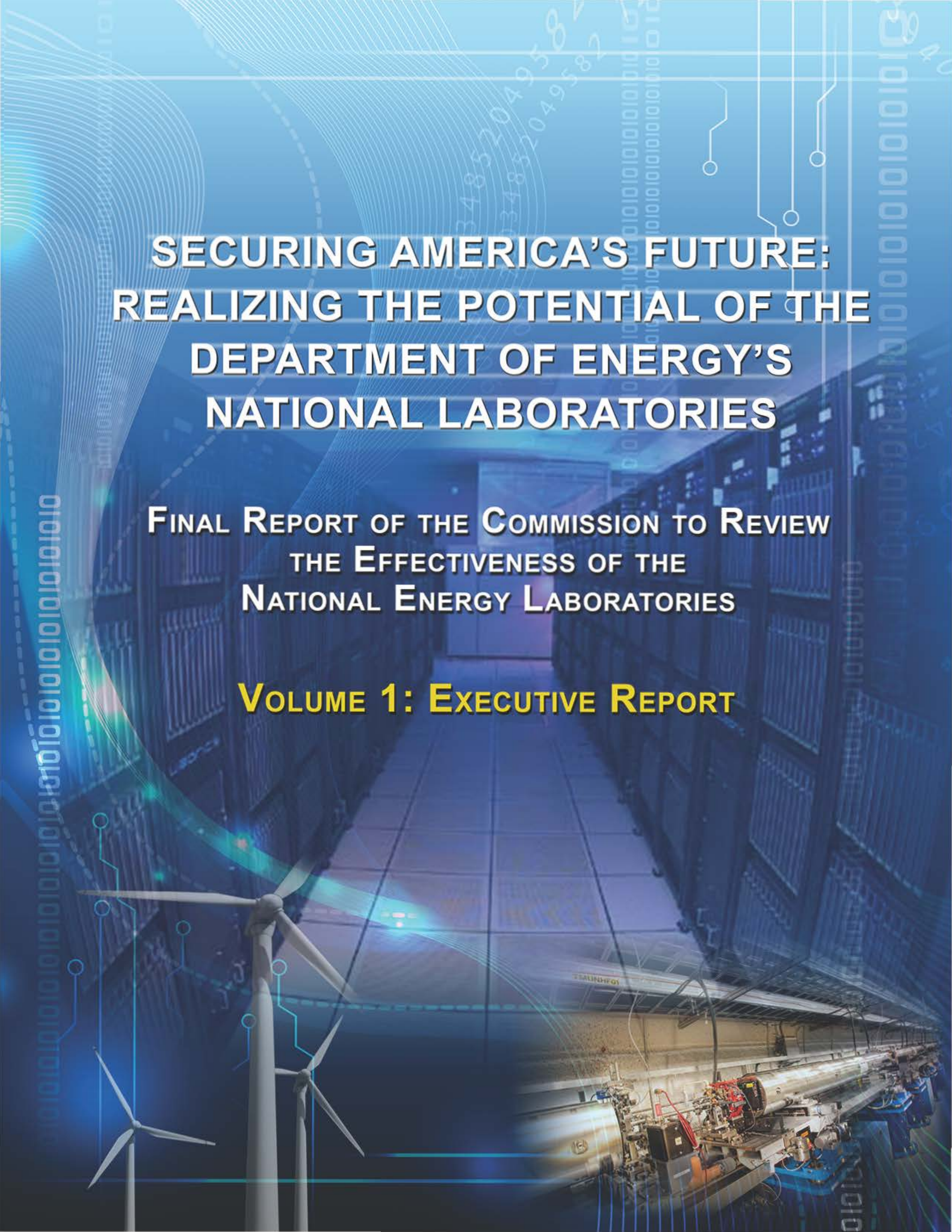
Section 319 of the Consolidated Appropriations Act, 2014, Public Law No. 113-76 established the Commission to Review the Effectiveness of the National Energy Laboratories. The Commission was charged with reviewing whether the DOE national laboratories are properly aligned with the Department's strategic priorities, have clear and balanced missions, have unique capabilities to meet current energy and national security challenges, are appropriately sized to meet the Department's energy and national security missions, and are appropriately supporting other Federal agencies. The Commission also looked for opportunities to more effectively and efficiently use the capabilities of the national laboratories and analyze the effectiveness of the use of laboratory directed research and development (LDRD) to meet the Department's science, energy and national security goals.

Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

Section 3166 of the Fiscal Year 2013 National Defense Authorization Act established the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise and tasked the advisory panel to offer recommendations "…with respect to the most appropriate governance structure, mission, and management of the nuclear security enterprise." This report summarized the panel's findings on the current health of the enterprise, examined the root causes of its governance challenges, and offered the panel's recommendations to address the identified problems.

Interim Report of the Secretary of Energy Task Force on DOE National Laboratories

The SEAB Task Force on DOE National Laboratories was established by the Secretary of Energy on June 16, 2014, to provide advice, guidance, and recommendations on important issues related to improving the health and management of the labs. The Task Force was charged to review past studies, Congressional reports and direction, and Departmental deliberations to identify key areas that have been raised concerning laboratory management and operations. The Task Force selected a few specific issues for study, where the Secretary of Energy has the authority to make changes, which will improve laboratory performance and efficiency.



SECURING AMERICA'S FUTURE: REALIZING THE POTENTIAL OF THE DEPARTMENT OF ENERGY'S NATIONAL LABORATORIES

Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories

Volume 1: Executive Report

Acknowledgments

The Commission appreciates the contributions of the IDA Science and Technology Policy Institute team led by Susannah V. Howieson and Mark S. Taylor, including Susan L. Clark-Sestak, Christopher T. Clavin, Laurie A. Dacus, Katherine E. Gliwa, Martha V. Merrill, Vanessa Peña, Kathleen A. Peroff, Elizabeth A. Turpen, Ryan M. Whelan, Julian L. Zhu, and Brian L. Zuckerman. The Commission would also like to thank all the individuals from the laboratory community, the Department of Energy, and beyond for their cooperation and valuable input.

Cover design by Keith B. Meador, Institute for Defense Analyses, Alexandria, VA.

Cover Photo Descriptions

Front cover:

Multi-programmatic Capability Resource (MCR)

The MCR, developed as part of NNSA's Advanced Simulation and Computing (ASC) program at Lawrence Livermore National Laboratory, was among the world's first systems using Beowulf PC-cluster architecture to deliver multi-teraFLOP per second power.

Linac Coherent Light Source (LCLS)

The LCLS, at SLAC National Accelerator Laboratory, is a powerful x-ray laser that generates high energy, ultrashort x-ray pulses with very high brilliance. It gives scientists an important tool for understanding materials, with wide-ranging impact.

Wind Turbines

Large wind turbines are capable of producing several megawatts of power and when grouped together into wind farms, can provide bulk power to the electrical grid.

Back cover:

Advanced Light Source (ALS)

The ALS, a 3rd generation synchrotron light source at Lawrence Berkeley National Laboratory, provides extremely bright X-ray and ultraviolet light for research in fields such as materials science, biology, chemistry, physics, and the environmental sciences.

Salt Waste Processing Facility (SWPF)

The SWPF, at Savannah River National Laboratory, handles spent nuclear fuel and is the key liquid waste facility for processing approximately 90 percent of the 36 million gallons of tank waste stored at the Savannah River Site.

Drilling Gas Well

Natural gas production from shale formations is one of the most rapidly-growing trends in U.S. domestic energy exploration and production.

Volume 1, Chapter 2 photos as above

For additional information about the Commission and links to download this report the reader is referred to http://energy.gov/labcommission.

Volume 1: Executive Report

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October 28, 2015

Executive Summary

The Department of Energy (DOE) laboratories are national assets that have contributed profoundly to the Nation's security, scientific leadership, and economic competitiveness. In recognition of the continuing and evolving threats to our security and the dramatic increase in global economic and scientific competition, the laboratories are and will continue to be vitally important.

Yet, the contributions of the National Laboratories are not inevitable, nor have they realized their full potential. This final report of the Commission to Review the Effectiveness of the National Energy Laboratories recommends ways the laboratories could overcome challenges to more efficiently and effectively accomplish the work for which they are uniquely suited. The Commission's unanimous findings and recommendations are grouped around six themes:

- Recognizing value
- Rebuilding trust
- Maintaining alignment and quality
- Maximizing impact
- Managing effectiveness and efficiency
- Ensuring lasting change

Recognizing Value

The National Laboratories provide critical capabilities and facilities in service of DOE's mission, the needs of the broader national science and technology (S&T) community, and the Nation as a whole. They, for example, offer a unique venue for the conduct of major, long-term, high-payoff/high-risk research. The funding for the laboratories has remained flat in constant dollars over the past decade. In addition, the amount of Federal research and development (R&D) support to DOE as a whole has stayed relatively level for the past 40 years, a period during which many other nations have increased their research investments. The Nation should recognize the value of these laboratories and the Administration and Congress should provide the necessary resources to maintain their critical capabilities and facilities.

Rebuilding Trust

The intended relationship between DOE and the National Energy Laboratories is as trusted partners, working together to carry out critical missions for the Nation. The Federal Government develops important R&D programs and turns to the National Laboratories to provide the expert people, facilities, and management systems to carry them out. Sixteen of the 17 laboratories are run as federally funded research and development centers (FFRDCs), managed through a management and operating (M&O) contract. Under the FFRDC/M&O model, the government is responsible for setting the "*what*" of strategic and program direction to meet the Nation's needs, while the contracted partners, along with the laboratories they manage and operate, are responsible for determining precisely "*how*" to meet the technical and scientific challenges and to carry out programs. Over the years, the relationship between DOE and many of the laboratories has eroded. This has resulted in a less-than-optimal working relationship and reduced efficiency.

DOE and the National Laboratories, with the support of Congress and others, must work together as partners to restore the FFRDC relationship with a culture of trust and accountability. As a foundation for this, the partners should jointly establish annual operating plans that delegate clearly defined authority to the laboratories in exchange for transparency and successful mission performance. Laboratories that earn DOE's trust should enjoy greater freedom to operate, while others will continue to experience heightened DOE oversight and control. DOE should strengthen leadership and management development for its Federal workforce—including multi-directional rotational assignments with the laboratories, field elements, and headquarters—to improve its ability to manage in this mode. DOE should abandon *incentive* award fees in their M&O contracts with the National Laboratories in favor of a fixed fee set at competitive rates. These rates should take into account contractor investments of talent and funds, as well as financial and reputational risk. DOE should also adopt a broader and richer set of incentives and consequences to motivate sound laboratory management and enforce accountability.

Enabling the laboratories to take more responsibility for managing their activities involves rebalancing contract requirements, local oversight, assessments and data calls, and budgeting. For example, for non-nuclear, non-high-hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and industry standards in place of DOE requirements. DOE should also utilize a risk-based model with meaningful stakeholder engagement when developing new requirements and conducting assessments.

While DOE has attempted to shift from transactional compliance to a performance-based oversight model by implementing a contractor assurance system (CAS) at each of the laboratories, systematic improvements to the implementation and utilization of the CAS must be made at many laboratories. All stakeholders responsible for assessments should reduce duplicative assessments and burden on the laboratories by making maximum use of these local assessments, and DOE should establish a single point of control over data requests to the laboratories. Also the roles and responsibilities of site offices and support centers must be clarified; support centers should not have approval authority.

DOE should give laboratories more flexibility to manage funds with full accountability within legal bounds. This translates to larger funding increments, fewer budgetary buckets, longer timelines with fewer milestones, and in many cases, notification rather than approval for fund transfers.

Maintaining Alignment and Quality

Despite the lack of a Department-wide, comprehensive, in-depth, long-term, strategic planning process, the National Laboratories' research programs and capabilities are generally well-aligned with DOE's missions and strategic priorities. There are robust processes in some program offices (particularly the Office of Science [SC]) that provide strategic oversight, evaluation, and direction to the laboratories. To improve the consistency of those processes across the Department, all DOE offices should adapt the processes of SC for laboratory planning, alignment, and quality to their particular contexts.

To maintain the quality of the technical staff, DOE should proactively encourage laboratory researchers to attend and participate in conferences—both national and international—so they may keep abreast of the latest developments in S&T. The Commission is encouraged by DOE's recently revised guidance on conference-related activities and spending, noting that the laboratories have been given more autonomy on this issue, while at the same time being held accountable for the appropriate use of taxpayer funds.

The ability to adapt, retool, invest in staff and capabilities, and enter new research areas is crucial to laboratory performance and maintenance of high-quality staff and research. Laboratories rely in large part on laboratory directed research and development (LDRD) programs to achieve these goals. Congress should support LDRD by restoring the LDRD cap to an unburdened 6 percent, or its equivalent, of laboratory budget.

To maximize the laboratories combined efforts, DOE should manage them as a system having an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry so long as the research aligns with mission priorities. Similar and competitive laboratory programs add value in the early, discovery phases of a new research initiative, but, once the research has matured to the point that a preferred or most promising approach can be identified, the Department should assert its strategic oversight and guidance to coordinate and potentially consolidate programs to achieve the most effective and efficient use of resources.

Maximizing Impact

A great deal of money and talent has been invested to create scientific and technical capabilities that are crucially important for the Nation's security and economic competitiveness. Realizing the full potential of the laboratories requires a much greater effort to tap their capabilities, especially in support of regional and national economic competitiveness. DOE and the laboratories must work to break down barriers to external collaboration with small and large businesses, academia, and other Federal agencies. Innovative technology transfer and commercialization mechanisms should continue to be pursued, and best practices in other sectors, including academia, should be examined. Congress and DOE should continue to support leading edge S&T user facilities, making sure to continue using scientific community input and peer review processes to determine future priorities for new and upgraded facilities.

Managing Effectiveness and Efficiency

The M&O contractors, in conjunction with DOE, must improve several areas of laboratory management: overhead costs, facilities and infrastructure, and project and program management. The Commission found laboratory overhead rates to be comparable to university-negotiated rates at the science and applied laboratories. The overhead rates at the National Nuclear Security Administration laboratories are understandably higher, due to the unique costs of their national security and nuclear weapons-focused mission. DOE should provide greater transparency into laboratory indirect costs and should publish an annual report of overhead rates for each laboratory.

DOE and the laboratories should continue efforts to improve laboratory facilities and infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. Given the limited budget, DOE, the laboratories, Congress, and the Office of Management and Budget (OMB) should actively work together to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long-term plan to resolve it through a combination of increased funding, policy changes, and innovative financing approaches. Such approaches might include third-party financing, enhanced use leases, State funding, gifts, and leveraging partnerships with other Federal agencies.

To better its project management record, DOE and the laboratories should maintain focus on strengthening institutional capability and imposing greater discipline in implementing DOE project management guidance. The Commission also supports the recent Secretary of Energy Advisory Board Task Force recommendation to put more resources into S&T development for the Environmental Management program given the technical complexity of its projects that seriously challenge project performance.

Ensuring Lasting Change

A review of over 50 past reports shows a strikingly consistent pattern of criticism with a repeating set of recommendations for improvement. Despite the extensive examination of the issues, none of these reports has led to the comprehensive change necessary to address the well-documented, persistent challenges confronting the Department and its laboratories. While the current Secretary of Energy has taken a number of steps to improve the relationship between DOE and its laboratories, and thereby the efficiency and effectiveness of the laboratories, these efforts must be institutionalized. A standing review body should be established to track implementation of the recommendations and actions in this report. This body should report regularly to DOE, the laboratories, the Administration, and Congress. Congress should also develop a more orderly and consistent process of reviewing the National Laboratories, in lieu of the past unrelenting pace of studies.

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The Commission wishes to acknowledge that the current Secretary of Energy and the current laboratory directors, and the management teams of both, have made much progress in improving the relationship between DOE and the laboratories. Rebuilding trust is a slow process that requires a sustained culture change that is underway. The Commission encourages future Secretaries and laboratory directors to continue these efforts and Congress and others to continue supporting them.

Today, DOE laboratories face a more complex set of challenges and have a more diverse array of missions than existed when the first National Laboratories were created more than a half-century ago. The recommendations in this report are intended to ensure that the laboratories are able to operate as efficiently and effectively as possible so that the Nation realizes the maximum benefit from this national asset in the years ahead.

Contents

1. Introduction

A. Congressional Charge

Section 319 of the Consolidated Appropriations Act, 2014 (Public Law No. 113-76) directed the Secretary of Energy to establish the Commission to Review the Effectiveness of the National Energy Laboratories. The Commission was charged with reviewing the 17 Department of Energy (DOE) National Laboratories.[1] It was established in May 2014 and held monthly meetings from July 2014 to July 2015. (See Appendix A for the names and biographies of the Commissioners.[2]) Congress directed the Commission to evaluate the laboratories in terms of their alignment with the Department's strategic priorities, duplication, ability to meet current and future energy and national security challenges, size, and support of other Federal agencies. The Commission was also to review the efficiency and effectiveness of the laboratories, including assessing overhead costs and the impact of DOE's oversight and management approach. Lastly, Congress had several specific questions related to the use of laboratory directed research and development (LDRD) such as the effectiveness of the Department's oversight approach and the extent to which LDRD funding supports recruiting and retention of qualified staff.[3] (Appendix B provides the complete text of Section 319.)

Due to the extensive scope of the Commission's task and the aggressive timeline, Secretary of Energy Ernest Moniz and Senator Diane Feinstein, then Chair of the Senate Energy and Water Appropriations Subcommittee, agreed to separate the Commission's charge into two phases. (See Appendix C for a copy of the letter documenting their agreement.) The agreement called for Phase 1 to focus on the mission and strategic planning of the laboratories and for Phase 2 to target the operation and oversight of the laboratory system. LDRD as it relates to the issues outlined above was to be considered in both phases of the Commission's task. The Commission issued an Interim Report in February 2015 with its preliminary observations and recommendations.

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[1] The 17 laboratories are Ames National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Idaho National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, National Energy Technology Laboratory, National Renewable Energy Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, Sandia National Laboratories, Savannah River National Laboratory, SLAC National Accelerator Laboratory, and Thomas Jefferson National Accelerator Facility.

[2] All appendices can be found in Volume 2.

[3] Consolidated Appropriations Act, 2014 (Public Law No. 113-76).

B. Important Questions about the DOE Laboratories

The Commission reframed the congressional charge in the form of seven important questions about the DOE laboratories.[4] The Commission felt that these questions underlie any evaluation of the National Laboratories and that its work would be incomplete if they were not addressed. The questions are:

- *Why do we need the DOE laboratories?*
- *Does DOE manage its laboratories well?*
- *Are the laboratories properly focused to address mission needs now and in the future?*
- *Is the research carried out at the laboratories of high quality?*
- *Is there too much duplication among the laboratories?*
- *Are the laboratories having an impact?*
- *Do the laboratories cost too much?*

The Commission's answers to these questions, based on the research and analysis described in this report, are summarized in Chapter 8 of this volume.

C. Approach, Scope, and Organization of Report

The findings and recommendations in this report are based on an extensive literature review; visits to all 17 of the National Laboratories; interviews with staff at more than 100 offices across the government and other sectors; and testimony by 85 witnesses at monthly public Commission meetings. The Commission's conclusions are unanimous. A list of organizations represented in interviews and public meetings can be found in Appendix D.

Through its research, the Commission determined that the DOE laboratories are a critical component of our Nation's science and technology (S&T) system (as discussed in Chapter 2). While the DOE laboratories serve our Nation well, they could be even more effective and efficient if they and DOE improve their relationship. In particular, both parties should focus on the principles of stewardship, accountability, competition, and partnership, upon which the federally funded research and development center (FFRDC) model is based, and DOE should give the laboratories sufficient freedom to operate in line with these principles (as discussed in Chapter 3).

The Commission found that, for the most part, the National Laboratories conduct research and have capabilities that are well-aligned to meet current and future mission

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[4] Unless otherwise stated, the terms *DOE laboratories* and *National Laboratories* are used interchangeably and are meant to include the National Nuclear Security Administration (NNSA) laboratories. Similarly, *DOE* should be read to include NNSA.

needs; that they are conducting high-quality research; that LDRD is crucial to maintaining first-class research and researchers; and that duplication among the laboratories is not excessive. DOE could better manage the National Laboratories as a system using an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry, so long as their research aligns with mission priorities (as discussed in Chapter 4).

The Commission determined that, in addition to supporting the missions of DOE, the laboratories serve the Nation's needs by operating S&T user facilities, and serving and working with other Federal agencies, the academic community, and industry. While such support is critical to many non-DOE entities, barriers to access need to be minimized. Realizing the full potential of the laboratories requires a much greater effort to tap their capabilities, especially in support of regional and national economic competitiveness. Although the Commission does not judge the laboratories to be inefficient overall, a concerted effort by DOE and the laboratories can improve efficiency and effectiveness of laboratory management in particular areas (as discussed in Chapter 5).

This is the Final Report of the Commission and includes its analysis and findings related to the entire charge; it therefore subsumes the Commission's Interim Report. This report consists of two volumes. The first is the executive volume with a high-level overview of the Commission's findings and recommendations. The second comprises technical chapters that provide detailed analyses and supporting evidence for those findings and recommendations.

2. Recognizing Value

As the Nation has changed, so too have the National Laboratories. Conceived to design and produce the world's first nuclear weapons, the laboratories of today face a vastly broader set of challenges and a more diverse array of missions. Throughout their history, however, it has been the culture of scientific excellence, technical rigor, and mission-focused vision that has defined the DOE Laboratories and served the United States time and again. The laboratories' role may indeed have changed with time, but their ability to rise to meet their charge has remained strong since their founding. From weapons science to clean energy and from legacy cleanup to basic research, the National Laboratories serve the Nation in diverse ways, and recognizing the fullness of the role they play is crucial to understanding their value.

A. Department of Energy Laboratory System

The 17 National Laboratories are categorized by their research focus and DOE stewarding office. There are 10 science laboratories stewarded by the DOE Office of Science (SC), 3 national security laboratories overseen by the National Nuclear Security Administration (NNSA), and 4 applied laboratories stewarded by the applicable DOE program office (one each by the Office of Energy Efficiency and Renewable Energy [EERE], the Office of Environmental Management [EM], the Office of Fossil Energy [FE], and the Office of Nuclear Energy [NE]). Table 1 provides information on each laboratory; including the managing contractor, the DOE stewarding office, and fiscal year (FY) 2014 cost and size data (detailed descriptions of the laboratories can be found in Appendix E). Overall, the National Laboratories employed over 55,000 people and received $11.7 billion of funding from DOE. When other funding sources are included, their total budget in FY 2014 was $14.3 billion.

The National Energy Technology Laboratory (NETL) is the only government-owned, government-operated (GOGO) laboratory among the National Laboratories. The other 16 laboratories are run as FFRDCs and managed through a management and operating (M&O) contract.[5] M&O contractors for the National Laboratories include individual universities, university consortia, nonprofit corporations, industrial firms, and partnerships involving the aforementioned types of organizations.

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[5] The Atomic Energy Act of 1946 (Public Law No. 79-585) formalized the M&O contract and established the Atomic Energy Commission, a precursor to DOE.

Table 1. Characteristics of Department of Energy National Laboratories

Stewarding Office	Laboratory	Managing Contractor	Budget from DOE (FY 2014)*	Total Budget (FY 2014)†	Size (FTE)‡	Year Est.
EERE	National Renewable Energy Laboratory	Alliance for Sustainable Energy, LLC	$290M	$340M	1,700	1977
EM	Savannah River National Laboratory	Savannah River Nuclear Solutions, LLC	$204M	$231M	800	1951
FE	National Energy Technology Laboratory	N/A	$690M	$692M	1,380	1910
NE	Idaho National Laboratory	Battelle Energy Alliance, LLC	$670M	$800M	3700	1949
NNSA	Lawrence Livermore National Laboratory	Lawrence Livermore National Security, LLC	$1.2B	$1.45B	5,700	1952
	Los Alamos National Laboratory	Los Alamos National Security, LLC	$2B	$2.2B	9,500	1943
	Sandia National Laboratories	Sandia Corporation	$1.8B	$2.75B	11,000	1949
SC	Ames National Laboratory	Iowa State University	$50M	$53M	280	1947
	Argonne National Laboratory	UChicago Argonne, LLC	$600M	$720M	3,400	1946
	Brookhaven National Laboratory	Brookhaven Science Associates, LLC	$530M	$580M	2,800	1947
	Fermi National Accelerator Laboratory	Fermi Research Alliance, LLC	$430M	$430M	1,800	1967
	Lawrence Berkeley National Laboratory	University of California	$640M	$760M	3,500	1931
	Oak Ridge National Laboratory	UT-Battelle, LLC	$1.1B	$1.3B	4,300	1943
	Pacific Northwest National Laboratory	Battelle Memorial Institute	$580M	$910M	4,300	1965
	Princeton Plasma Physics Laboratory	Princeton University	$90M	$92M	460	1951
	SLAC National Accelerator Laboratory	Stanford University	$410M	$420M	1,400	1962
	Thomas Jefferson National Accelerator Facility	Jefferson Science Associates, LLC	$170M	$172M	710	1984

Note: Total budget differs from these values as the laboratories receive funds from external sources through partnerships and work for other agencies.

* DOE figures are from the DOE FY 2016 Budget Justification.

† Total budget figures provided by DOE Chief Financial Officer.

‡ Contractor-submitted calendar year 2014 data to the Office of Management and NNSA. Full time employee (FTE) Definition: the sum of FTEs as of the last calendar day of each month during the calendar year, divided by 12. FTE = straight hours divided by 2080. FTEs may be lower than employee count as a result of part-time employees. This figure does not include temporary employees and contractors.

B. Purpose and Importance of the DOE Laboratories

Most members of the public do not understand what the DOE National Laboratories do, or what a critical role they play in the nation's security and economic vitality. Those people who do know about the National Laboratories often are familiar with only a fraction of what they do, perhaps linked to one of the laboratories in their region.

The DOE National Laboratories occupy a key role in the nation's S&T community that cannot be carried out solely by academic institutions or the business sector. The laboratories are a place where sustained, long-term, complex research and development (R&D) programs can be managed and executed across a range of basic and applied research areas. They are also able to perform sensitive, classified research regarding nuclear weapons and non-proliferation. In addition, they are places where the Federal government has been able to build and operate large-scale user facilities, such as linear accelerators, synchrotron light sources, and high performance computer systems and networks for use by thousands of researchers in academia, the business community and the National Laboratory system.

As illustrated in Figure 1, the National Laboratories exist in cooperation with the university community and with industry, and fill a vital role in the process of scientific exploration and technology innovation. During the early stages of research, university scientists have a greater role than most scientists at the National Laboratories. As the research advances from individual projects to larger scale programs involving large numbers of researchers in highly complex, multi-disciplinary, long-term projects, the DOE laboratories take on a much bigger role and are an ideal location to host research and researchers from other institutions. As the research advances further towards commercialization, industry takes on the lead role, and the involvement of the National Laboratories declines.

Broadly stated, the purposes of the DOE National Laboratories are to "solve important problems in fundamental science, energy, and national security…steward vital scientific and engineering capabilities including technology transfer…design, build, and operate unique scientific instrumentation and facilities… [and] promote innovation that advances U.S. economic competitiveness and contributes to our future prosperity."[6] The National Laboratories carry this out across the four mission areas of DOE, as described briefly in the subsections that follow.

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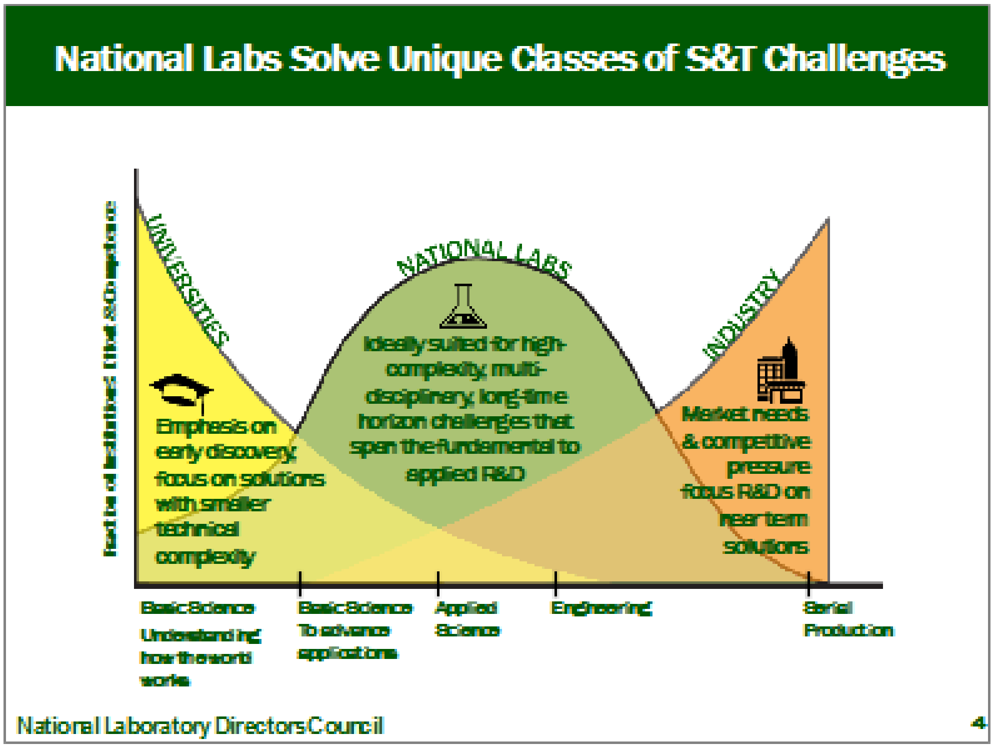
[6] DOE, *Strategic Plan 2014–2016* (Washington, DC: DOE, 2014).



Source: DOE National Laboratory Directors Council, "The DOE National Labs: A Vital Network in the U.S. science and Technology Ecosystem," November 12, 2014.

Figure 1. Role of the National Laboratories in the S&T Enterprise

1. Nuclear Security Mission

The National Laboratory system began with the Manhattan Project in World War II when the Federal government assembled the Nation's top scientists to design and build the first nuclear weapons. That mission has evolved over the years and for at least the past two decades has focused on stewardship of our nation's nuclear weapons, nuclear nonproliferation, homeland security, support to the intelligence community, and countering weapons of mass destruction. The three NNSA laboratories are primarily devoted to this mission, but several of the other laboratories participate as well.

To assure the reliability, safety and security of our nation's nuclear deterrent without testing, the laboratories are carrying out science-based stockpile stewardship, including highly complex Life Extension Programs (LEPs) for each of the major nuclear weapons that remain in our arsenal. The primary goals of the W76-1 LEP, for example, are to extend the original warhead service life from 20 to 60 years, address identified aging issues, incorporate nuclear surety enhancements and minimize system certification risk in the absence of underground nuclear testing and refurbish the system in a managed affordable manner. As of last year, the program was over halfway complete. In addition, in support of the nonproliferation programs, the laboratories have converted over 90 research and test nuclear reactors worldwide from highly enriched uranium to low-grade uranium and have removed nuclear material from over 230 sites worldwide. DOE laboratory technology that quickly identifies the chemical makeup of weapons is being used to verify treaties around the world.

To carry out the nuclear weapons work without nuclear testing, the laboratories have worked with the leading computer manufacturers to advance the state of the art in high performance computing and computer codes. Today the DOE laboratories have four of the ten fastest supercomputers in the world at NNSA and SC laboratories. At the SC-managed laboratories, the computers are now also being used by other laboratories and by university and industrial researchers on a wide range of complex computational problems, including human genomic analyses, analyses of chemical structures, climate change modeling, and mapping of energy resources.

The laboratories also serve other Federal agencies in support of their national security missions, by providing capabilities such as nuclear and WMD forensics, special nuclear material detection, and knowledge about foreign S&T capabilities. For example, the National Atmospheric Release Advisory Center at Lawrence Livermore[7] tracked releases from the Fukushima Daiichi Reactors after the nuclear disaster in 2011. The laboratories also

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[7] "National Atmospheric Release Advisory Center (NARAC)," *Lawrence Livermore National Laboratory*, last modified September 14, 2012. https://narac.llnl.gov/.

provided critical assistance after the April 2010 Deepwater Horizon oil spill,[8] and during the 2014–2015 negotiations with Iran on its nuclear program.[9]

2. Science Mission

The challenges of new energy sources, energy efficiency, economic competitiveness, and global security ultimately rest on understanding fundamental science in areas such as materials, physics, chemistry, biology and nanoscience. The national laboratories support this science mission through its staff of outstanding scientists and by collaborating with over 30,000 academic and industrial scientists who annually utilize DOE's large-scale particle accelerators, supercomputers, x-ray light sources, neutron sources and other large user facilities.

DOE's scientists are among the best in the world in these areas of basic and applied R&D. Over 60 researchers affiliated with DOE laboratories have been awarded Nobel Prizes,[10] and DOE laboratories have received over 800 R&D 100 Awards since 1962, when the annual competition began.[11] They have discovered 17 new elements that have been added to the periodic table.

A number of important developments have arisen from the laboratories' cutting-edge scientific work. For example, research in condensed matter physics and materials science led to important discoveries in superconductivity, which is becoming increasingly important in energy storage and transmission, and high performance machines. The emerging field of additive manufacturing, or 3-D printing, is another area in which the National Laboratories are playing a crucial role in developing the basic and applied scientific knowledge needed to produce, in collaboration with industry, complex parts

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8 Hruby, J., D. Manley, R. Stoltz, E. Webb, and J. Woodward. *The Evolution of Federally Funded Research & Development Centers, Public Interest.* Washington, D.C.: Federation of American Scientists (2011).

9 D. E. Sanger and W. J. Broad, "Atomic Labs across the U.S. Race to Stop Iran," *The New York Times*, April 21, 2015, http://www.nytimes.com/2015/04/22/us/in-atomic-labs-across-us-a-race-to-stop-iran.html?_r=0.

10 See http://www.osti.gov/accomplishments/nobel.html.

11 "The R&D 100 Awards recognize the most promising new products, processes, materials, or software developed throughout the world and introduced to the market the previous year. Awards are based on each achievement's technical significance, uniqueness, and usefulness compared to competing projects and technologies." For a full list of awards from 1993 to 2014, see http://science.energy.gov/about/honors-and-awards/rd-100-awards/.

made of high strength materials for aircraft engines and other high performance applications that are important to U.S. industrial competitiveness.

The Human Genome Project, which was begun by the National Laboratories, has transformed biomedical research, diagnosis and treatment. In addition, protein crystallography being carried out at the DOE synchrotron light sources has been used to test nearly all new pharmaceutical drugs introduced over the past 20 years. DOE science has also contributed to the development of MRI machines, now in virtually every hospital in the country, and Los Alamos is developing a portable "battlefield MRI" that can be used in war zones and in underdeveloped countries.

3. Energy Mission

The National Laboratories play a very important role in DOE's development of advanced technologies for the generation, distribution, storage, and use of energy in both stationary and mobile applications. Much of this work is centered at the four applied National Laboratories, but almost all of the other laboratories participate in these programs as well.

The laboratories have worked closely with industry in many of the technology and system developments in this area. For example, they have helped to develop the current breed of high efficiency wind generators and new, high efficiency solar cells. They have also been instrumental in advances in traditional energy sources, such as high efficiency combined cycle natural gas turbines, super critical coal boilers, and nuclear generating plants.

They had a major role in the development of hydro-fracking technology, which has led to the nation's "shale gas revolution" yielding huge increases in oil and gas production. The laboratory scientists helped develop 3-D seismic imaging, directional drilling techniques, diamond drill bits, computer simulation of fracking, pore level analysis, and modeling, monitoring and evaluation.

On the end uses of energy, the laboratories have made major contributions to energy efficiency and conservation. For example, the laboratories developed the solid-state ballast for fluorescent lighting, which has been one of the greatest gains in energy efficiency ever. They continue to work on both construction and design of buildings, as well as on the efficiency of the equipment inside them.

4. Environmental Management Mission

DOE's environmental management mission is a consequence of its responsibility for cleaning-up the legacy environmental wastes generated by the weapons programs from the cold war. In support of that mission, the laboratories provide expertise in areas such as radiology and chemistry, subsurface monitoring, groundwater modeling, and technology development.

The laboratories have developed innovative groundwater remediation methods and long-term monitoring that are saving millions of dollars and providing better information to local communities. In 2014, with the aid of these techniques, DOE completed the cleanup of 90 percent of Hanford's River Corridor, representing 479 square miles.

The technology development process for treating the legacy wastes in tanks at various facilities has been extremely challenging. Nevertheless, the laboratories lead the world in developing cleanup processes and technologies for these highly radioactive wastes. With that support, in 2014 DOE converted 15 million pounds of liquid waste at Savannah River into glass, enabling the closure of 6 high-level waste storage tanks.

C. The Laboratories' Funding in Perspective

Despite these critical and continuing contributions, DOE's budget for its laboratories has remained relatively flat in constant dollars over the past decade at approximately $12 billion per year (Figure 2).

In addition, the constant dollar level of Federal R&D support to DOE as a whole has stayed relatively level since 1976 (Figure 3).[12] However, the percentage of Federal R&D spending bound for DOE has dropped considerably in the same timeframe; the high of 18 percent was in 1979, and it has remained between 6 percent and 9 percent for the past 20 years. This is at a time when some other nations' have increased their share of GDP going into R&D, and the U.S. overall rate of R&D spending as a fraction of GDP has declined. At 8.1 percent of Federal R&D spending and Federal R&D spending at 0.81 percent of the

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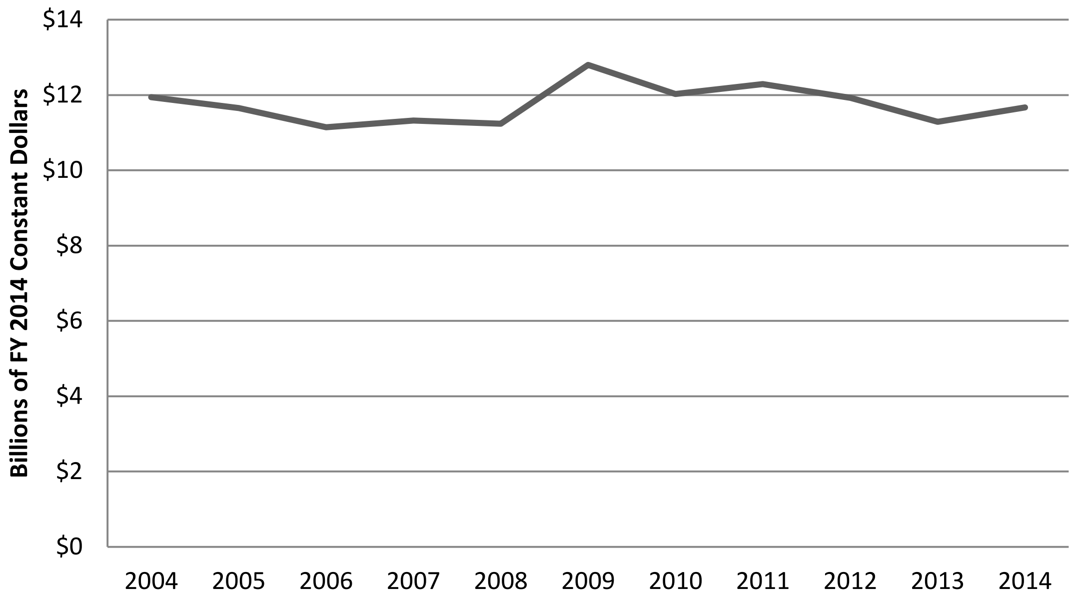
[12] Although the overall budget of the Department has remained relatively stable, specific DOE program funding has varied over the years due to changing strategic priorities within the Department's four missions: energy, science, environmental cleanup, and national security.

Nation's GDP, DOE's R&D budget is 0.066 percent, or less than one thousandth, of the Nation's GDP.[13]



Source: DOE Budget.

Figure 2. Total DOE Laboratory Budget from DOE in Constant Dollars ($B 2014)

Considering the positive impact the laboratories have had and the small size of DOE's funding relative to other Federal R&D expenditures, the Commission concludes that the overall funding level for the DOE laboratories is not too large. In fact, the case can be made for budgetary increases in specific areas. The Commission sees sustained federal support of R&D at the National Laboratories as critical to the future of the national S&T enterprise, as well as the Nation's economy and security. The principal challenges are to make the DOE laboratory system as efficient as possible to enable it to perform the maximum amount of R&D for the available level of Federal funding, and to ensure that it focuses on important endeavors not otherwise being addressed, especially high-payoff (often high-risk) longer-term research.

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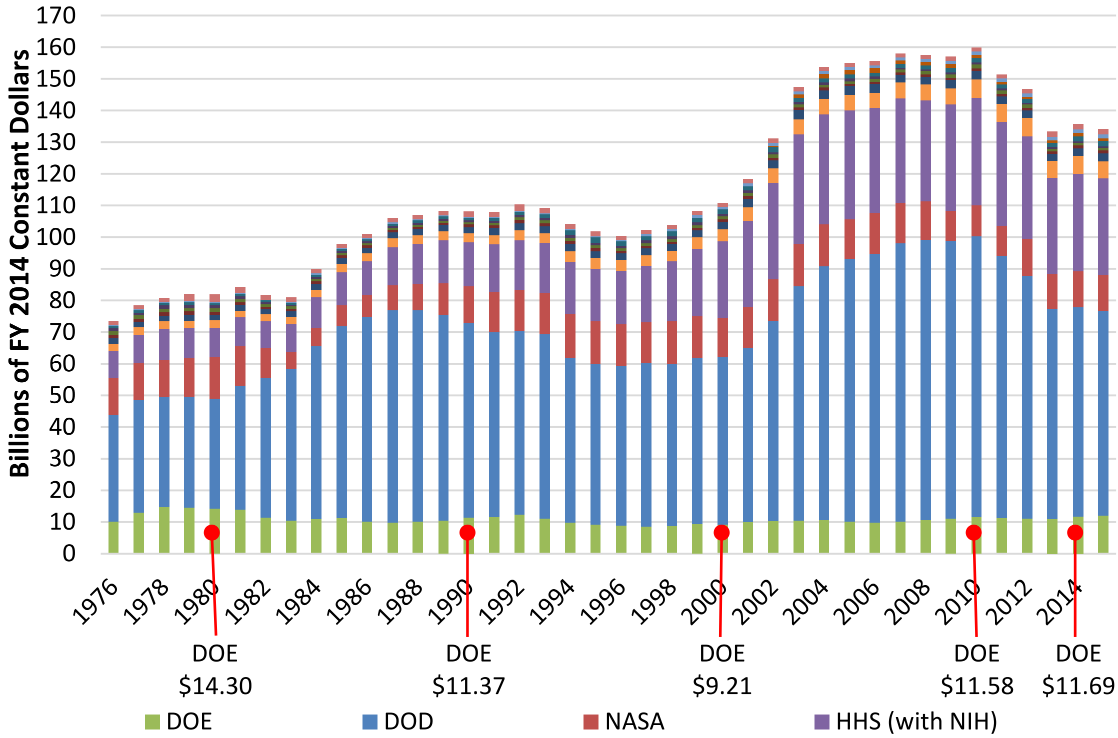
[13] DOE percentage of Federal R&D spending from American Association for Advancement of Science (AAS) website, *AAAS Historical Trends in Federal R&D, Total by Agency 1976–2015* (http://www.aaas.org/page/historical-trends-federal-rd). Percentage of Federal R&D of U.S. GDP from AAAS, Intersociety Working Group, *AAAS Report XXXIX: Research and Development FY 2015* (2014). These values are from FY 2013. More recent values (FY 2014 and FY 2015) are estimates. The most recent values for percentage of total national R&D are for 2011. In 2011, DOE R&D funding was 7.39% of Federal R&D funding, and Federal R&D funding was 29.5% of total U.S. R&D funding. Thus, DOE R&D funding was 2.18% of total national R&D expenditures.

Prominent among areas for which a real increase in funding should be considered is support for facilities and infrastructure at the laboratory sites. The issue of aging facilities and infrastructure is discussed in detail in Chapter 6 and addressed by Recommendations 31, 32, and 33.



Source: AAAS website, *AAAS Historical Trends in Federal R&D, Total R&D by Agency 1976–2015*, http://www.aaas.org/page/historical-trends-federal-rd.

Note: Values for 2015 are latest estimates from the President's budget request.

Figure 3. Trends in R&D by Agency ($B 2014), 1976–2015

The Commission also notes that Congress and others have repeatedly directed external reviews of the laboratories. In the past four decades, over 50 commissions, panels, reviews and studies of the National Laboratories have been conducted by a multitude of groups. For many of these studies, the undertone of the charge has been to question whether the DOE laboratories should exist at all. The Commission concludes that the unique role and value to the Nation of the National Laboratories clearly justify their continued support.

Recommendation 1: The National Energy Laboratories provide great value to the Nation in their service to DOE's mission, the needs of the broader national S&T community, and the security needs of the Nation as a whole. The Administration and Congress should provide the necessary resources to maintain these critical capabilities and facilities. It would also benefit all stakeholders if the key committees in Congress would develop a more orderly process of reviewing the National Laboratories, to replace the unrelenting pace of studies evaluating the performance of the DOE laboratories. For example, Congress could initiate a comprehensive review of the entire laboratory system in predetermined intervals.

3. Rebuilding Trust

Under the FFRDC/M&O model, government and the contractor should work together as partners in a relationship with clearly understood roles. The government is responsible for setting the "*what*" of strategic and program direction to meet the Nation's needs, while contracted university and industry partners are responsible for determining precisely "*how*" to meet the technical and scientific challenges and to carry out programs. However, over the years, the relationship between DOE and the laboratories has eroded. There is fault on both sides. The National Laboratories, for their part, do not fully trust DOE and therefore maintain secrecy about some of their actions, including contacts with Congress and other agencies; not informing DOE of emerging problems in a timely manner; and taking some actions below the radar to create new programs and compete for turf in new and emerging areas. DOE, for its part, does not trust the laboratories to keep them fully informed about technical and financial progress or safety and security issues. As a result, DOE micromanages work at the laboratories with excessive milestones and budget limitations and other requirements about *how* work should be done. This chapter is focused on steps that can be taken to rebuild trust in order to recapture the advantages of the FFRDC model.

A. Restoring the Partnership between DOE and its Laboratories

Perhaps the greatest strength of the FFRDC/M&O model, when it is working properly, is the freedom it grants to both parties. It allows the M&O contractors to innovate and apply their best practices to meet national needs and it frees DOE to focus on developing programs and policies, without burdening them with excessive implementation details and responsibilities. This freedom, however, is not granted but rather must be earned, through proven performance and transparency on both sides that develops into mutual trust and respect.

1. Restoring the FFRDC Model

The FFRDC/M&O relationship is designed to get the greatest leverage and results from the combination of government tasking and expert scientific and technical organizations to carry out DOE's missions. Using M&O contractors enables the government to access an exceptionally skilled workforce, to be agile in shifting resources to new R&D areas as needs change over time, and to adopt the best management practices from these experienced organizations.

DOE's role is to provide direction, oversight and funding to the National Laboratories to carry out those programs. The laboratories, as experts and trusted partners, play active roles in supporting DOE in that process. Once programs are defined, DOE is responsible for providing direction to the laboratories to develop and implement the details of those programs. The wording is precise: "direction" is not "management." Similarly, "oversight" should be risk-based and not excessive and intrusive.

Many of the problems cited in earlier reports stem from "broken trust" between DOE and its laboratories because these respective roles are frequently not honored.[14] In contrast with the ideal relationship that is envisioned in the FFRDC model, the laboratories too often act independently in their own perceived self-interests, as described earlier, without keeping DOE properly informed. DOE responds to this lack of transparency with an excessive level of transactional oversight and control over the activities of the laboratories. The Commission recognizes that the issue of trust (or lack thereof) is not experienced uniformly across the system. Some laboratories along with their M&O contractors, especially in SC, have been able to develop much better trusting relationships with their program offices and site offices than others. Two examples are Pacific Northwest and Brookhaven, which today have much stronger and more effective relationships with their site offices and with DOE headquarters than they did a decade ago.

Trust between Congress, DOE, and the laboratories has also deteriorated due to several high profile failures in project management, security, safety, or operations by certain laboratories. This has resulted in both tighter congressional budgetary controls on DOE, and therefore the laboratories, and also more frequent congressionally mandated studies of the laboratories. Congressional confidence in DOE and the laboratories' abilities is another key to restoring an efficient operational environment.

The role of the M&O contractors is important here as well. There is a subtle, but important distinction between the M&O contractor and the laboratory, as an entity in and of itself. While the laboratory is answerable only to the government customer, the M&O contractor, as a separately organized entity, is ideally answerable to its customers, partners, shareholders and the public at large (through the local, state and Federal governments). DOE has created an apparent dichotomy between the laboratory management and their M&O corporate parent(s). The contracts have been structured to ensure great laboratory management but do little to involve the parent organization(s). Laboratory management, while extremely important to the day-to-day operation and strategic direction of the laboratory, should not be solely accountable as the M&O contractor. The parent

[14] Secretary of Energy Advisory Board (SEAB), *Alternative Futures for the Department of Energy National Laboratories* (Washington, DC: DOE, 1995), 6 (also referred to as the Galvin report); and the National Academy for Public Administration (NAPA), *Positioning DOE's Laboratories for the Future: A Review of DOE's Management and Oversight of the National Laboratories* (Washington, DC: NAPA, January 2013), 13, 23, and 75.

organization can drive improvement and ensure high performance across the enterprise, but only if this involvement is valued. Both the laboratory management and the respective M&O parent organization should aid in the improvement of the laboratory system.

One cannot mandate or legislate trust; it must be earned. Transparency and agreement on scope or scale of laboratory activities and a shared safety and security culture are prerequisites for trust and independent authority. Vital to this is the clear definition of the roles and responsibilities of each partner.

Along with trust comes accountability; there must be consequences to the laboratory and its management if they do not uphold their ends of the agreement. Consequences should be a rich and graduated set of potential responses when performance is inadequate. Incentive fees are, at best, a limited instrument, as discussed later. The most effective incentive can be a greater degree of freedom to operate independently. The corresponding remedy for negligence may be giving a laboratory a shorter leash by withholding or limiting some authorities. Alternatively, DOE could condition funding on more numerous and frequent milestones, at least temporarily until performance improves. It is also important that such consequences be graded, matched to the severity of the situation, and only imposed on the transgressing laboratory rather than on the entire laboratory system.

The Commission notes that there is significant improvement being made in this area under the current Secretary and directors of the National Laboratories, and wishes to support these and other steps in this direction. In particular, reactivating the National Laboratory Directors Council was a very positive step, which has resulted in much more open and effective collaboration between DOE and its laboratories in areas such as strategic planning and overall management. Likewise, reactivating the Laboratory Operations Board and other forums for collaboration of various groups within DOE and the laboratories is having very positive results. It is important that these continue.

Recommendation 2: Return to the spirit of the FFRDC model (stewardship, accountability, competition, and partnership). DOE and the National Laboratories must work together as partners to restore the ideal nature of the FFRDC relationship as a culture of trust and accountability. DOE should delegate more authority and flexibility to the laboratories on *how* to perform their R&D, and hold them fully accountable for their actions and results. For their part, to be trusted partners and advisors, the laboratories must be transparent with DOE about their planned activities ahead of time, as well as about their actions and results as they are carried out.

The mechanism by which this recommendation might be implemented turns on an agreed-upon long-term strategic plan that describes the vision for the laboratory and an annual operating plan for how the strategy will be executed in the coming year. Such strategic and operational planning for both DOE and the laboratories is best accomplished jointly, with DOE and its laboratories working together.

Recent initiatives have led to an increase in laboratory involvement in DOE's strategic planning. The Big Ideas Summits, which involve the laboratories in discussions of ways in which their capabilities can help solve grand challenges, is an example of this commitment. The summits resulted in Crosscuts, or system-wide strategic planning on a series of important topics. One key to the success of the Crosscut initiative has been the treatment of laboratories as partners in the strategic planning exercise.

An annual operating plan for each laboratory can serve as the foundation for an effective working relationship with appropriate roles and responsibilities. The concept is centered on the idea that the laboratories are FFRDCs and that the document would be one between trusting partners, not simply an addendum to the M&O contract. Once an agreement is in place, DOE should give the laboratory the flexibility and authority to carry it out, so long as its activities are consistent with the operating plan and the law. Each laboratory, of course, must also maintain an appropriate degree of transparency with DOE about its activities, and must discuss with the department any new opportunities that are outside the scope of the operating plan. The laboratories will be held accountable not only for performance of technical work, but also for compliance with all applicable requirements, such as financial, environmental, safety and health, and other standards.

In practical terms, the annual operating plan should represent a high-level agreement between DOE and a specific laboratory on the nature and scope of the laboratory's planned major activities for the year ahead, including the major areas of significant program funding, work for other agencies, collaborations with academia and the private sector, hiring plans, facilities and infrastructure plans, and any other activities that the Department and the laboratory deem significant. It is very important in the Commission's view that this NOT become an extensive new planning process. The idea is to draw upon the many detailed planning and budgeting systems that already exist within DOE and its program offices to produce a brief, high-level summary of major activities for the year ahead. Although the Commission does not want to dictate the detailed form and structure of the operating plan, it envisions such plans would be relatively short documents (less than ten pages) containing information such as:

- Major areas of activity in support of DOE programs for the coming year, including general levels of funding, compared to the prior year
- Top priorities for the coming year, including key milestones and goals, and collaborations with other laboratories
- General nature and scope of SPP for Federal agencies, including any major changes from the prior year

- General nature and scope of collaborations with business and others for technology commercialization and regional development, through cooperative research and development agreements (CRADAs) and other vehicles, including any major changes from the prior year
- Levels of activity regarding user facilities compared to the prior year
- Major infrastructure and facilities priorities for the coming year
- Any other major changes, including human resources, and new initiatives not identified above

Looking across existing Department documents, the 10-year plans developed annually by the SC laboratories in collaboration with SC are the closest to what the Commission is envisioning. However, the SC's 10-year plans are much more detailed and contain a mix of strategic (e.g., core capabilities) and tactical (e.g., facilities and infrastructure investments) elements. The new annual operating plans should only focus on a single year's activities and provide a high-level summary, much of which can be drawn from the more detailed plans.

The narrative of the annual operating plan, while brief, can also provide an opportunity for DOE and the laboratory to highlight key priorities, but should not become a "laundry list" of all activities. Strong discipline will be needed to preserve the high-level summary nature of the annual operating plan.

Recommendation 3: DOE and each laboratory should cooperatively develop a high-level annual operating plan, with specific agreements on the nature and scope of activities at the laboratory, and milestones and goals that are jointly established. Within that framework, DOE should provide increased flexibility and authority to the laboratory to implement that plan. This increased flexibility must go hand-in-hand with greater transparency and accountability. The annual operating plan is not intended to be a retrospective evaluation document, such as SC's Performance and Evaluation and Measurement Plan (PEMP) or NNSA's Performance Evaluation Plan (PEP). Instead it can provide high-level perspective for such evaluation plans. In other words, as envisioned by the Commission, the annual operating plan fits between the laboratory's long term strategic plan and its evaluation plan.

The report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise (the Augustine/Mies panel report) and this Commission found that DOE does not have the career development programs needed to build a DOE workforce with the necessary technical and managerial skills.[15] Too little emphasis is placed on technical training, experience, and accomplishments. In addition, too few headquarters personnel have spent time in the field and, as a result, do not have an in-depth understanding of the issues between the field and headquarters. To rectify this, the Department has recently instituted an executive rotator program designed to encourage rotation of DOE staff from headquarters into the field.

After a series of negative reports from DOE's Office of the Inspector General (IG),[16] particularly related to the high cost, personnel rotations in the other direction—laboratory personnel into the Department—have been discouraged. While such programs are expensive, the Commission's view is that the long term benefits are far greater than the costs. The Commission feels while waste and fraud should certainly not be allowed, laboratory rotational programs are important to the Department's effective management of its laboratories and research programs, and the exchange program must be reinvigorated across the Department.

Recommendation 4: To improve DOE's ability to manage the laboratories, DOE should implement greater leadership and management development for its Federal workforce, including multi-directional rotational assignments with the laboratories.

NETL is unique among the 17 National Laboratories in two respects. First, and most obvious, it is the only one that is not contractor-operated; it is both government-owned (as are all of the laboratories) *and* government-operated (unlike the others). Thus, NETL has not enjoyed the flexibility and other benefits that come with management by an M&O contractor.

In addition, NETL also differs from the other laboratories in terms of its structure and missions. In addition to its on-site R&D related to fossil fuels, NETL manages a large contracting operation for FE. In fact, only about 10 percent of NETL's funding goes to support its own research at the laboratory; the vast majority, about 90 percent, is sent elsewhere or is used for program management. In effect, FE has co-located its program offices and contracting and other service support functions with its laboratory. In other locations, this contracting and service support activity might be categorized as a "support

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[15] Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Security Enterprise* (also referred to as "the Augustine/Mies panel"), November 2014, 12–14.

[16] DOE IG, *Audit Report: The Department of Energy's Management of Contractor Intergovernmental Personnel and Change of Station Assignments* (DOE/IG-0761, March 2007); DOE IG, *Management of Facility Contractors Assigned to the Washington, D.C. Area* (DOE/IG-0710, November 2005); DOE IG, *Summary Audit Report on Contractor Employee Relocation and Temporary Living Costs* (DOE/IG-0400, January 1997).

center," which provides administrative services for the host DOE program office and for other offices as well.

There is nothing inherently wrong with locating service and program office functions in the field, which is done in other locations within DOE. However, placing the program and service functions within the "laboratory" itself and having its director oversee all of it diminishes the attention and emphasis that the director and the "laboratory" bring to the R&D function. Because of this structure, the R&D function at NETL does not enjoy the singular focus seen at the other DOE laboratories. As a result of all of the above, the laboratory has not consistently produced research results or had an impact concomitant with the best of the laboratories in the National Laboratory network.

The Commission is aware of the important national and regional role of the laboratory, and the concern of elected officials and union representatives that any changes in the structure of NETL might jeopardize the continued employment and accomplishments at the laboratory. The Commission takes those concerns very seriously and is making a two-part recommendation that it believes will strengthen NETL and the region in the long run.

The first part of the recommendation concerns the management structure of the laboratory, but would not change the employment status of the personnel – they would continue to be federal government employees, as they are now. This recommended change is for DOE to organize the workforce at NETL into two organizational units: one focused on the R&D work, and the other on the federal program management, contracting and other support functions. The R&D unit, with approximately 10 percent of the annual funding, would be the "national laboratory" and be called "NETL". The other unit, with about 90 percent of the funding, would consist of federal employees who provide program management direction for the Office of Fossil Energy, and other federal employees who provide contracting and other inherently governmental services in support of FE and other DOE offices.

The Commission believes that this would yield significantly increased clarity and focus on the R&D mission for the research staff at NETL and for others outside NETL who work with them. The Commission believes those changes would enhance the standing of the R&D programs at NETL and lead to a more consistent level of high quality research. That should also result in even better opportunities for collaboration with researchers in academia and industry, and strengthen the lab's ability to attract and retain top quality professional staff.

In the long run, the Commission believes that portion of NETL's activity that is the R&D work would benefit even more if it were converted to a government-owned, contractor-operated FFRDC. The Commission recognizes the strongly held local views against this idea. Yet in the Commission's view, the other DOE National Laboratories that are structured that way benefit from stronger affiliations with universities and other organizations, have greater success in recruiting and retaining top quality personnel, and have a more consistent record of producing high quality R&D. It is the Commission's view that a careful assessment of the pros and cons of such a possible change should be made by DOE working with NETL and the local and regional governments, academic institutions, and other stakeholders.

In recent years, a collaboration with a group of universities in NETL's region produced significant gains in research quality and productivity—as measured by journal publications—until it was discontinued last year. Apparently, there are plans to resume university collaborations, but at a reduced level.

Recommendation 5: DOE should separate NETL's R&D function from its program responsibilities (and call the R&D portion—not the program activities—NETL). Furthermore, consideration should be given to converting the new, research NETL into a government-owned, contractor-operated FFRDC. Whether or not the above steps are taken, NETL should increase its interactions and collaboration with universities.

2. M&O Contractor Motivations and Performance Incentives

Contracting organizations may be motivated to run laboratories out of a sense of service to the Nation, for reputational enhancement, for access to quality technical staff, or for other reasons, but management fee should not be the primary motivating factor. Incentive fees may be appropriate for some types of production operations, but are not the best mechanism for research programs. Fees must be adequate to cover unallowable costs, such as gaps in salary, community and educational contributions, employee scholarships, and potential risks, but they do not need to be as high as some of the recent NNSA laboratory contracts.[17] The Commissioners find that a high fee perpetuates the stereotype that laboratory managers and M&O contractors are focused only on profit and are merely "contractors" rather than partners. In addition, the process to evaluate performance and award fee has led to excessive box checking and transactional compliance for the laboratories. Both of these have contributed to the breakdown in trust between some of the laboratories and DOE. The Commission agrees with the Augustine/Mies panel finding that the relationship between the NNSA laboratories and the government has been eroded by

[17] The average available award fee as a percentage of the laboratory budget from DOE is 1.76%. While Sandia's (1.56%) is lower than the average, both Lawrence Livermore's (3.83%) and Los Alamos's (3.17%) are higher. This translates to an available award fee of $28.1M for Sandia, $45.9M for Lawrence Livermore, and $63.4M for Los Alamos. See Appendix F for complete award fee information.

the fee structure and contract approach that invites detailed, tactical, and transactional oversight rather than a strategic, performance-based management approach.[18]

The Commission also notes that approximately 6 years ago, the National Aeronautics and Space Administration (NASA) changed its contract for the Jet Propulsion Laboratory (JPL), also an FFRDC, from an incentive fee to a fixed fee. JPL personnel have found the change to be positive in that it has decreased bureaucracy associated with the annual fee awarding process. The primary incentive for the laboratory to perform well is that it will receive more research funding from NASA; the punishment is that it will receive less.

Recommendation 6: DOE should abandon *incentive* award fees in the M&O contracts of the National Laboratories in favor of a fixed fee set at competitive rates with risk and necessary investment in mind. In addition, DOE should adopt a broader and richer set of incentives and consequences to motivate sound laboratory management and enforce accountability.

B. Giving the Laboratories Sufficient Freedom to Operate

The Secretary of Energy Advisory Board (SEAB) Task Force on the DOE National Laboratories described the oversight environment of the laboratories as involving six groups with managing roles: "the laboratory director and the director's leadership team, DOE Headquarters (HQ) sponsoring program offices, DOE site offices (field offices in NNSA), DOE Service Centers, DOE operational oversight offices (e.g., the Office of Independent Enterprise Assessment), [and] the M&O Contractor."[19] The multitude of oversight entities has led "to a highly burdensome operating environment that severely diminishes the effectiveness of this arrangement."[20]

1. Contract Requirements

Previous commissions and studies have highlighted the duplicative and unnecessarily burdensome requirements that govern DOE laboratories. Under the FFRDC model, DOE should provide broad direction for the work performed at the laboratories and hold the laboratories accountable for mission execution and compliance with relevant operational standards. As a result of internal and external criticism of the poor management practices of a few M&O contractors, DOE has become increasingly prescriptive in its oversight of all the laboratories. This completely undermines the model since the whole point of engaging M&O contractors is for them to bring their best scientific research and business

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18 See Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Security Enterprise*, November 2014, 12–14.

19 SEAB, *Report of the Secretary of Energy Task Force on DOE National Laboratories* (Washington, DC: DOE, June 17, 2015).

20 *Ibid.*

practices to laboratory operation. While it is appropriate for DOE to develop its own unique requirements to cover nuclear, high hazard, and/or classified activities, DOE has often established its own requirements across a wide variety of low-risk areas, such as human resources, business services, and other administrative functions. These requirements add little value to laboratory operation and performance, waste time and resources on unnecessary transactional details, and lead to redundant layers of bureaucracy, adding to laboratory overhead as well. This focus on such requirements has skewed DOE's relationship with its laboratories toward compliance and away from mission.

Another area in which DOE requirements can be overly prescriptive is in construction and related activities on laboratory sites. There are situations in which the Federal, state, local and industry standards are more appropriate than DOE requirements. For instance, the Commission found that some industry standards are more up-to-date than the analogous DOE standards. This situation creates confusion when, for example, sub-contractors that are brought on-site from off-site locations have been trained to follow the more updated industry standards. In fact, when this occurs, the laboratory technically may not be in compliance with their M&O contract.

DOE's requirements often also involve multiple levels of approvals rather than allowing decisions to be made at the lowest possible level. It is sometimes said that virtually anyone in the chain can say "no," but only the highest level has the authority to say "yes." The Commission also notes that the multi-layered approval process at DOE builds a culture of excessive conservatism because a margin of safety is added at every step.

Recommendation 7: DOE should give the laboratories and M&O contractors the authority to operate with more discretion whenever possible. For non-nuclear, non-high-hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and national standards in place of DOE requirements. DOE should review and minimize approval processes.

DOE's processes for developing directives, orders and other requirements provide some opportunities for involvement and input from the functional offices, field elements and laboratories. However, engagement could be improved by increasing participation from subject matter experts, particularly from the field, to maximize input on the relative benefits of the proposed requirements and on their true impact on laboratory operations. In addition, when developing new requirements, DOE does not effectively consider risk.

Recommendation 8: DOE should modify its processes for developing directives, orders and other requirements to more fully engage subject matter experts for input on the benefits and impacts of the proposed requirements. When developing new requirements, DOE should use a risk-based model, ensuring the level of control over an activity is commensurate with the potential risk.

Recently DOE has established an "Evolutionary Working Group" and a "Revolutionary Working Group" to evaluate potential changes to the contractual relationship between DOE and its laboratories. The Evolutionary Working Group reviewed the M&O contracts for single-program laboratories to identify and potentially eliminate relatively low-risk requirements, including human resources, foreign travel approvals, and data requests.[21] The Revolutionary Working Group is evaluating more drastic changes such as either using a cooperative agreement or a more aggressive paring down of an M&O contract.[22] The Commission endorses these efforts.

2. Local Oversight: Contractor Assurance, Site Offices, and Support Centers

DOE has attempted to shift from transactional compliance to a performance-based oversight model by installing a contractor assurance system (CAS) at each of the laboratories. Generally, CAS is a system of metrics produced by the laboratories to assure DOE that they are meeting requirements, mitigating risk, and effectively managing the laboratory. CAS also has been used to reduce Federal oversight by focusing on laboratory system approval, verification of system effectiveness, and the use of management information systems. It also emphasizes periodic assessments of high-risk operations, rather than continuous Federal inspection of all operations. One critical aspect of this model is transparency and mutual access to data. CAS implementation increases the use of laboratory-conducted oversight in operational domains such as finance and human resources, thereby prioritizing work at the site office and decreasing the number of external assessments. As a result, site office leadership has been able to reduce the staff size of some site offices by a factor of two to reflect the reduced workload. The status and maturity of CAS vary across laboratories; so too does the extent to which site offices rely on CAS for oversight. Trust between the laboratory and site office staff is important to the site office's willingness to depend on CAS to manage operational risk effectively.[23]

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21 DOE, *Working Groups to Study Modifications to Laboratory M&O Contracts for Single-Program Laboratories* (2015).

22 There is precedence for DOE using cooperative agreements for research and facility operations. For instance, DOE developed a cooperative agreement with Michigan State University for construction of the Facility for Rare Isotope Beams (FRIB), a new national user facility for nuclear science. More broadly, DOE has solicited 387 cooperative agreements since 2009 according to www.grants.gov, of which most are for research rather than for facility construction and management.

23 NAPA, *Positioning DOE's Laboratories for the Future*.

SC has completed a peer review of the CAS across its 10 laboratories that documented the varying degree of adequacy of systems and allowed for dissemination of best practices. The Government Accountability Office (GAO) found that NNSA has not fully established policies or guidance for using information from the CAS, which has led to inconsistency in their field office procedures.[24] NNSA itself has been concerned that the laboratory systems are not sufficiently mature to act as a reliable replacement for site office on-site inspections and transactional reviews.[25] NNSA has a current opportunity to improve oversight at the laboratories by amending its new CAS policy to ensure effective implementation by both its laboratories and field office personnel.

Recommendation 9: DOE should focus on making the use of CAS more uniform across the laboratories. DOE local overseers should rely on information from the CAS systems, with appropriate validation, as much as possible for their local oversight. The quality of CAS can be increased through peer reviews for implementation and effectiveness.

The laboratories execute their missions in the midst of a complicated oversight environment, including significant local or on-site oversight. Particularly important to local oversight is the relationship between the laboratory and its site office.[26] If the relationship is adversarial, then it can seriously impede mission execution. These site offices serve as the local DOE oversight for the laboratory and management of the contract, and a site office (or two) co-locates and oversees each of the 16 FFRDC laboratories.[27] The number of Federal oversight personnel in many site offices is substantially higher than at other Federal agency FFRDCs. Given the importance of trust in the relationship between the site offices and the laboratories, the site offices impact the laboratories, both positively and negatively, and the character of this impact can affect mission execution.

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24 GAO, *National Nuclear Security Administration: Actions Needed to Clarify Use of Contractor Assurance Systems for Oversight and Performance Evaluation*, GAO-15-216 (Washington, DC: GAO, May 2015).

25 NAPA, *Positioning DOE's Laboratories for the Future*.

26 The importance of the site office/laboratory relationship is discussed in previous reports on the National Laboratories, such as NAPA's *Positioning DOE Labs for the Future* report, SEAB Task Force report, Galvin Report, and Augustine/Mies panel report.

27 The term "site offices" is used to describe the DOE Federal offices located at each laboratory site. These offices are called "site offices" or "field offices" depending on the location, but the roles and responsibilities are consistent even with the differing name. The Golden Field Office, however, serves both as a site office and a support center to EERE and NREL and co-locates NREL in Golden, CO (http://energy.gov/eere/about-us/business-operations/golden-field-office). NETL, as a GOGO, does not have a site office. The Savannah River Site, which includes the Savannah River National Laboratory, has two site offices, one for its stewarding office, EM (http://sro.srs.gov/), and one for NNSA. For more information about each site office at NNSA's eight sites, go to http://nnsa.energy.gov/aboutus/ourlocations. For information on SC's 10 site offices, go to http://science.energy.gov/about/field-offices/.

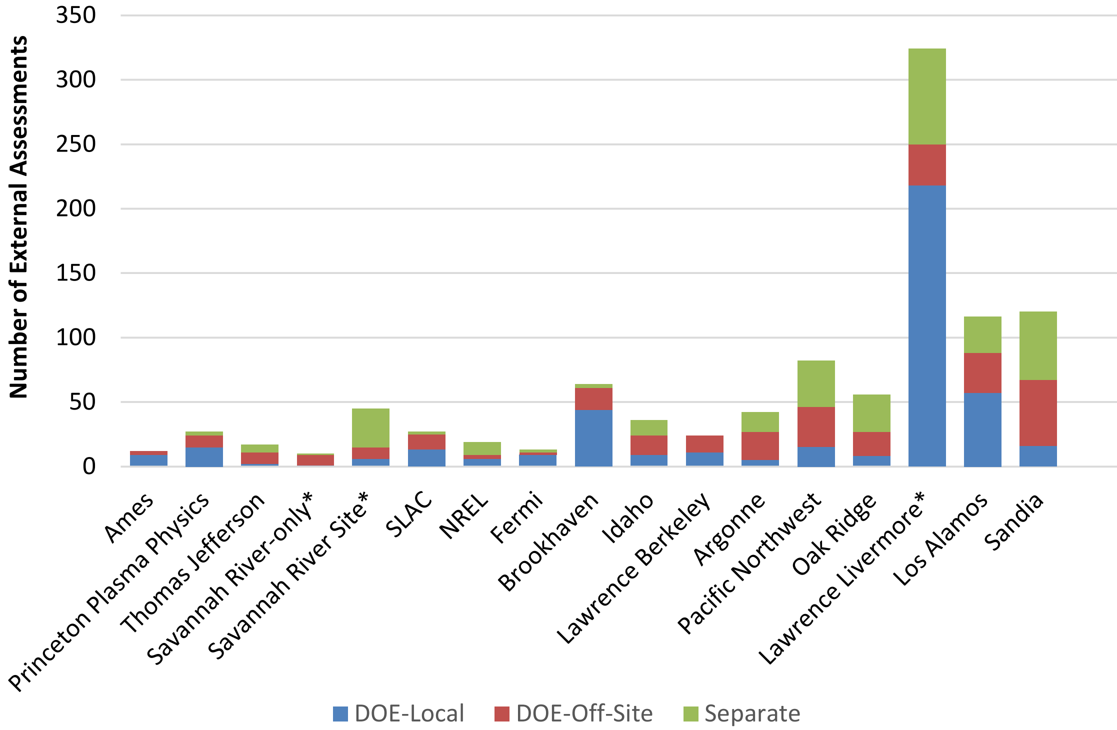
Recommendation 10: The role of the site office should be emphasized as one of "mission support" to the program offices at DOE and to the laboratories. The site office manager should be clearly responsible for the performance of the site office in support of the mission, and all staff in the site office, including the Contracting Officers, should report to the site office manager. Since site office effectiveness is so dependent on site office leadership, DOE should devote more effort to leadership training and professional development of field staff.

The roles, responsibilities, and authority of the support centers are unclear to many in the laboratory network. In certain cases, support centers have approval authority, which confuses and complicates matters. The main rationale for support centers is to provide specialized expertise, such as real estate lawyers, who are not needed full-time at each site office. The Commission accepts that justification. The responsibility for drawing on that expertise and for making decisions ultimately rests in the program, which is responsible for mission execution. The Commission heard complaints from both the field and headquarters that support centers sometimes inappropriately claim approval authority for various decisions and can be unresponsive to mission priorities and schedules.

Recommendation 11: DOE should clarify the role and authority of the support centers. Wherever approval authority resides with a support center, DOE should remove it and reinstate it at either the site office or DOE headquarters, as appropriate.

3. Assessments and Data Calls

Previous reports found that the National Laboratories are subject to too many assessments and data requests, which are time consuming and a distraction from the mission. To develop a greater understanding of the underlying causes and complexities of the issue, the Commission collected data on assessments and data requests from all 17 of the National Laboratories. Though the Commission did find examples of burdensome and duplicative assessments at almost all the laboratories, the problem is more prevalent at the NNSA laboratories (Figure 4).



Source: Data supplied by each laboratory through list of assessments for FY 2014.

Notes: Laboratories are organized by increasing size of operating budget from left to right.

"External assessments" include those that were open for at least part of the fiscal year. These values include assessments that started or ended in other fiscal years as some assessments span fiscal years.

* Savannah River National Laboratory is part of the Savannah River Site contract. Thus, the values presented for "Savannah River Site" include assessments of the laboratory. The values presented for "Savannah River-only" are a subset of the site assessments that included only the laboratory, not other parts of the site. Lawrence Livermore's site office also performs over a 1,000 walkthroughs per year at the laboratory, which are not reflected in the DOE-local value, as they are meant to be reduced in scope and impact as compared to full audits or inspections. The number of walkthroughs at other laboratories is unknown, although this is an oversight tool that other site offices leverage.

Figure 4. Number of External Assessments at the DOE Laboratories (FY 2014), Operations Only

Other than the site offices and support centers, the primary conductors of assessments at the laboratories within DOE are the Office of Enterprise Assessments (EA) and IG. EA is the independent assessment office for the Secretary within the Department and conducts assessments in safety and security.[28] IG is the auditing organization charged with

[28] The former Office of Health, Safety and Security was divided into two separate organizations on May 4, 2014: EA and the Office of Environment, Health, Safety and Security. According to EA's webpage ("About Us," http://energy.gov/ea/about-us), the office is DOE's "autonomous organization responsible for performance of assessments on behalf of the Secretary and Deputy Secretary, in the areas of nuclear and industrial safety, cyber and physical security, and other critical functions as directed by the Secretary and his Leadership team."

discovering "waste, fraud, and abuse" across the Department, not just at the laboratories.[29] The effective implementation of the CAS has reduced much of the separate oversight and assessment activity at many of the laboratories. Site offices at laboratories with a mature CAS have been more successful acting as gatekeepers by aiding non-DOE external assessors in leveraging assessments conducted by the laboratory or the site office.

Recommendation 12: All stakeholders should make maximum use of local assessments (performed by site offices and laboratories), with appropriate verification, to reduce duplicative assessments and burden on the laboratories.

The Commission found that onerous and lengthy data requests can often arrive at the laboratories without being sufficiently vetted or filtered. Many of the data calls are sent to all of the laboratories and could be answered by one call to a single laboratory, rather than 5 or 17. SC has successfully reduced the number of unfiltered data requests at the laboratories by establishing a single point of contact for data requests for all of its 10 laboratories. This filtering process does not occur at other program offices, and burdensome data requests still arrive at all laboratories. In a previous Administration, all data requests were screened and approved by the Deputy Secretary in order to assure a consistent application across all offices and laboratories.

Recommendation 13: DOE should establish a single point of control—within the Department or each stewarding program office—for all laboratory-directed data requests.

4. Flexible Budgeting

Several past reports have emphasized the laboratories' concern regarding "budget atomization," which refers to ever smaller increments of funds under the laboratory's control for a particular project or program. The result of budget atomization is increased reporting requirements and decreased flexibility, which may reduce the laboratories' effectiveness and efficiency.

Budget flexibility depends on both the legal restrictions imposed by Congress in their allocation of funding and the granularity of management by each DOE program office (Table 2). The pyramid graphic (Figure 5) shows the view from the laboratory's perspective. It demonstrates the different levels of controls placed on the NNSA laboratories' budgets and indicates what legal or institutional requirements pertain at each level.

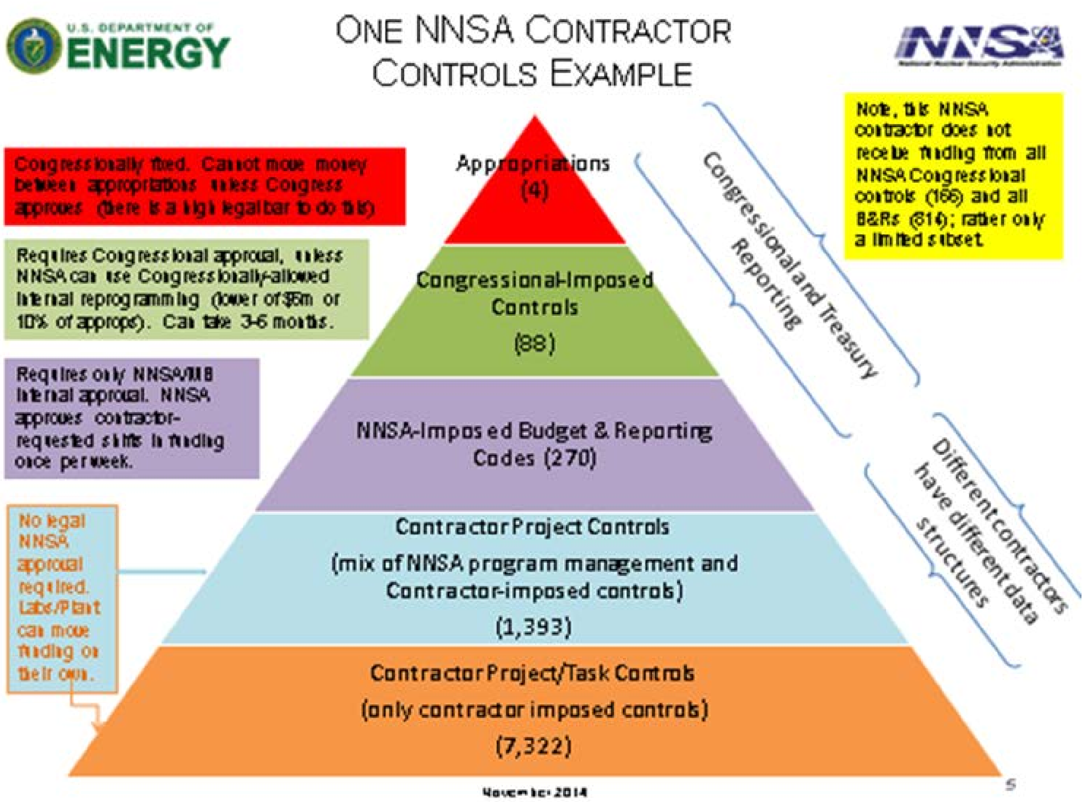
[29] More information is available at the DOE Office of Inspector General's webpage, "About Us," http://energy.gov/ig/about-us.

Table 2. Number and Source of Control Points for Laboratory Budgets

	Legal Control	Program Office			
	FY 2014 Appropriations Only				All Years
	Appropriation (year & period of availability)	Program Project Activity (PPA)	9 Digit Budget and Reporting (B&R) Codes	Place	Place
Weapons	1	70	321	1,278	2,369
Defense Programs	*1*	*44*	*161*	*566*	*979*
All other	*1*	*26*	*160*	*712*	*1390*
Defense, EM	2	33	119	609	1,292
SC	3	26	253	1054	2,120
EERE	3	18	84	553	1,253
OE	2	7	14	80	211

Source: DOE Office of the Chief Financial Officer.

Note: The table does not include the Obligational Control Level (OCL).



Note: The figure does not include the PPA level.

Figure 5. One NNSA Contractor Controls Example

Congress is responsible for the first three layers: the Appropriation, the Obligational Control Levels (OCL), and the program, project, and activity (PPA) levels which are established by statute. Within any given OCL, there is some flexibility at the level of a total dollar amount or a percentage of the total funding line, whichever is lower. For example, the ceiling for movement of funds for NNSA is $5 million or less than 10 percent of the funding amount, whichever is lower. This permits some movement of funding between OCLs without congressional approval. However, when a movement of funds between OCLs that exceeds the statutorily defined thresholds occurs, NNSA reported that the time required for each congressional approval is between 3 and 6 months.

DOE, in turn, divides each PPA into multiple budget and reporting (B&R) codes. The degree of programmatic control is set forth in the work breakdown structure that corresponds to each B&R code. Table 2 shows the obligations for five appropriations as examples of how these buckets proliferate as funding moves out to the field—from congressional PPAs to individual program offices to individual laboratories. The first four columns show the number of buckets for FY 2014 funding only. The last shows how many buckets each office manages when all years of funding are considered.

The budget atomization problem is not uniform across program offices or laboratories. The 2014 Augustine/Mies panel report called for the Congress, DOE Secretary, and the NNSA Administrator to "adopt a simplified budget and accounting structure" through a reduction of the Obligational Control Levels and to "better align resources" for efficient mission execution.[30] The report went on to say that NNSA should reduce the internal budget control lines to the "minimum number needed to assign funding for major programs and mission-support activities across the sites." The Commission endorses these recommendations and believes they should be extended to other parts of DOE's laboratory system.

The Commission also supports the Office of Energy Efficiency and Renewable Energy's recent move towards larger grants with longer periods of performance and fewer milestones and reporting requirements. In 2014, EERE leadership established a policy for its program managers to assign fewer, larger projects to the laboratories.[31] The guidance was to double the size and halve the number of funding buckets. In addition, the new EERE policy decreased the number of milestones per project to one per quarter. These milestones are to be well-defined, quantitative and rigorous. Accountability is still key; every 12 to 18 months, the office makes a go/no-go decision based on the work accomplished to date.

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[30] Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Security Enterprise*, November 2014.

[31] The policy changes are reflected in DOE Energy Efficiency and Renewable Energy (EERE), *EERE – National Laboratory Guiding Principles* (Washington, DC: DOE, March 9, 2015).

Recommendation 14: To reduce the number of funding buckets and minimize the accompanying transactional burden, DOE and its program offices should adopt and adhere to the following principles:

- Increase the size of funding increments through consolidation of B&R codes at the highest level possible within each program area.
- Extend timelines and minimize milestones for each increment of funding. Work breakdown structures must be formulated to focus on strategic goals rather than tactical milestones and reporting requirements.
- Within legal limits, institutionalize mechanisms for laboratory flexibility via notification, rather than formal approval, to move money between B&R codes on cross-cutting R&D objectives or closely interrelated research areas among DOE program offices.

The recent reliance on continuing resolutions to fund the U.S. Government and a change in law has exacerbated the budget atomization issue. DOE used to be able to control funds at the OCL when operating under a continuing resolution. However, Section 301(c) in the FY 2012 appropriations bill, which was reinstated as Section 301(d) in FY 2014 and FY 2015, changed the legal level of control to the program, project, and activity (PPA) level.[32] In one example cited by DOE personnel, this change expanded the number of control categories from 30 to over 300. This, in combination with other Office of Management and Budget (OMB) apportionment requirements—including quarterly apportionment for SC and other program areas—creates constant turmoil and delay in getting money to the laboratories. Repealing Section 301(d) would allow the laboratories to manage more effectively, while still complying with all new start and other legal restrictions when operating under a continuing resolution.

Recommendation 15: Congress should repeal Section 301(d) of the FY 2015 Consolidated Appropriations Act as soon as feasible to remedy the transactional burden it creates for OMB, DOE Headquarters, and the laboratories when operating under a continuing resolution.

[32] Section 301(d) reads “Except as provided in subsections (e), (f), and (g), the amounts made available by this title shall be expended as authorized by law for the programs, projects, and activities specified in the ‘Final Bill’ column in the ‘Department of Energy’ table included under the heading ‘Title III—Department of Energy’ in the explanatory statement described in section 4 (in the matter preceding division A of this consolidated Act).”

4. Maintaining Alignment and Quality

DOE is responsible for aligning the research performed at its laboratories with the Department's mission priorities, ensuring the quality of the research and research programs, monitoring for duplication, and providing sufficient resources to allow the laboratories to execute effectively. As steward of the 17 National Laboratories, DOE has the important role of providing strategic direction to the laboratory system. Strategic review, planning, and implementation are essential for alignment among the laboratories, the laboratories' sponsors, and the Department's priorities. Currently there are no processes to provide this type of comprehensive strategic direction to the laboratory system as a whole. Recent initiatives, such as the Crosscuts and the Science and Energy Plan, address this objective in part by creating strategic links across DOE programs and between programs and laboratories. They have either focused on a single, albeit broad, topic (in the case of the Crosscuts) or have focused only on pieces of the mission (in the case of the Science and Energy Plan, which excludes the nuclear and environmental management missions).

A. Alignment with DOE's Objectives

Despite the lack of a Department-wide, comprehensive strategic planning process, the National Laboratories' research programs and capabilities are generally well-aligned with DOE's missions and strategic priorities. There are robust processes in some program offices to provide strategic oversight, evaluation and direction to the laboratories. However, those processes are not consistently utilized throughout the Department.

SC has established effective formal processes to ensure proper alignment between its laboratories' research programs, and the Department's missions and strategic priorities. Alignment is assessed annually during the Laboratory Strategic Planning process. During this process, SC requires laboratory leaders to define the long-range visions for their respective laboratories. This information provides a starting point for discussion about each laboratory's future directions, immediate and long-range challenges, and resource needs. DOE and the laboratory leaders settle on new research directions and the expected development or sustainment of capabilities. In addition, external advisory committees provide advice on establishing research and facilities priorities; determining proper program balance among disciplines; and identifying opportunities for inter-laboratory collaboration, program integration, and industrial participation.

By contrast, within the NNSA, each program office reviews its strategic plans with the laboratories separately. For example, Defense Programs coordinates the Stockpile Stewardship and Management Plan, a congressionally mandated 25-year program planning document that is a collaborative effort of all the sites and stakeholders.[33] Semiannually, the Defense Nuclear Non-Proliferation Office (NA-20) uses an Assistant Laboratory Director "science council" with all the laboratories to discuss strategic direction and core capabilities that are critical to the NA-20 mission. Since these reviews are program based and not integrated, their effectiveness in providing strategic direction to the three weapons laboratories remains unclear.

An essential cultural difference also exists between SC and many of DOE's other program offices. That is the principle of stewardship for the laboratories that exists within SC. The basic orientation of SC leadership in its planning processes is one of responsibility to ensure the long-term health and scientific excellence of each of its laboratories. That principle is not consistently embraced to the same degree in the other program offices. In some cases, it depends completely upon the orientation of the political leadership of the program office at the time, and has varied from indifference to a solid commitment.

Recommendation 16: Other DOE program offices should adapt to their contexts the procedures and processes that DOE's Office of Science has in place for guiding and assessing the alignment of the laboratories under its stewardship with DOE's missions and priorities.

B. Ensuring High-Quality Research and Research Programs

Relative to other offices within DOE, SC has mature processes in place for assessing the quality of the research being done by the 10 laboratories under its stewardship. The office also has numerous processes to assess the quality of the research portfolio in each of its major program areas. The processes in place at the other DOE program offices are not as mature.

SC conducts an annual evaluation of the scientific, technical, managerial, and operational performance of its 10 laboratories. This process is coordinated by the Office of Laboratory Policy on behalf of the SC Director. These evaluations provide the basis for determining annual performance fees and the possibility of winning additional years on the contract through an extension. They also serve to inform DOE decisions regarding whether to extend or to re-compete the M&O contracts when they expire.

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[33] The Stockpile Stewardship and Management Plan's (SSMP) validity as an executable plan remains an issue of debate between the Department of Defense and NNSA. See Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Security Enterprise*, November 2014, 12–14.

The current laboratory appraisal process began in 2006 and was designed to improve transparency, increase the involvement of SC leadership, standardize laboratory evaluation, and more effectively incentivize contractor performance by tying performance to fee earned, contract length, and publicly released grades.

SC's laboratory appraisal process uses a common structure and scoring system across all laboratories and is structured around eight performance goals, each of which comprises several objectives. Within each objective, the program offices and site offices further identify notable outcomes that illustrate important features of the laboratory's performance. The performance goals, objectives, and notable outcomes are documented at the beginning of each year in the PEMP, which is appended to the laboratory's M&O contract.

At the conclusion of each fiscal year, the organizations that fund work at a given laboratory evaluate its S&T performance. In addition to managing its science programs, SC solicits input from all organizations that spend more than $1 million at the laboratory. This input is weighted according to the dollars spent. Each site office evaluates the laboratory's performance against the M&O objectives. The program offices and the site office consider the laboratory's performance against the notable outcomes, defined in the PEMP, as well as other sources of performance information that become available throughout the year. These sources might include independent scientific program and project reviews; external operational reviews conducted by GAO, IG, and other parts of DOE; and results of SC's own oversight activities. The evaluation process concludes with a series of meetings, one for each performance goal, during which the various organizations involved report their proposed scores and work to ensure a consistent and fair approach across all 10 SC laboratories.

Other significant assessment activities also occur within SC program offices. These assessments include division-led laboratory management reviews of the research programs and status of each project; discussion of topics for current and proposed white papers and related LDRD activities; and relevant programmatic activities, such as recruitment, infrastructure, equipment, and instrumentation. SC also carries out a triennial science/operational review of its user facilities, which is an essential part of the performance assessment of these facilities.

Each of the programs within SC has established an external Advisory Committee to provide independent advice to the SC Director regarding the scientific and technical issues that arise in the planning, management, and implementation of the program. The recommendations from the Advisory Committees include research and facilities priorities; proper program balance among disciplines; and opportunities for inter-laboratory collaboration, program integration, academic collaboration and industrial participation. The Advisory Committees include representatives of universities, research laboratories, and industries involved in energy-related scientific research.

The SC Director charges the Advisory Committees to assemble Committees of Visitors (COVs) "to assess the efficacy and quality of the processes used to solicit, review, recommend, monitor, and document funding actions and to assess the quality of the resulting portfolio."[34] The national and international standing of the research are part of the evaluation. Every program must be reviewed by a COV at least once every 3 years. Each review panel is made up of scientists and research managers known to have significant expertise in the appropriate field. The COV prepares a report that is reviewed by the Advisory Committee, which may make modifications prior to acceptance. Following acceptance, the report is transmitted to the SC Director and released publicly.

Another type of external review process used by the SC program offices is the Comparative Research Review. These reviews provide independent comparative evaluations of supported research activities as a means of ensuring the quality and impact of the science that SC supports. By providing a critical assessment of all grants simultaneously, the program offices are able to identify those efforts that should be phased out so that funding can be re-competed. In FY 2013, for example, the Comparative Research Review carried out by the SC's Office of Nuclear Physics (NP) resulted in approximately 25 percent of the least competitive grants being phased out. Not only did the review provide important input to NP regarding the quality and balance of its research portfolio, it also helped establish a strategic vision for U.S. nuclear science developed in partnership with the broader research community.

SC's processes for assessing the quality of both the research conducted by their 10 laboratories and of the research portfolio in each SC program have begun to influence other programs. For example, NE adopted a PEMP-like process, but with greater emphasis on safety. NNSA also recently instituted a process similar to the PEMP, but the NNSA process focuses more on operations than on strategic direction. Although some factors necessarily limit the applicability of SC's processes to other programs (e.g., the classified nature of the work at the NNSA laboratories, which affects their use of Advisory Panels and Committees of Visitors), the Commission is encouraged to see other program offices developing similar processes.

Recommendation 17: The processes that the Office of Science has in place for assessing the quality of the research being done by the 10 laboratories under its stewardship, and for assessing the quality of the research portfolio in each of its programs, should be adapted by the other DOE program offices.

In 2012, partly as a result of the 2010 GSA conference scandal, OMB released a memorandum that, among other things, outlined new policies and practices to reduce

[34] DOE website, "Committees of Visitors," http://science.energy.gov/sc-2/committees-of-visitors/.

spending in areas such as travel and conference attendance.[35] Subsequently, the DOE Deputy Secretary released guidance on the implementation of the new OMB requirements.[36] During every laboratory visit, laboratory staff told the Commission that the resulting conference management rules and their implementation have discouraged scientists and engineers from attending technical conferences, thereby hindering the laboratory's ability to maintain contact with researchers at the leading edge. A lengthier approval process for conference attendance had led many laboratory scientists to choose not to submit and/or present papers at scientific conferences for fear they would not be able to attend. According to the National Academy of Sciences, scientific conferences provide a venue for researchers to collaborate with others in their field and allow access to the latest research findings, which may not be published in scientific journals in a timely fashion.[37] The Commission strongly believes that attendance at professional conferences is essential to maintain the highest quality research at the National Laboratories, and to attract and retain the highest quality scientific and technical staff. Very recently DOE, working closely with the laboratories, updated its guidance on conference-related activities and spending. The new guidance "refines the Department's conference management policies and procedures using a risk-based approach."[38] The changes are expected to streamline approval processes and reduce transactional oversight of the laboratories thereby better enabling participation in scientific/technical conferences. Essentially, the revised conference policy provides the laboratories with more autonomy in managing conferences, but makes them responsible for ensuring that tax payer funds are used appropriately. The Commission is encouraged by both DOE's updated guidance and the laboratories' involvement in the revision process.

Recommendation 18: There must be a government-wide reconsideration of the conference travel restrictions to enable conference participation at levels appropriate to both the professional needs of the existing scientific staff and to attract the highest quality staff in the future. The Commission is encouraged by DOE's recently revised guidance on conference-related activities and spending, and notes that the laboratories have been given more autonomy on this issue, while at the same time being held accountable for the appropriate use of taxpayer funds.

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[35] J. Zients, *Promoting Efficient Spending to Support Agency Operations* [Memorandum], Office of Management and Budget.

[36] D. Poneman, *Promoting Efficient Spending to Support Agency Operations* [Memorandum], Department of Energy.

[37] National Research Council (NRC), *Strategic Engagement in Global S&T: Opportunities for Defense Research* (Washington, DC: National Academies Press, 2014).

[38] E. Sherwood-Randall, *Updated Guidance on Conference-Related Activities and Spending* [Memorandum] (Washington, DC: DOE, August 17, 2015).

C. Laboratory Directed Research and Development

The ability to adapt, retool, invest in staff and capabilities, and to enter new research areas is crucial to laboratory performance and the maintenance of high-quality staff and research. Laboratories rely in large part on LDRD programs to achieve these goals. LDRD is the sole source of discretionary research funding under the control of the laboratory director. First authorized in the Atomic Energy Act of 1954, LDRD supports researcher-initiated work of a creative and strategic nature. These projects might serve as proofs of concept in emerging fields, address significant technical challenges facing laboratory programs, or explore innovative concepts to address DOE missions.

LDRD's accomplishments are noteworthy. Multiple programs across the system have often begun through initial LDRD investments in capabilities and expertise, and the investments have often produced significant returns—both scientific and financial. At Lawrence Berkeley, for instance, LDRD-funded projects totaling $484,000 helped establish the technical foundations that allowed the laboratory and its partners to secure both the $250 million DOE Joint Bioenergy Institute program and a $500 million contract for the Energy Bioscience Institute from British Petroleum. Other major programs, such as the Joint Center for Energy Storage Research at Argonne, the Energy Frontier Research Center led by NREL, and early-stage work on the Human Genome Project at the NNSA laboratories, rose out of LDRD investments. In the field of stockpile stewardship, findings of LDRD projects have had a significant impact on stewardship strategy, resulting in dramatic savings to the Nation through a more informed understanding of life extension science. Lastly, a large volume of the scientific output from the laboratories (measured by peer-reviewed publications, patents, and invention disclosures) result from LDRD-funded projects.

Many laboratories also depend on LDRD to support the recruitment and retention of qualified staff. The importance of LDRD for the purpose of workforce development at NNSA laboratories is demonstrated by Table 3, which shows the significant degree to which LDRD is used to support post-doctoral researchers, a crucial source of the NNSA laboratories' scientific workforce. NNSA laboratories must often hire people who have not yet received their security clearance—a process which can take up to a year or longer—so having a flexible unclassified pool of funds is critically important for hires at all levels.

Table 3. LDRD Recruitment/Retention Metrics at NNSA Laboratories (FY 2008–FY 2012)

	Sandia	Lawrence Livermore*	Los Alamos
Post-doctorates supported by LDRD	56%	51%	59%
LDRD post-doctorates converted to full-time staff	77%	74%	49%

* Data for Lawrence Livermore provided by NNSA for FY 2010–FY 2013.

All of the laboratories employ competitive, merit-based processes to solicit, review, and select LDRD projects for funding. DOE has interpreted LDRD authorizing legislation to require site office and headquarters staff to separately review and approve each LDRD project for mission alignment and compliance with the Department's statutory requirements.[39] The Commission finds the requirement for individual LDRD review and approval by the Federal Government counter to the tenets of trusted partnership, but both laboratories and DOE HQ report that the process of review and approval are not burdensome. Regardless, Congress should consider amending LDRD authorizing legislation such that the Department conducts periodic audits or reviews a sampling of each year's project pool after a one-time certification that the laboratory's LDRD proposal selection process is rigorous, based on peer review, and includes all necessary criteria.

Laboratories acquire funding for LDRD as part of the overhead on R&D performed at the laboratory. As illustrated in Figure 6, funding levels for LDRD vary widely across the system, reflecting the diversity of the laboratories in size and mission needs. LDRD is especially important at NNSA laboratories, which spend more on LDRD in both percentage and absolute terms.

In FY 2006, Congress required the laboratories to burden LDRD, changing the cap from an unburdened 6 percent to a burdened 8 percent.[40] Then in FY 2014, Congress reduced the LDRD cap from 8 percent to 6 percent, still burdened.[41] In 2015 Congress added another restriction, requiring the 6 percent cap to be applied program by program, rather than at the total R&D funding level, further reducing flexibility for the labs. Some laboratories reported that the burdening and reduced cap on LDRD significantly reduced the amount of LDRD work that could be done, while others reported minimal impact. For laboratories with programs closer to the cap—primarily the NNSA laboratories—the decrease from 8 percent to 6 percent resulted in substantial cuts to the size of recruitment and retention programs, number and size of projects, and funding for specific types of projects, such as exploratory research. Non-NNSA laboratories typically elect lower LDRD rates for a variety of reasons—including concern about overhead rates and their reduced reliance on LDRD to attract top talent or maintain scientific creativity due to their more research-focused missions—and the change in cap had less of an effect.

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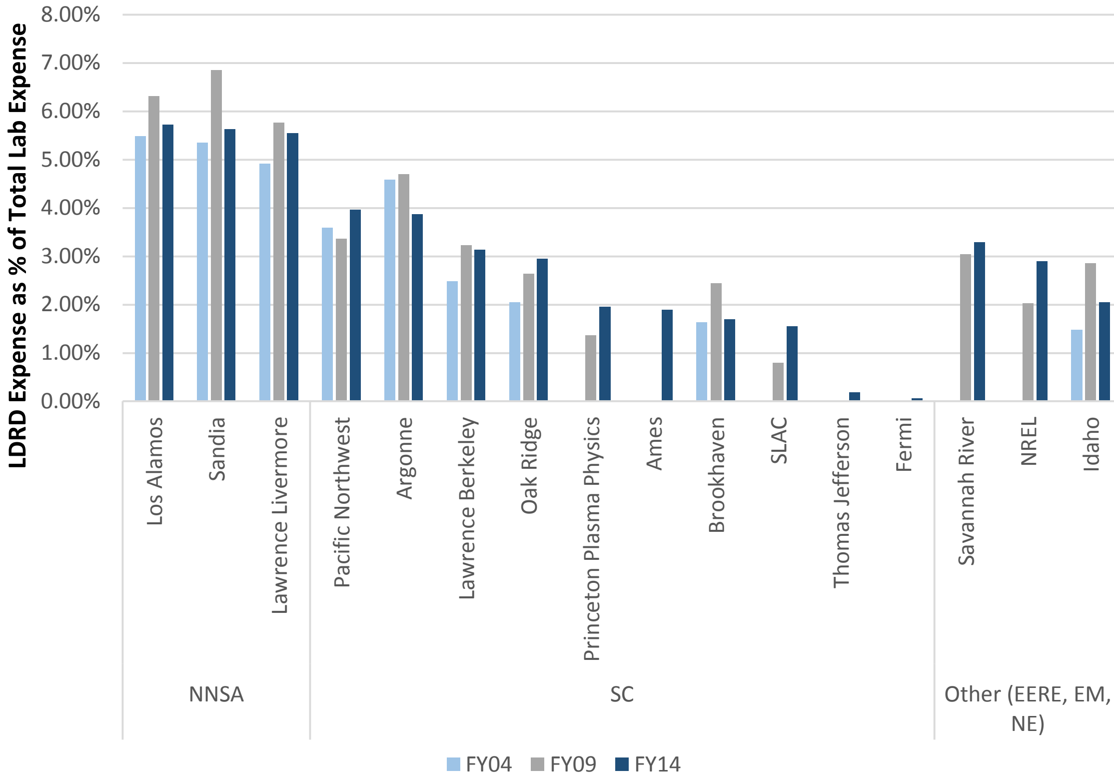
[39] DOE, Order 413.2B, *Laboratory Directed Research and Development* (January 2011). These requirements prohibit the use of LDRD funds for projects that would require non-LDRD funds to accomplish technical goals, provide for general purpose capital expenditures, and substitute for programmatic projects where funding has been limited by Congress or DOE/NNSA.

[40] Energy and Water Development Appropriations Act, 2006 (Public Law 109-103). "Burdened" means overhead is charged to LDRD projects.

[41] Consolidated Appropriations Act, 2014 (Public Law No. 113-76).



Note: Data derived from DOE Fiscal Year 2004 and Fiscal Year 2014 LDRD Reports to Congress. In FY 2004 and all other fiscal years prior to FY 2006, LDRD-funded projects were unburdened. After FY 2006, Congress mandated the burdening of LDRD, such that LDRD-funded projects pay the appropriate share of overhead. The percent cap on LDRD was also raised to 8 percent during the same year, to be reduced to 6 percent while maintaining the burden in FY 2014. In terms of FTE hours of work, an 8 percent burdened cap enables considerably less research to be conducted than with a 6 percent unburdened cap. Laboratories that did not report LDRD data for specific years did not have LDRD programs during those years. As a GOGO, NETL does not have an LDRD program.

Figure 6. Reported LDRD Spending as a Percentage of Total Laboratory Expenditures, FY 2004, FY 2009, and FY 2014

The quantitative difference between burdening and unburdening LDRD with overhead is significant. To return to the level of real funding provided by a 6 percent unburdened LDRD program under burdening, a laboratory with an 80 percent overhead rate would require a cap of roughly 10 percent burdened.[42] Given the mission importance

[42] For 6% unburdened, each $1M of laboratory R&D budget would provide $60K in LDRD funds. Assuming an 80% overhead rate, the same $1M would provide ~$45K in LDRD funds under an 8% burdened cap and only ~$33K under a 6% burdened cap. To reach levels comparable to the historical 6% unburdened policy, the cap would need to rise to 10% burdened (i.e., $1M budget would produce $100K LDRD, of which ~$56K would go to R&D while the remainder ~$44K would be collected as overhead).

of LDRD, the Commission strongly endorses a reconsideration of LDRD policy to enable a return to the previous levels of R&D effort.

> **Recommendation 19:** The Commission strongly endorses LDRD programs, both now and into the future, and supports restoring the cap on LDRD to 6 percent unburdened, or its equivalent. The Commission recognizes that, in practice, restoring the higher cap will have the largest impact on the LDRD programs of the NNSA laboratories.

D. Appropriate Level of Duplication of Research

Competition among similar groups—and thus some degree of duplication across the laboratories—is integral to scientific advancement. Scientific progress is made through exploring many avenues of inquiry at the same time and the chance of success increases with the number of people who try different ideas and strategies. The reality of finite resources must, of course, also be recognized—the government simply cannot fund every idea in every field. In addition, spreading resources too thinly across too many researchers is inefficient. A balance must therefore be struck between allowing creativity and innovation to blossom and appropriately managing resources to maximize productivity. Resources should allow several laboratories to participate in a healthy competition, so that different ideas can thrive during the genesis of a new field or technology. Once a specific scheme has proved superior to others, resources should be focused there.

Most "duplication" that occurs within the R&D programs of the laboratories is intentional, managed, and beneficial to the Nation. For example, it may occur during the early stages of new research, when it is appropriate to encourage multiple researchers to carry out small-scale projects and explore different potential avenues. In mature program areas, the Department has processes to provide strategic oversight and guidance. This is healthy and should be supported.

There is, however, some period of time between the early and more mature stages of a research field during which the laboratories do compete with one another to achieve prominence in new research areas. The Galvin report characterized this in the 1990s, for instance, as "excessive scrambling by the laboratories to establish programmatic activities in new mission areas."[43] If this entrepreneurial stage is allowed to extend for too long, it can seriously inhibit inter-laboratory collaboration and transparency, as the laboratories maintain secrecy and compete aggressively for funding support. DOE has attempted various solutions to this, including the research Hubs that were designed to foster teams of laboratories and other organizations working together. A promising current effort is the

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43 SEAB, *Alternative Futures for the Department of Energy National Laboratories* (Washington, DC: DOE, 1995); also referred to as the Galvin report.

Grid Modernization Initiative, in which the 10 laboratories that are currently working on modernization of the electricity grid are forming a collaborative program with differentiated roles for each of them. That is a good step, but should have been initiated by DOE perhaps as much as a decade earlier while the 10 laboratories were working independently.

Because of the significant resources involved, the Department has developed processes for prioritizing user facilities and avoiding duplicative facilities. These processes are often led by external topic-based advisory panels and often involve multiple Federal agencies—for example, the Basic Energy Sciences Advisory Committee (BESAC)[44] and the High Energy Physics Advisory Panel,[45] which report to DOE and the National Science Foundation (NSF) jointly. The success of these processes in planning large user facilities may be best illustrated by recent changes to DOE's thinking about new light sources, which are essential for basic research in many scientific fields, from physics to life sciences, chemistry and materials science. SC significantly amended its strategy for synchrotron light sources as a result of the BESAC report, *Future X-Ray Light Sources*. As a result of this report, SC tasked SLAC to modify its plans for the Linac Coherent Light Source II to integrate new functionality; Argonne to incorporate diffraction limited storage ring technology into its Advanced Photon Source Upgrade; and terminated Lawrence Berkeley's proposed Next Generation Light Source. This strategic restructuring of facility upgrades and termination of a proposed facility has been claimed to have saved between $250 million and $850 million, while simultaneously ensuring the U.S. remains at the forefront of light source and storage ring science.[46] It also ensures that the broader S&T community will have the facilities it needs.

Recommendation 20: DOE should manage the National Laboratories as a system having an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry, so long as the research aligns with mission priorities. Once the research has matured to the point that a preferred or most promising approach can be identified, the Department should provide strategic oversight and guidance, including expert peer review, for the laboratory system to coordinate and potentially consolidate their programs to achieve the most effective and efficient use of resources.

An area in which the question of competition and duplication is more subtle involves the two nuclear weapons physics design laboratories, Los Alamos and Lawrence Livermore. The

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[44] For more information, see "Basic Energy Sciences Advisory Committee (BESAC)," http://science.energy.gov/bes/besac/.

[45] For more information, see "High Energy Physics Advisory Panel (HEPAP)," http://science.energy.gov/hep/hepap.

[46] DOE SC, *FY 2015 Budget Request to Congress for DOE's Office of Science* (2014).

U.S. has relied on design competition and inter-laboratory peer-reviewed competitive processes to develop and maintain its nuclear deterrent successfully for over 50 years. Los Alamos and Lawrence Livermore have participated in vigorous design competitions for the design of all nuclear explosive packages currently in the stockpile. Sandia has been and continues to be responsible for engineering all parts of the weapons, other than the nuclear explosive package. In contrast to the current policy, which forbids testing of the nuclear explosive package, Sandia components and systems can be tested experimentally.

Now the principal challenge of the three NNSA laboratories is to maintain confidence in the Nation's smaller nuclear weapons stockpile, while continuing to improve its safety and security, all without nuclear explosive testing. This is an enormous scientific and technical challenge and it is essential that the government continue to have the benefit of two strong, independent physics laboratories responsible for the nuclear explosive package, which use different computational codes and experimental techniques short of nuclear explosive tests.

In the absence of nuclear explosive testing, the Nation's confidence in the stockpile ultimately rests on the technical and scientific judgments of Los Alamos and Lawrence Livermore for the nuclear explosive package and on Sandia for the testable remainder of the weapons systems.

Since the cessation of nuclear weapons explosive testing in the early 1990s, we have relied on science-based stockpile stewardship (SBSS). SBSS requires a redundancy in approach that entails a unique mix of competition, collaboration, and duplication, which has been remarkably successful. It is sometimes argued, however, that since we are designing no new nuclear weapons, we no longer need two design laboratories. The basic premise of this argument is flawed. We are still involved in nuclear weapons science and design. Since the start of the Stockpile Stewardship Program, Los Alamos and Lawrence Livermore have continued to discover problems not revealed by the earlier nuclear tests and have occasionally even solved problems that nuclear explosive testing did not. For example, starting with different hypotheses about the aging behavior of plutonium, Los Alamos and Lawrence Livermore, after an intense scientific competition, both eventually came to the conclusion that the plutonium pits in nuclear weapons were much more stable than originally thought, providing greater confidence in the reliability of the pits and the stockpile.

In addition, the current annual assessment process, which is a central element of stockpile stewardship, has included the Independent Nuclear Weapons Assessment Process (INWAP) since 2010. INWAP employs assessment teams from one physics laboratory to independently develop and refine nuclear performance baselines for weapons types that are the responsibility of the other physics laboratory. The technical experts on these teams are uniquely qualified to conduct these assessments because they draw from the only organizations that have the computational and experimental capabilities necessary to conduct such technical evaluations as well as the personnel who possess the required security clearances. The results of these independent annual assessments are reported to the responsible laboratory Director, who uses them as one element of the overall annual assessment process to evaluate the certification basis of the weapons types for which the laboratory is responsible.

Any viable alternative to maintaining two nuclear explosive package design laboratories must provide the same high level of confidence in the nuclear weapons stockpile that is currently ensured by the independent peer review process. This process has been key to U.S. nuclear weapons R&D since the 1950s. Any proposed alternative must also retain key personnel and facilities. The Commission believes that such an independent review process requires the technical capabilities of both Los Alamos and Lawrence Livermore and that these capabilities must remain separate and independent. Since nuclear weapons research is classified, and explores ranges of temperatures, pressures and other physical regimes not usually accessed by the general scientific community, the knowledge, expertise, and experimental capabilities exist only at the nuclear weapon design laboratories. The Commission strongly believes that these capabilities must be maintained.[47]

Recommendation 21: Congress should recognize that the technical capabilities currently housed within the NNSA laboratories are essential to the Nation. Maintaining the nuclear explosive package capabilities in separate and independent facilities has proven effective and should continue, thereby providing senior decision makers the highest possible level of confidence in the country's nuclear weapons stockpile.

[47] For a more in depth look at this subject the reader is referred to the recently released National Academies report entitled "Peer Review and Design Competition in the NNSA National Security Laboratories" which can be found at http://www.nap.edu/catalog/21806/peer-review-and-design-competition-in-the-nnsa-national-security-laboratories.

5. Maximizing Impact

The National Laboratories represent a national asset of inestimable value. A great deal of money has been invested to create scientific and technical capabilities that are crucially important for the Nation's security and economic competitiveness. Realizing the full potential of the laboratories requires a much greater effort to tap their capabilities, especially in support of economic competitiveness.

Today, the National Laboratories interact with many stakeholders beyond DOE, from other Federal agencies and universities to businesses and industrial partners small and large. Strategic Partnership Projects (SPP)[48] is the performance of work for non-DOE entities, such as other Federal agencies, state or local governments, academia, and industry.[49] Working to encourage these mission-aligned collaborations both invigorates the laboratories with fresh ideas and allows their housed knowledge and expertise to reach beyond the site fence, in service of the public good and national prosperity.

At the same time, more can be done to broaden collaboration and to make the laboratories run efficiently and effectively. By addressing inefficiencies in management and burdensome practices, effectiveness can be improved, and the impact of the laboratories maximized.

A. Support of Other Agencies

Supporting other Federal agencies offers opportunities for the cross-pollination of ideas among the broad scientific and engineering community. It also helps to ensure greater use of existing facilities; enables some Federal agencies to perform work they would not otherwise be able to since they do not possess the capabilities and assets themselves; and sustains S&T capabilities that the DOE budget may not be able to fully support in a given year, but which are important to maintain for the long term.

Of the total $17.2 billion funding for the laboratories in FY 2013, SPP for other Federal agencies accounted for 14 percent ($2.43 billion). The Department of Defense was by far the largest other Federal agency customer, contributing $1.49 billion (61 percent) of the SPP for

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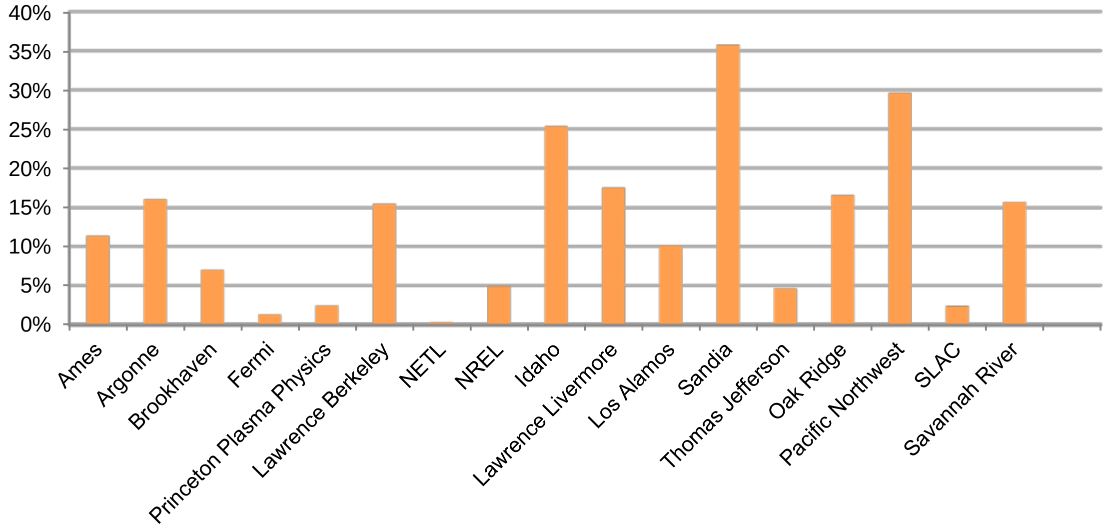
48 Under DOE Order 481.1, DOE has renamed Work for Others (WFO) as Strategic Partnership Projects (SPP). DOE defines SPP as "work for non-DOE entities that is performed by DOE/contractor personnel and/or utilizes DOE facilities and is not directly funded by DOE appropriations."

49 Section A of this chapter focuses on the Commission's specific mandate: SPP for other Federal agencies. Sections B, C, and D offer examples of other types of SPP: academic collaboration, industry partnerships and technology transition, and operation of user facilities.

other Federal agencies total.[50] The percentage of laboratory work devoted to other agencies varies widely across the laboratories (Figure 7).



Source: Data provided by DOE to the Commission, October 2014.

Figure 7. SPP for other Federal Agencies as a Percentage of Average Total Budgets, FY 2009–FY 2013, by Laboratory

The Commission observes that DOE has policies in place to ensure that work supporting other agencies meets necessary criteria and aligns with the Department's missions. Multiple Federal agencies have identified a range of core DOE mission areas and capabilities that are also part of their mission sets, which the National Laboratories help them address through SPP for other Federal agencies; these include: modeling and simulation; non-proliferation and weapons of mass destruction threat reduction; physical protection of nuclear materials and facilities; nuclear forensics; knowledge about foreign S&T capabilities; energy efficiency; and wide area surveillance technologies.

On the whole, other Federal agency customers are very satisfied with the quality and value of the work performed by the laboratories. However, many find laboratory costs are high relative to other research performers. Satisfaction is much lower with the role that DOE headquarters plays in SPP for other Federal agencies. One source of frustration is the lengthy process required to obtain approvals for SPP, especially within the NNSA laboratories, and the fact that this process is usually the same for a small level of effort as it is for a multi-million dollar initiative. While there has been some progress in using standardized umbrella agreements, which identify acceptable areas of work, this has yet to

[50] This figure does not include funding for the existing nuclear weapons and naval reactors programs, nor is Intelligence Community funding fully reported.

be applied consistently across the system.[51] An additional improvement has been NNSA's creation of the position of Director of Interagency Work, one of the aims of which is to shorten the timeline of the SPP for other Federal agencies approval process. However, absent established relationships with DOE or the laboratories, it is sometimes unclear to SPP customers where to find the needed capability within the National Laboratory system.

Recommendation 22: DOE should establish policies and procedures to make the Strategic Partnership Projects (SPP) process more efficient, especially for work that is consistent with the annual operating plans, such as institutionalizing ongoing efforts to streamline the contracting process through more consistent use of umbrella SPP agreements and oversight mechanisms dedicated to shortening the timeline of the approval process; encouraging greater use of personnel exchanges and "customer relationship managers"; and creating a central point of contact in DOE headquarters to field questions from other Federal agency customers about where specific capabilities lie within the laboratory system.

Just as there is a lack of strategic planning across the entire National Laboratory system, so too is there a lack of strategic planning involving other Federal agencies with respect to S&T requirements for the DOE laboratories. The Mission Executive Council (MEC) was established in July 2010 and, consists of DOE, Department of Defense, Department of Homeland Security, and the Intelligence Community. Its purpose is to match the laboratories' technical capabilities with technical needs of the other agencies, thereby providing long-term strategic planning for capabilities that are unique to the DOE laboratories. However, the MEC has not been as effective a coordination resource as it was intended to be.[52]

Recommendation 23: DOE should support efforts to strengthen the Mission Executive Council.

B. Collaboration with the Academic Community

It is mutually beneficial for the academic and DOE laboratory communities to be closely linked. The laboratories benefit from university ties as a way to enhance recruitment and retention, and as a means of interacting with academic scientists working at the cutting edge of basic research. Academia also provides opportunities for enhanced external assessment through the academic peer review process. Academics, for their part,

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[51] This issue and recommendations to improve the process have been identified most recently in two other studies: Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Enterprise*, and NRC, *Aligning the Governance Structure of the NNSA Laboratories to Meet 21st Century National Security Challenges* (Washington, DC: National Academies Press, 2015).

[52] NRC, *Aligning the Governance Structure of the NNSA Laboratories*.

benefit from access to DOE's user facilities and involvement in the large, long-term, multidisciplinary projects that are common at the DOE laboratories.

The level of collaboration between the laboratories and universities is high. Based on an analysis of over 300,000 laboratory publications in archival journals over the last decade, the Commission found that roughly 75 percent of them included co-authors from outside the laboratory system. And about 70 percent of these collaborators were at academic institutions.

Recommendation 24:DOE and its laboratories should continue to facilitate and encourage engagement with universities through collaborative research and vehicles such as joint faculty appointments and peer review.

C. Partnering with Industry and Transitioning Technology

Partnering with industry and contributing to the economic development of the Nation is an important part of the mission of the National Laboratories. While every year there are hundreds of patents, invention disclosures, CRADAs and other forms of collaboration with the private sector throughout the laboratory network, support for technology transition is inconsistent across the laboratories and across the DOE program offices. According to interviewees, this is at least partially due to oscillating political pressure that swings from criticisms for favoring industry too much to condemnation for not doing enough to boost the economy.

The barriers to partnership can be significant for many companies, particularly small businesses. These barriers include the early stage of development of many technologies; the financial cost of collaboration with the National Laboratories, including the advance funding requirement; the complexity of many contract terms; the length of negotiation and approval times; and the inability or difficulty of researchers to serve as consultants. Laboratories and DOE have experimented with many innovative mechanisms for engaging industry to make such collaboration easier, faster, less expensive, and more effective. These include centers and institutions, such as the Illinois Accelerator Research Center at Fermi and the High Performance Computing Innovation Center at Lawrence Livermore; legal mechanisms, such as Lawrence Berkeley's umbrella CRADA, CalCharge, and the Agreements to Commercialize Technology pilot; targeted funding, such as Argonne's technology maturation program; and programs to encourage laboratory researchers to engage in technology transfer, such as Sandia's Entrepreneurial Separation to Transfer Technology program. DOE has also focused specifically on addressing barriers to partnership for small businesses through such initiatives as the Small Business Vouchers Pilot.[53]

Recommendation 25: All DOE programs and laboratories should fully embrace the technology transition mission and continue improving the speed and effectiveness of collaborations with the private sector. Innovative technology transfer and commercialization mechanisms should continue to be pursued and best practices in other sectors, including academia, should be examined.

DOE recently established the Fast-Track CRADA Program to streamline the execution of CRADAs by forgoing individual agency approval for each agreement so long as the agency has approved an annual strategic plan.[54] Fast-Track CRADAs can only contain "standard, pre-approved terms and conditions without substantive modification," which do not typically involve long review times under the normal system. Lengthier review times are associated with CRADAs or other agreements that deviate from standard terms and conditions. It would be helpful if DOE could specifically describe the range of acceptable terms and conditions to decrease negotiation and review time.

Recommendation 26: DOE should determine whether the annual operating plans proposed by the Commission in Recommendation 3 could qualify as the "agency-approved strategic plan" under the Stevenson-Wydler Technology Innovation Act of 1980, and the Fast-Track CRADA Program, and, if not, Congress should amend the law accordingly. For CRADAs with non-standard terms and conditions, DOE should define the acceptable range for each term and condition to greatly expedite negotiation and review/approval time.

Universities are natural partners for the laboratories in the pursuit of regional economic development. DOE laboratories with university managers have the option to use the university technology transfer office for many of their patenting and licensing needs. In addition, laboratories have partnered with States and universities to create centers of economic activity.

Recommendation 27: Laboratories should pursue innovation-based economic development by partnering with regional universities.

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[53] For more information, see "New National Labs Pilot Opens Doors to Small Businesses," http://breakingenergy.com/2015/07/09/new-national-labs-pilot-opens-doors-to-small-businesses/.

[54] The Fast-Track CRADA Program at DOE facilities streamlines the execution of CRADAs by forgoing individual agency approval for each agreement. Under 15 U.S.C. § 3710a (a), directors of Government-owned, contractor-operated laboratories may enter into CRADAs to the extent provided in an agency-approved joint work statement, or if permitted by the agency, in an agency-approved annual strategic plan.

D. Operating User Facilities

The user facilities at the National Laboratories are a unique and enormously valuable national resource to researchers at other Federal agencies, academic institutions, and the private sector here and abroad. These users are often funded through NSF, National Institutes of Health, NASA, Department of Defense, private industry, and other sources.[55] Many of the scientific user facilities run competitive, peer-reviewed processes to allocate time among potential researchers, and all of the SC user facilities designate time in this way. Many key user facilities are oversubscribed, some by as much as a factor of 3.

The strategic planning process for user facilities is strong in some parts of DOE. The best-run processes, such as those of SC, involve extensive work by peer review panels that use experts from the DOE National Laboratories, other Federal agencies, universities, and the private sector. These processes aim to develop long-term technical and funding plans for new and existing user facilities that meet national R&D needs and avoid inappropriate duplication.

> **Recommendation 28:** DOE, the Administration and Congress should continue to support user facilities at the DOE laboratories. Peer review by relevant external advisory groups should continue to be used to decide which facilities to build and where to put all future upgrades and new and replacement user facilities.

[55] Statement of Dr. Antonio Lanzirotti, *Department of Energy User Facilities: Utilizing the Tools of Science to Drive Innovation through Fundamental Research: Hearing before the Subcommittee on Energy and Environment and the Committee on Science, Space, and Technology, United States House of Representatives*. 112th Cong. 21–61 (2012).

6. Managing Effectiveness and Efficiency

A. Overhead

When the National Laboratories are criticized for being too expensive, overhead is often identified as the major source of excessive laboratory costs. All of the National Laboratories are concerned and proactive about managing their overhead costs. During its visits to laboratories, the Commission found how variable factors such as mission scope, age of facilities, and location impacted laboratory costs. These considerations are important context for an analysis of laboratory cost-efficiency.

Figure 8 compares the overhead rates at the National Laboratories with the official overhead, or facilities and administrative rates at twenty of the top major research US universities. Laboratory rates were composed from DOE's Institutional Cost Report (ICR) and adjusted to reflect the direct funding of construction and maintenance and repair at the laboratories. While the NNSA laboratories stand out with higher rates than universities and non-NNSA laboratories, this difference is understandable when the unique costs associated with their national security and nuclear weapons-focused mission are considered. The Commission found rates at non-NNSA laboratories to be slightly higher, but comparable to university negotiated rates.

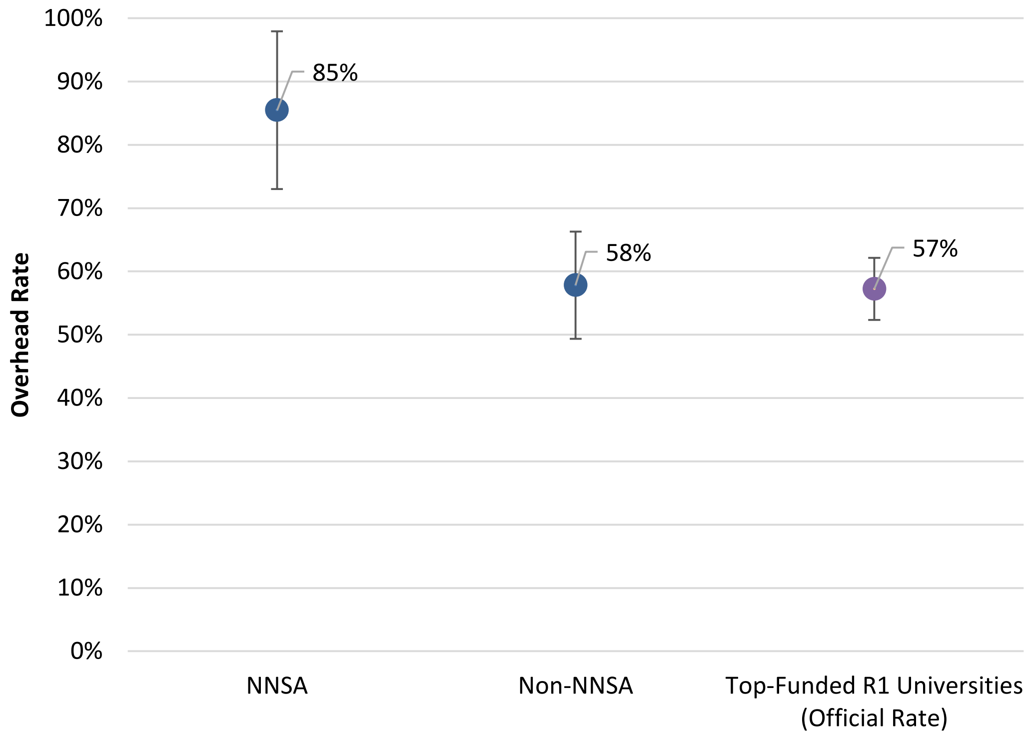
Two primary factors impact a comparison of laboratory and university rates. First, universities include depreciation and interest expenses associated with facilities in their overhead, while DOE's laboratories do not. The Commission estimates these costs to represent approximately 14.5 percentage points of the mean university rate based on public information available at six major research universities. Second, university administrative costs are capped by OMB policy at 26 percent, whereas actual administrative costs are typically higher by roughly 5 percentage points.[56]

Combining these two sources of error, overhead rates at both NNSA laboratories and non-NNSA laboratories are higher than the values identified in Figure 8, by approximately 10 points. Nevertheless, the Commission finds the rates between non-NNSA laboratories and universities to be comparable, especially when one considers that there are many university indirect costs of research that are lowered by the university's ability to spread those costs over non-research functions. In contrast, laboratories are required by law to

[56] OMB policy limits the government to reimbursing universities for no more than 26% of costs. GAO, *University Research: Policies for the Reimbursement of Indirect Costs Need to Be Updated*, GAO-10-937 (Washington, DC: GAO, 2010).

fully recover costs for all work, eliminating the possibility of unaccounted expenses. Taking this into account would further reduce the potential error.

The overhead rates at the NNSA laboratories are higher than both the major research universities and the non-NNSA laboratories by about 25 percentage points. That difference is understandable given the special nuclear and classified nature of the missions of the NNSA laboratories. Recall that for purposes of this analysis, the Commission allocated the NNSA costs for safeguards and security to the indirect, rather than the direct, cost categories.



Note: Percentages represent the mean overhead rate for each class of laboratory, as calculated by dividing total indirect costs by total direct costs, and universities. Error bars represent one standard deviation. Laboratory data is derived from the DOE Institutional Cost Report for FY 2014. Two laboratories—NETL and Savannah River—are excluded from the rate calculation. University data is derived from published F&A rate agreements for FY 2013 at top-funded research universities. Top-funded R1 universities include only “Research I” universities, as designated by the Carnegie Foundation within the NSF Higher Education Research & Development (HERD) Survey and ranked by total R&D expenditures. Institutions reporting data as an aggregate of multiple campuses were excluded from the rankings.

Figure 8. Adjusted Indirect Costs as a Percentage of Direct Costs at National Laboratories (Grouped by Class) and Top-Funded Research I Universities, Adjusted for Direct Laboratory Construction

Laboratory accounting practices are federally regulated and consistent with the requirements of Federal cost accounting standards, which allow them to conduct business in a way that best matches work at their laboratory. Laboratories report all their costs biweekly into STARS, the DOE-wide cost reporting system. When laboratory financials are audited, auditors use data from STARS and disclosure statements as baselines for assessment.

In partnership with financial leadership from the National Laboratories, DOE established the ICR in 2010 to supply high-level data to the Department and other stakeholders regarding cost drivers at the laboratories. Although the ICR must continue to develop, it promises to be a mechanism by which DOE and other stakeholders can better understand laboratory costs. The ICR will become more useful as data consistency improves with subsequent years, made possible through peer reviews between different laboratories.

Recommendation 29: DOE should continue implementing the ICR as a consistent method for tracking indirect costs across all laboratories, and encourage additional peer reviews to help mature the ICR as a tool for DOE, the laboratories, and other stakeholders.

Today, most of the work at the 17 laboratories is publicly funded. As recipients of Federal funds, it is reasonable to ask, for the purpose of greater accountability and transparency, that laboratory financial data be made available to the public. Public disclosure also provides an additional incentive for laboratories to be mindful of their overhead rates.

Recommendation 30: DOE should provide greater transparency into laboratory indirect costs and publish an annual report of the overhead rates at each National Laboratory.

B. Facilities and Infrastructure

DOE laboratory facilities and infrastructure include a wide range of R&D buildings and fixed capital equipment, such as research centers, laboratories, reactors, and particle accelerators; major equipment and instrumentation for R&D, such as supercomputers, workstations for beamlines, industrial 3-D printing machines, and detectors; and infrastructure associated with the laboratory, such as utility plants and roadways. The scope of laboratory facilities and infrastructure is significant; as a whole it consists of over 800,000 acres, which house over 5,000 buildings and trailers.[57]

[57] Data provided by DOE from the Facilities Information Management System (FIMS) database, FY 2014 Snapshot. Numbers do not include Other Structures and Facilities, which account for non-buildings, such as roads, fencing, storage reservoirs, and stacks (when not a part of a building).

Facilities and infrastructure can have a substantial impact on laboratory research and operations in a variety of ways. Laboratory facilities and infrastructure in poor condition can have inadequate functionality for mission performance; negative effects on the environment, safety, and health of the site; higher maintenance costs; and problems with recruiting and retaining high-quality scientists and engineers. There is also a significant cost associated with the upkeep of excess facilities that are no longer used or needed by laboratory staff but that remain at the laboratory due to a lack of funding for disposal.

DOE laboratory facilities and infrastructure construction and renovation are primarily funded through centrally controlled line items or locally controlled General Plant Projects and Institutional General Plant Projects. Unlike universities, industry, and many State and local governments, the Federal Government does not use a capital budget, but instead an operating budget that presents the government's expenditures and revenues for each fiscal year. While facilities and infrastructure planning occurs at multiple levels—at each individual laboratory, within each stewarding office, and across the Department as a whole—the available budget is simply not sufficient to meet the needs of the laboratories to maintain and revitalize the system.

Recommendation 31: DOE should consider whether a capital budget will better serve its internal facilities and infrastructure budgeting and management needs.

The condition of laboratory facilities and infrastructure across the network is hampered by high levels of deferred maintenance and excess facilities. Deferred maintenance refers to facility and infrastructure repairs that were postponed in order to lower costs, meet budget levels, or liberate funding for research. While all laboratories have deferred maintenance, 3 laboratories hold approximately 64 percent ($1.4 billion) of the total deferred maintenance backlog of $2.2 billion.[58]

Excess facilities have no future mission and the natural conclusion to the facilities lifecycle is deactivation and decommissioning (D&D). Excess facilities that have not yet been deactivated and decommissioned must be stabilized and then surveilled and maintained until their D&D. Laboratories have contaminated and non-contaminated excess facilities that they cannot afford to D&D. The estimated cost for D&D of excess facilities at the SC laboratories is $2 billion.[59] DOE established EM in 1989 to oversee cleanup of its weapons research and production legacy. The total cost of cleanup at all DOE sites was estimated to be $280 billion in 2013.[60] As of 2015, EM has determined that 234 additional

58 Laboratory portion estimate from FIMS database, FY 2014 Snapshot.

59 J. Smith, *The Importance of Core Infrastructure*, presentation to the Commission to Review the Effectiveness of the National Energy Laboratories, February 24, 2015.

60 DOE IG, *Audit Report: The Department of Energy's Management of High-Risk Excess Facilities* (DOE/IG-0931, January 2015).

facilities meet its criteria for transfer to EM, but it does not have the funding to accept them for remediation. In addition to the issue of cost of surveillance and maintenance for the program offices, contaminated excess facilities continue to pose a risk to mission, workers, the public, and the environment.

Recently, the Department and the laboratories have been working together to address the facilities and infrastructure issues, at least initially by accurately assessing the scope of the problems in condition and budget shortfall.

Recommendation 32: DOE and the laboratories should continue efforts to improve laboratory facilities and infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. DOE should work with Congress and OMB to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long-term plan to resolve it through a combination of increased funding, policy changes, and innovative financing.

Despite the magnitude of need to maintain and revitalize the system, not to mention the cost to build the next generation of scientific facilities, innovative financing mechanisms have been largely unavailable to the DOE laboratories. Non-contaminated excess facilities could be leased to interested third parties if DOE were granted Enhanced Use Lease (EUL) authority, which it does not currently possess. EULs are long-term leases on agency-owned property in exchange for cash or in-kind consideration. DOD, which does have that authority, has used it to lease excess land at military bases for renewable energy systems, such as solar arrays. If DOE were granted EUL authority, it could generate funds that could be used to address its facilities resource needs, while offloading some of its excess square footage.

Alternative financing through an operating lease is another approach in which the Federal Government contributes the real property or land and a private entity provides the initial capital to develop or renovate it. A lease agreement allows non-Federal entities or contractors to occupy the real property for a defined time period while the agency repays the financed amount through lease payments.

OMB is responsible for approving these projects, but no DOE R&D facilities projects using alternative financing have moved forward since 2007. Proponents of alternative financing argue that it allows laboratories to pursue construction projects in times of budget austerity. Critics of alternative financing do not approve of DOE committing to a long-term "mortgage" when there is no guarantee the Nation will continue to see a mission need for maintaining a laboratory. However, the Commission is disappointed by the lack of independent analysis of alternative financing, particularly cost benefit analyses.

Recommendation 33: DOE, the laboratories, Congress, and OMB should actively work together to identify appropriate situations and methods for utilizing innovative financing approaches, such as third-party financing, enhanced use leases, and other methods, including State funding, gifts, and leveraging partnerships with other Federal agencies.

C. Project and Program Management

DOE has a decades-old history of project performance problems.[61] While recent DOE efforts to improve project management are enjoying some success, more work must be done. The Department needs to build more project management and cost-estimating capacity. It also needs a more homogenous and disciplined project/program management culture. DOE is moving in this direction with organizational changes and more frequent high-level involvement. DOE has also strengthened its project management guidance and processes by making them binding on all program offices.

SC, in particular, has a good project performance record. NNSA and EM have improved their management of small projects (less than $750 million), a fact which GAO recognized in a 2009 report.[62] Their large projects ($750 million or more), however, have experienced issues. These projects are managed primarily by commercial contractors rather than National Laboratories.

Ironically, DOE actually has very good policies on its books for project management. Its Directive 413.3 has been in place for over 15 years and is now in its third version. This guidance emphasizes the need for clear project accountability, independent analysis of alternatives, better cost estimating practices, more design and technical readiness prior to

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[61] NAPA, *Positioning DOE's Laboratories for the Future*; DOE, *Improving Project Management*: *Report of the Contract and Project Management Working Group* (November 2014); GAO, *Department of Energy: DOE Lacks an Effective Strategy for Addressing Recommendations from Past Laboratory Advisory Groups*, GAO/T-RCED-98-274 (Washington, DC: GAO, September 1998); GAO, *Status of Contract and Project Management Reforms*, GAO-03-570T (Washington, DC: GAO, March 20, 2003); GAO, *Actions Needed to Develop High-Quality Cost Estimates for Construction and Environmental Cleanup Projects*, GAO-10-199 (Washington, DC: GAO, January 14, 2010); NRC, *Progress in Improving Project Management at the Department of Energy* (Washington, DC: National Academies Press, 2001); DOE IG, *Management Challenges at the Department of Energy*, DOE-IG-0858 (Washington, DC: DOE, November 2011); GAO, *Department of Energy: Office of Science Has Kept Majority of Projects within Budget and on Schedule, but Funding and Other Challenges may Grow*, GAO-08-641 (Washington, DC: GAO, June 2008); GAO, *Department of Energy: Contract and Project Management Concerns at the National Nuclear Security and Office of Environmental Management* (Washington, DC: GAO, March 2009); DOE, *Department of Energy Contract and Project Management Root Cause Analysis Corrective Action Plan* (Washington, DC: DOE, 2008); DOE IG, *The Department of Energy's Management of High-Risk Excess Facilities*, DOE-IG-0931 (Washington, DC: DOE, January 2015).

[62] GAO, *Department of Energy: Contract and Project Management Concerns at the National Nuclear Security and Office of Environmental Management*.

moving ahead officially on a project, and better project management controls. The problem is that the procedures are too often followed in form but not in substance. Or, where the policy recommends, but does not require, steps such as independent cost analyses, they are too often omitted in the interests of time. The result is that some major projects experience serious cost overruns and delays that could have been avoided by applying the existing policies with greater discipline.

Recommendation 34: DOE should maintain focus on increasing institutional capability and imposing greater discipline in implementing DOE project guidance, which is currently being incorporated into its DOE directive 413.3 B. Expanding on recent DOE efforts, there should be more peer reviews and "red teams" within DOE, among laboratories, other agencies, industry, and academia when appropriate.

In the area of environmental remediation, a recent SEAB Task Force report stated that DOE has spent over $150 billion on environmental management and cleanup and is currently spending roughly $5–6 billion per year in this area.[63] At the same time, the current EM budget for technology development is only $13 million per year, despite the many technical obstacles which remain. The Commission agrees with SEAB that the success of the cleanup effort will require significant new understanding of the science and with this understanding, development of new technology.

Recommendation 35: The Commission supports the recent SEAB Task Force recommendation to put more resources into science and technology development for the EM program given the technical complexity of its projects.

[63] SEAB, *Report of the Task Force on Technology Development for Environmental Management*, December 2014; also, *Presentation to the Task Force by the Office of Environmental Management* (July 15, 2014).

7. Ensuring Lasting Change

Lasting change takes time and work. In the past four decades, over 50 commissions, panels, reviews and studies of the National Laboratories have been conducted. Yet, the true power to implement and realize change rests with the Department, the laboratories, and Congress —those for whom the National Laboratories are more than the object of a year-long study. Where past assessments have sometimes failed to produce meaningful change, this Commission strives to go beyond identifying findings and recommendations by charging the implementation of recommendations to those with the ability to realize them. Table 4 identifies the responsible actors for all of the Commissions' recommendations and provides a cross-reference to where additional information can be found in Volume 2. In doing so, the Commission hopes to assist the key stakeholders—laboratory leadership, DOE, and Congress—in their efforts to improve the impact, effectiveness, and efficiency of the National Laboratories.

A. Lack of Meaningful Change from Past Reports

A review of many past reports shows a strikingly consistent pattern of criticism and a similar set of recommendations for improvement. Despite the extensive examination of the issues, none of these reports has led to the comprehensive change necessary to address the well-documented, persistent challenges confronting the Department and its laboratories.

B. Progress Made during Current Administration

Under the current administration, many steps have been made towards improving the effectiveness and the efficiency of the National Laboratories. Department-led Crosscuts, formation of the Laboratory Operations Board within DOE, and efforts to more actively involve the National Laboratories—primarily through the National Laboratory Directors' Council—with DOE strategic planning are a few noteworthy examples of the progress realized under a thoughtful and proactive administration.

These administration-led changes are significant because they address the relationship between DOE and the National Laboratories which lies at the root of many of the issues raised in this report. With the upcoming change in administration, however, a real fear exists that much of the progress made under the leadership of the current Secretary may be lost due to lack of institutionalization. Lasting, meaningful change is an ongoing process rarely accomplished within a single administration, and recommendations made by past reports have not always led to implementation. To address this concern, the Commission has focused on identifying ways to not only institutionalize the positive changes made recently, but also to assess how recommendations made in this report and numerous others can be carried into the future, for the betterment of DOE and its National Laboratories.

C. How This Commission Can Be Impactful

The Commission notes the absence of a standing body or internal DOE mechanism to advocate for implementation of recommended changes, perform systematic assessments, and evaluate progress over time.

It would be extremely valuable if Congress and DOE had a credible independent group to turn to for perspective and advice on issues relating to the National Laboratories when questions arise, without having to create a new commission, panel or review each time. Such a group need not be large. It could consist of a few senior people who had previously held responsible positions in DOE, the National Laboratories, industry, academia, or Congress. They might be named to such a board on a part-time basis, as they have been when appointed to commissions such as this CRENEL commission. They would need to be supported by a small staff.

With this in place, not only could Congress get high-quality advice on a faster turnaround time, but also DOE and the National Laboratories could be spared the disruption of as many new review groups as they have experienced in the past. With the right composition and charter, this group could provide brief and insightful perspective on the broad issues regarding the relationship of DOE and the laboratories over time, such as whether changes to restore the FFRDC relationship are truly being made in substance or only cosmetically, by both DOE and the laboratories.

A challenge, of course, is where to locate such a group in order to make it efficient, effective, and independent. One possibility is to ask the National Academies to host it. Another possibility is to have the group report to the President's Council of Advisors on Science and Technology (PCAST). Yet another option is to have the Secretary of Energy establish the group to serve both the Secretary and the Congress. A formal, though larger, example of such a group is the Nuclear Waste Technical Review Board, which was created by Congress as an independent agency of the Federal government to provide independent scientific peer review and recommendations to the Secretary and the Congress regarding DOE's programs for high-level radioactive waste and spent nuclear fuel. That group consists of eleven members who serve on a part-time basis, nominated by the National Academy of Sciences and named by the President. Wherever a new body is located, it would seem appropriate to establish it under a sunset provision, so that the entity's effectiveness would be reviewed and reconsidered at appropriate intervals.

Recommendation 36: A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly to DOE, the laboratories, the Administration, and the Congress on progress, results, and needed corrective actions. The standing body could assist congressional committees in developing a rational plan for future evaluations of the DOE laboratories.

8. Conclusion

In summation, the Commission has the following answers to the important questions posed in Chapter 1 about the DOE laboratories:

Why do we need DOE laboratories?

The National Laboratories are a unique scientific resource and national security asset, providing a vital experimental infrastructure to the Nation's research community and sustaining the nuclear weapons expertise critical to modern American security. In addition, the laboratories maintain a scientific and technical workforce, as well as a way of working, that fills a key need in the research and development process. Whether through stewardship of open-access scientific user facilities, assessment of the nuclear arsenal, or fostering environments for cutting-edge research in energy, environmental management, and weapons science, the National Laboratories are an important component of the national S&T enterprise. Furthermore, the Nation often calls upon the scientific and technical expertise of the National Laboratories in times of emergent need, as has been done recently in response to the Fukushima Daiichi nuclear reactor accident and during the Iran nuclear negotiations, among others.

Does DOE manage its laboratories well?

While the DOE laboratories are a critical resource that serves the Nation well, they could be better. The relationship between DOE and the laboratories has eroded, leading to ever-increasing levels of micromanagement and transactional oversight, which, in turn, have reduced the efficiency and effectiveness of laboratory operations. DOE and the laboratories must return to the spirit of the FFRDC model, focused on stewardship, accountability, competition, and partnership.

Instead, the National Laboratories are managed at multiple levels: day-to-day operations are overseen by the laboratory director and team in conversation with DOE through either DOE headquarters or site offices, which supply compliance guidance and strategic direction. Elements of departmental management can adversely impact the effectiveness and efficiency of the laboratories. For instance, mounting contract requirements, large numbers of assessments and data calls, and a lack of budgetary flexibility add undue administrative burdens on parts of the laboratory system. Addressing these concerns should be a priority for making the laboratories function better as a whole.

Are the laboratories properly focused to address mission needs now and in the future?

For the most part, the National Laboratories are properly focused to address their mission needs in science, energy, weapons, and environmental management. In some areas, however, shifting the focus should be a priority: managing emerging fields to control for duplication while still allowing the best ideas to compete and flourish is an important strategic planning function that the Department should embrace. There are robust processes in some program offices to provide strategic oversight, evaluation, and direction to the laboratories. However, those processes are not consistently used throughout the Department. With the proper balance of freedom for innovation as new areas emerge, and strategic direction as they mature, the laboratories will be able to continue to evolve to meet the Nation's needs in coming decades.

Is the research carried out at the laboratories of high quality?

During its 17 laboratory visits, the Commission observed that the quality of the R&D at the laboratories is indeed high. For SC and its laboratories, extensive use of external advisory panels, composed of leading subject-matter experts, is a powerful mechanism for maintaining quality, and for assessing the quality of the research portfolio and performance. Partnerships with universities and industry through collaborative work or joint faculty appointments—in the case of universities—further contribute to research quality. The National Research Council (NRC) emphasized in its 2013 report that the quality of science and engineering at the NNSA laboratories was healthy and vibrant.[64] The Commission concurs with this finding. The quality of R&D at all laboratories can be enhanced by further engagement with external peer review groups.

LDRD also plays a critical role in maintaining high-quality talent and research, especially at the NNSA laboratories where fewer opportunities exist for researchers to pursue ideas outside of specific project scope. LDRD helps to generate new ideas and empower research staff to think critically and broadly about the challenges faced. The true value of any institution is its people, and LDRD enables laboratories to develop and invest in its workforce for both the short and long term. In the absence of other discretionary funding for exploratory research, LDRD is vital in providing the freedom laboratories need to innovate and ensure their sustained performance in service of the Nation.

Is there too much duplication among the laboratories?

The Commission does not believe there are too many laboratories, nor is there an undesirable degree of duplication. During its visits to all 17 laboratories, the Commission found each to be unique, conducting work of merit, and becoming of the title "National

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[64] NRC, *The Quality of Science and Engineering at the NNSA National Security Laboratories* (Washington, DC: National Academies Press, 2013).

Laboratory." While work might appear duplicative at a high level, the Commission's closer look revealed that their capabilities and focus areas are diverse, complementary, and well-honed to meeting the missions of the Department. Every laboratory plays a key role: for instance, different synchrotrons address different types of scientific questions, while the existence of two NNSA physics laboratories promotes both competition and a second opinion on high-stakes nuclear weapons work. Having grown out of historic mission decisions, the laboratories of today have evolved to serve not just the Nation but also their home regions and States through the fostering of a scientific community. Many also serve their regional economies.

That said, DOE could do a better job of managing the National Laboratories as a system with an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry, so long as the research aligns with mission priorities. Once the research has matured beyond a certain threshold, the Department should provide strategic oversight and guidance for the laboratory system to coordinate and potentially consolidate their programs to achieve the most efficient use of resources.

Are the laboratories having an impact?

The National Laboratories interact with many stakeholders beyond DOE, from other Federal agencies and universities to businesses and industrial partners, small and large. These mission-aligned collaborations both invigorate the laboratories with fresh ideas and allow their knowledge and expertise to reach beyond the site, in service of the public good and national prosperity.

Though much has been achieved by supporting other Federal agencies, collaborating with the academic community, partnering with industry, and operating user facilities, barriers to engagement remain. While there are hundreds of CRADAs and other forms of collaboration with the private sector throughout the laboratory system, support for technology transfer is inconsistent across the laboratories and across the DOE program offices. More can be done to increase the effectiveness of the National Laboratories by streamlining their interactions with all external parties.

At the same time, the value of the laboratories has sometimes been poorly communicated or quantified. For example, the Human Genome Project was begun at the laboratories and revolutionized the life sciences, and laboratory accelerator R&D eventually helped to develop MRI technology that is available today in every major hospital. The role of the DOE laboratory system in these advances is not widely recognized. In the interest of greater understanding, both the Department and the laboratories should do more to highlight their achievements.

Do the laboratories cost too much?

Laboratories are indeed costly, but whether they are too expensive is a more nuanced question. The primary business of the National Laboratories—including the operation of large-scale scientific facilities, multidisciplinary research, and weapons science—is costly by nature. How do we determine the appropriate price for these services, a large portion of which cannot or is not conducted elsewhere? This makes the laboratory business model especially difficult to benchmark against other R&D institutions. The Commission focused on overhead as a measure of organizational efficiency. Overhead is a component of cost, but it does not represent an institution's entire cost profile.

When benchmarked to official overhead rates at the 20 research universities with the largest sponsored research expenditures, the cost of doing research at non-NNSA laboratories was found to be comparable. NNSA laboratory rates were higher, but this is understandable due to the additional requirements of their national security mission (heightened safeguards and security, health, and cleanup of legacy facilities). Overall, the Commission believes that laboratory costs are not unreasonable in light of the services they provide.

There is a significant opportunity for increased efficiency in the system if the roles and responsibilities of DOE and the laboratories are returned to the intended FFRDC model. The current degree of micromanagement and oversight impose a "stealth overhead" cost at DOE headquarters, the site offices, and the laboratories by virtue of the extra professional time that those activities require, without yielding corresponding benefits. The Commission believes that there will be significant cost and time savings at each of these levels if its recommendations are implemented.

In addition, there are specific areas of concern, particularly major capital construction projects and facilities and infrastructure. While problematic projects are not always laboratory-related and SC and its laboratories are notable for their strong record of project performance, the Department and all program offices must strengthen their project management capabilities and enforce the processes that are on the books. All laboratories and DOE must also find ways to improve the condition of the facilities and infrastructure. In this time of budget austerity, DOE must work with OMB and the Congress to develop a long-term strategy for dealing with these resource needs, including the appropriate use of innovative financing techniques. The recent joint laboratory-DOE efforts to address the project management and facilities and infrastructure shortcomings have resulted in some improvements.

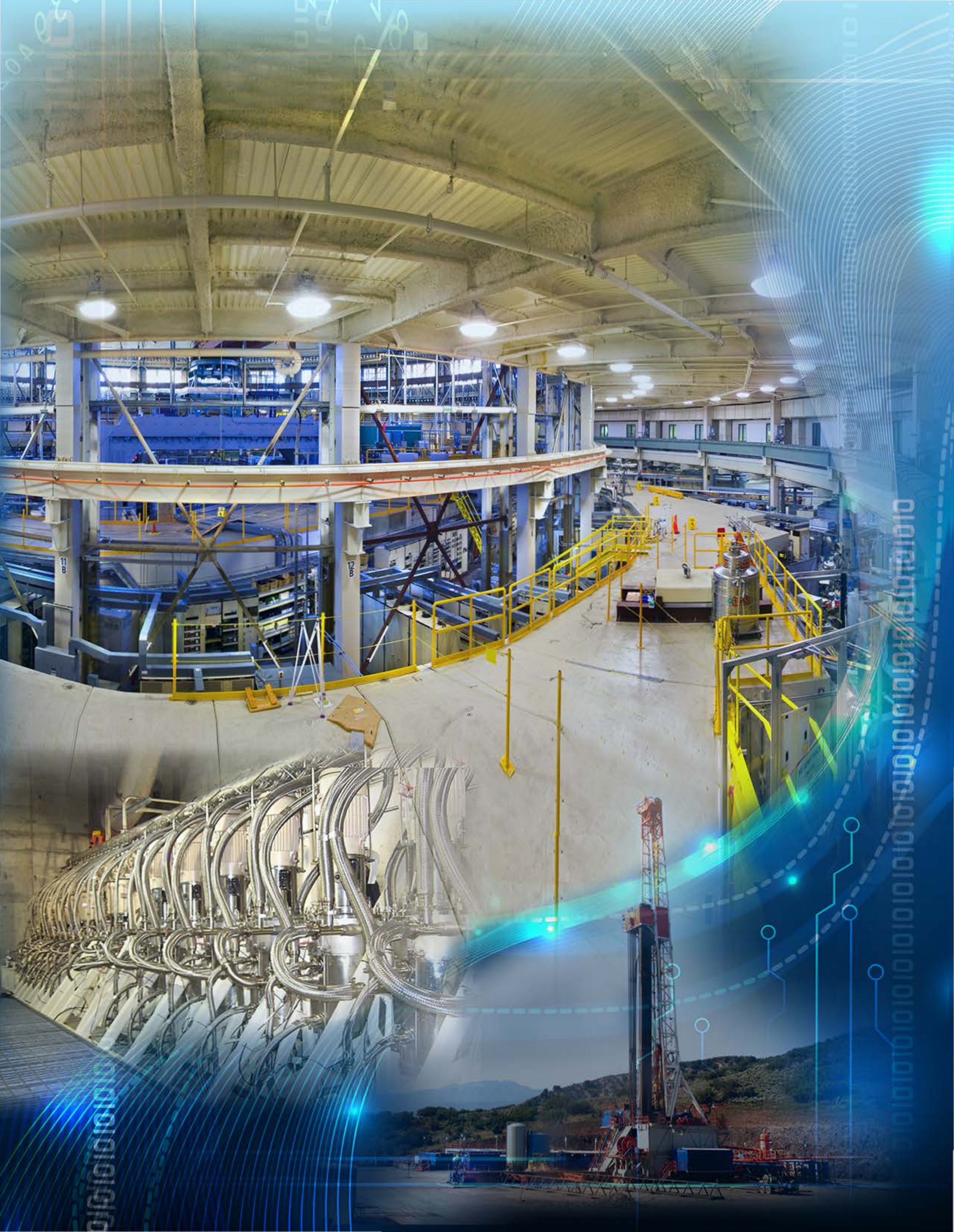
The National Laboratories are a national treasure with the potential to serve the Nation now and well into the future. This report offers recommendations to make the laboratories more efficient and effective in accomplishing the work for which they are uniquely suited.

Table 4. Responsible Actors for Each Recommendation and Cross-References to Volume 2

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
2.C	1	The Administration and Congress should recognize the value of the National Laboratories and provide the necessary resources to maintain their capabilities and facilities. Congress should also develop a more orderly process of reviewing the laboratories.	Administration and Congress	**1.E**
3.A.1	2	Department of Energy (DOE) and the laboratories must work together to restore the ideal Federally Funded Research and Development Center (FFRDC) relationship as one of trust and accountability. DOE should delegate more authority and flexibility to the laboratories and hold them accountable. The laboratories must be more transparent with DOE about their activities.	DOE and Laboratories	**2.C**
3.A.1	3	DOE and each laboratory should jointly develop an annual operating plan, with agreements on the nature and scope of the laboratory's activities, including goals and milestones. DOE should then provide increased flexibility and authority to the laboratory to implement that plan.	DOE and Laboratories	**2.C**
3.A.1	4	To improve DOE's ability to manage the laboratories, DOE should implement greater leadership and management development for its Federal workforce, including multi-directional rotational assignments.	DOE	**2.C**
3.A.1	5	DOE should separate the National Energy Technology Laboratory's (NETL) research and development (R&D) function from its program responsibilities. Consideration should be given to converting the new, research NETL into an FFRDC. NETL should increase its interactions with universities.	DOE and Congress	**2.C**
3.A.2	6	DOE should abandon *incentive* award fees in favor of a fixed fee set at competitive rates with risk and necessary investment in mind. DOE should also adopt richer set of incentives to motivate sound management.	DOE	**2.C**
3.B.1	7	DOE should give the laboratories the authority to operate with more discretion whenever possible. For non-nuclear, non-high-hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and national standards in place of DOE requirements. DOE should review and minimize approval processes.	DOE	**3.G**
3.B.1	8	DOE should modify its processes for developing directives, orders and other requirements to get more input on the benefits and impacts of the proposed requirements. When developing new requirements, DOE should use a risk-based model, ensuring the level of control over an activity is commensurate with the potential risk.	DOE	**3.G**
3.B.2	9	DOE should focus on making the use of Contractor Assurance System (CAS) more uniform across the laboratories. DOE local overseers should rely on information from the CAS systems, with appropriate validation, as much as possible for their local oversight. The quality of CAS can be increased through peer reviews for implementation and effectiveness.	DOE	**4.D**
3.B.2	10	The role of the site office should be emphasized as one of "mission support." The site office manager should be responsible for the performance of the site office; all staff, including the Contracting Officers, should report to the site office manager. DOE should devote more effort to professional development of field staff.	DOE	**4.D**
3.B.2	11	DOE should clarify the role and authority of the support centers. Wherever approval authority resides with a support center, DOE should remove it and reinstate it at the site office or DOE headquarters.	DOE	**4.D**

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
3.B.3	12	All stakeholders should make maximum use of local assessments (performed by site offices and laboratories), with appropriate verification, to reduce duplicative assessments and burden on the laboratories.	DOE and External Auditors	**5.C**
3.B.3	13	DOE should establish a single point of control within the Department for all laboratory-directed data requests.	DOE	**5.C**
3.B.4	14	DOE should increase the size of funding increments by consolidating budget and reporting (B&R) codes, extending timelines and minimizing milestones for each funding increment and institutionalizing mechanisms to move money between B&R codes for related research areas.	DOE	**6.D**
3.B.4	15	Congress should repeal Section 301(d) of the FY 2014 Consolidated Appropriations Act as soon as feasible to remedy the transactional burden it creates for the Office of Management and Budget (OMB), DOE Headquarters, and the laboratories.	Congress	**6.D**
4.A	16	Other DOE program offices should adapt the processes that DOE's Office of Science has in place for guiding and assessing the alignment of the laboratories under its stewardship with DOE's missions and priorities.	DOE	**7.E**
4.B	17	The processes that Office of Science has in place for assessing the quality of the research being done by its laboratories and for assessing the quality of its research portfolio should be adapted by the other program offices.	DOE	**7.E**
4.B	18	There must be reconsideration of the travel restrictions to enable conference participation at levels appropriate to the professional needs of the existing scientific staff and to attract the highest quality staff in the future. The Commission is encouraged by DOE's recently revised guidance on conference-related activities and spending.	DOE and OMB	**7.E**
4.C	19	The Commission strongly endorses Laboratory Directed Research and Development (LDRD) programs, both now and into the future, and supports restoring the cap on LDRD to 6 percent unburdened, or its equivalent. The Commission recognizes that, in practice, restoring the higher cap will have the largest impact on the LDRD programs of the National Nuclear Security Administration laboratories.	Congress	**8.D**
4.D	20	DOE should manage its laboratories as a system having an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry. Once the research has sufficiently mature, DOE should provide strategic oversight and guidance to coordinate and potentially consolidate their programs.	DOE	**7.E**
4.D	21	Congress should recognize that the capabilities currently housed within the NNSA laboratories are essential to the Nation. Maintaining these capabilities in separate and independent facilities should continue.	Congress	**7.E**
5.A	22	DOE should establish techniques to make the Strategic Partnership Projects process more efficient.	DOE	**9.E**
5.A	23	DOE should support efforts to strengthen the Mission Executive Council.	DOE	**9.E**
5.B	24	DOE and its laboratories should continue to facilitate and encourage engagement with universities through collaborative research and vehicles such as joint faculty appointments and peer review.	DOE and Laboratories	**10.C**
5.C	25	DOE and the laboratories should fully embrace the technology transition mission and continue improving the speed and effectiveness of collaborations with the private sector. Innovative transfer and commercialization mechanisms should be pursued and best practices in other sectors should be examined.	DOE and Laboratories	**11.E**

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
5.C	26	DOE should determine whether the annual operating plans proposed by the Commission could qualify as the "agency-approved strategic plan" under the Stevenson-Wydler Technology Innovation Act of 1980, and the Fast-Track Cooperative Research and Development Agreement Program. If not, Congress should amend the law accordingly.	DOE and Congress	**11.E**
5.C	27	Laboratories should pursue innovation-based economic development by partnering with regional universities.	Laboratories	**11.E**
5.D	28	DOE and Congress should continue to support user facilities at the DOE laboratories. External advisory groups should continue to be used to decide which facilities to build and how to upgrade existing facilities.	DOE, Administration, and Congress	**12.C**
6.A	29	DOE should continue implementing the Institutional Cost Report (ICR) as a method for tracking indirect costs across the laboratories, and encourage peer reviews to help mature the ICR as a tool for DOE, the laboratories, and other stakeholders.	DOE	**13.E**
6.A	30	DOE should provide greater transparency into laboratory indirect costs and publish an annual report of the overhead rates at each individual National Laboratory.	DOE	**13.E**
6.B	31	DOE should consider whether a capital budget will better serve its internal facilities and infrastructure budgeting and management needs.	DOE	**14.D**
6.B	32	DOE and the laboratories should continue efforts to improve facilities and infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. DOE should work with Congress and OMB to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long-term plan to resolve it through a combination of increased funding, policy changes, and innovative financing.	DOE, Laboratories, Congress, and OMB	**14.D**
6.B	33	DOE, the laboratories, Congress, and OMB should actively work together to identify appropriate situations and methods for utilizing innovative financing approaches, such as third-party financing, enhanced use leases, and other methods, including State funding, gifts, and leveraging partnerships with other Federal agencies.	DOE, Laboratories, Congress, and OMB	**14.D**
6.C	34	DOE should maintain focus on increasing institutional capability and imposing greater discipline in implementing DOE project guidance, which is currently being incorporated into its DOE directive 413.3 B. There should be more peer reviews and "red teams" within DOE.	DOE	**15.G**
6.C	35	The Commission supports the recent Secretary of Energy Advisory Board Task Force recommendation to put more resources into science and technology development for the EM program given the technical complexity of its projects.	DOE, Administration, and Congress	**15.G**
7.C	36	A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly to DOE, the laboratories, the Administration, and the Congress. This body could assist Congress in developing a rational plan for future evaluations of the DOE laboratories.	DOE, Administration, and Congress	**16.D**



U.S. DEPARTMENT OF ENERGY

Departmental Response to the Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories

Report to Congress
February 2016

United States Department of Energy
Washington, DC 20585

Message from the Secretary

The Department of Energy (DOE) is, at its core, a science and technology organization that advances critical missions for the American people: nuclear security; scientific leadership and discovery; clean energy innovation and energy security; emergency response; technology transfer; and environmental remediation. DOE's National Laboratories are key to mission success across the broad spectrum of DOE's responsibilities.

The National Laboratories comprise the most comprehensive research network of its kind in the world, and they are essential links in the Nation's innovation chain. Each has distinctive capabilities; together, they are greater than the sum of their parts. Individually and collectively, the Labs conduct cutting-edge fundamental and applied scientific research, develop problem-solving technologies, and are one of the Nation's most effective "on call" resources for tackling unprecedented challenges – from the threat of unsecured nuclear materials as the Soviet Union collapsed, to the Macondo oil spill in the Gulf of Mexico, to the Fukushima nuclear disaster, to deep and rapid scientific analyses for the Iran nuclear negotiations.

The National Laboratories are an indispensable part of the American research enterprise, creating knowledge at the scientific frontier and housing major scientific facilities used by over thirty thousand university, laboratory and industry researchers annually. Core enabling technologies – such as high performance computers and modeling of complex physical systems and particle accelerators – are continuously pushed to new heights. In addition, completely new directions are established for the research community, such as launching human genomics and then developing the genomics field for energy. In turn, these advances have contributed greatly over many decades to ensuring the competitiveness of U.S. industry and of the broader economy. Well over a hundred science Nobel Prizes have been directly associated with DOE National Laboratory research.

The labs also have helped spark the energy revolution, from early work on drilling technologies and basin characterization for shale gas to materials discovery, advanced manufacturing techniques, and other research that has driven down the cost of wind and solar, batteries and LEDs, and continues to do so.

And of course the labs are core national security assets, sustaining the nuclear deterrent without testing, securing dangerous nuclear materials worldwide and propelling the nuclear

Navy, and providing critical technology and analysis for the Departments of Defense and Homeland Security and the intelligence community.

These unique and invaluable capabilities must be developed, sustained, and nurtured over decades. Sound stewardship of the laboratories has been one of my highest priorities as Secretary. Top talent must be attracted and retained by providing a vibrant research environment focused on challenging problems that call upon multidisciplinary teams integrating scientific, engineering, and management expertise.

This stewardship and further strengthening of the National Lab enterprise is both a major responsibility of and opportunity for DOE in service of the national interest. Recognizing that success in this endeavor has vital national consequences and meets critical national needs, Congress directed formation of the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL).

I thank the Commission for its conscientious and serious work. In formulating its recommendations, the Commission visited all 17 DOE National Laboratories, interviewed staff in more than 100 offices across government and other sectors, and heard testimony by 85 witnesses at public Commission meetings. There is no doubt that the Commission's findings and recommendations are thoroughly researched and a testament to the leadership of its Co-Chairs, Jared Cohon and TJ Glauthier. The Department has carefully considered each of the Commission's findings and recommendations in formulating this response.

In addition, I have asked for input from the National Laboratory Directors' Council (NLDC), which is comprised of the Directors of all 17 National Laboratories, and the Secretary of Energy Advisory Board (SEAB), a Federal Advisory Committee of experts outside the Department that provides advice to me on key issues. Both have provided me with thoughtful views to help shape our response to the CRENEL report; their feedback is attached to this Departmental response.

A central finding of the Commission reinforces the unparalleled value of the National Laboratory system to the Nation, serving as a science and technology powerhouse, and occupying a critical role that cannot be carried out solely by universities or the private sector. However, the report also notes that since the end of the Cold War, oversight by DOE has grown increasingly transactional rather than strategically mission-driven. One of my priorities as Secretary has been to reset this critical relationship – to improve the strategic partnership between the Department and the National Laboratories and, in emphasizing an enterprise-wide approach to the lab system, to help maximize their unique role in the Nation's innovation ecosystem.

The Commission also recognized the importance of an overarching strategic approach for the laboratories. Steps that I have taken in recent years to underscore the value of such an approach include:

- reorganizing the Department to integrate and better coordinate basic research and applied energy programs under a single Under Secretary for Science and Energy;
- establishing a Laboratory Policy Council and a Laboratory Operations Board to convene a senior-level strategic dialogue on key priorities and improve the effectiveness and efficiency of the laboratories' execution of the DOE mission;
- strengthening project management, including by establishing a Project Management Risk Committee, restructuring the Energy Systems Acquisition Advisory Board, and reinforcing the independent peer review process;
- launching cross-cutting research initiatives that involve coordinated efforts between DOE and multiple laboratories;
- creating an annual Big Ideas Summit that convenes lab scientists and Departmental program leadership to generate new mission-related research challenges of importance to the Nation;
- initiating an integrated approach to cyber issues through the establishment of the DOE Cyber Council, in which the labs are called upon to play a significant role; and
- inaugurating a Technology Commercialization Fund for National Laboratory collaboration with the private sector on energy technology development.

Not only do these and other changes make it possible for the labs to become engaged in providing substantive input about research directions for the Department, but also they have helped to form networks of labs with complementary capabilities to deliver results. All of these steps have been focused on reinvigorating the strategic partnership necessary for effective stewardship of the laboratories as Federally Funded Research and Development Centers (FFRDCs).

The Commission's report appropriately focuses on the importance of the FFRDC model in providing an environment in which DOE sets the mission needs and provides oversight, while the managing contractor and laboratory leadership and staff put together the teams and structure programs in response to the mission needs, all in the public interest. The CRENEL effort has contributed to our re-examination of the management framework for the National

Laboratory system and how it can best serve the public interest. In addressing the Commission's findings and recommendations, the Department's response articulates and defines core objectives that embody this concept of lab management and stewardship. These objectives, along with the related recommendations from the Commission, are as follows:

- Identify and provide necessary resources by conducting rigorous, comprehensive strategic planning across DOE, to include the laboratories in the process (Recommendations 1, 20)
- Assist Congress in its role of reviewing the laboratories by promoting greater transparency with Congress and the taxpayer (Recommendations 1, 2, 30, 36)
- Implement laboratory stewardship through partnership (Recommendations 2, 3, 4, 6, 9, 12, 21)
- Clarify roles and responsibilities (Recommendations 5, 10, 11)
- Improve the development and implementation of requirements; improve the laboratory oversight environment (Recommendations 7, 8, 13, 14, 15, 18)
- Improve annual laboratory planning and evaluation (Recommendations 3, 16, 20)
- Manage the laboratories as a system, seeking to achieve maximum benefit for the Nation (Recommendations 17, 19)
- Beyond revising strategic planning, examine procedures to allow laboratories flexibility to maintain excellence in the expertise of research staff (Recommendations 18, 19, and 21)
- Enhance laboratory mission-aligned collaboration with stakeholders and the broader science and technology community (Recommendations 22, 23, 24, 25, 26, 27, 28)
- Continue to develop the Institutional Cost Report (ICR) (Recommendations 29, 30)
- Revitalize laboratory infrastructure, reduce the risk of excess facilities, and improve project management (Recommendations 31, 32, 33, 34, 35)

It is evident that we have a shared vision for a National Laboratory system focused on innovation, partnership, and stewardship that sustains the DOE laboratories as a science and technology powerhouse for the Nation. The CRENEL report, as well as inputs from SEAB and the lab directors, will continue to help guide progress towards this vital imperative.

Sincerely,

Ernest J. Moniz

Departmental Response to the Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories

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1 INTRODUCTION

Congress, through Section 319 of the Consolidated Appropriations Act, 2014 (Public Law 113-76), directed the Secretary of Energy to establish an independent commission known as the Commission to Review the Effectiveness of the National Energy Laboratories (Commission). In the legislation, Congress asked that the Commission review the 17 Department of Energy (DOE) National Laboratories with respect to their alignment with DOE's strategic priorities, duplication, ability to meet current and future energy and national security challenges, size, and support of other Federal agencies. Congress also asked the Commission to consider whether there are opportunities to more effectively and efficiently use the capabilities of the National Laboratories, and to analyze the effectiveness of the use of laboratory directed research and development (LDRD) to meet DOE's science, energy, and national security goals.

The Secretary established the independent Commission in May 2014, and it published its Final Report in October 2015. In its report, the Commission concluded that the DOE laboratories are "a unique scientific resource and national security asset, providing a vital experimental infrastructure to the Nation's research community and sustaining the nuclear weapons expertise crucial to modern American security" and are "a national treasure with the potential to serve the nation now and well into the future." The Commission noted that, while the DOE laboratories serve the Nation well, they could be even more effective and efficient if they and DOE improve their relationship, focusing on the principles of stewardship, accountability, competition, and partnership inherent in the fundamental model of Federally Funded Research and Development Centers (FFRDC).[1] To that end, the Commission offered 36 recommendations for improvement that focus on six key themes.

As reflected in the Message from the Secretary, DOE agrees with the Commission that the DOE laboratories provide unparalleled value to the Nation, serving as a science and technology powerhouse and occupying a critical role that cannot be carried out solely by universities or the private sector. The laboratories produce innovations that spur the Nation's economy, play a critical role in our national security, and serve as a key catalyst for clean energy development

[1] Pursuant to U.S. Code of Federal Regulations, Title 48, Part 35, Section 35.017, "An FFRDC meets some special long-term research or development need which cannot be met as effectively by existing in-house or contractor resources. FFRDC's enable agencies to use private sector resources to accomplish tasks that are integral to the mission and operation of the sponsoring agency. ...FFRDC's are operated, managed, and/or administered by either a university or consortium of universities, other not-for-profit or nonprofit organization, or an industrial firm, as an autonomous organization or as an identifiable separate operating unit of a parent organization."

and climate mitigation strategies. Continued investments in the laboratories, coupled with effective and efficient stewardship, are critical to strengthening and preserving this vital partnership.

2 RESPONSE

DOE's response to the Commission is organized around the six themes articulated by the Commission in its report: (1) recognizing value, (2) rebuilding trust, (3) maintaining alignment and quality, (4) maximizing impact, (5) managing effectiveness and efficiency, and (6) ensuring lasting change. For those themes, DOE has identified specific objectives which articulate strategic outcomes that DOE seeks to achieve to effectuate its vision of laboratory stewardship and partnership, and to respond to the Commission's findings, conclusions, and recommendations. The response then details those actions that DOE is engaged in, or will commit to execute, to accomplish these objectives.

2.1 RECOGNIZING VALUE

The DOE National Laboratory system consists of 17 laboratories, each with a core mission and core programmatic sponsor at DOE. Of the 17 laboratories, 16 are operated through Management and Operating (M&O) contracts. Some National Laboratories are focused on a single DOE program, while others have a core program that is strengthened by work performed for other DOE programs and sometimes for other government entities (such as DOD or DHS) or private sector partners. DOE uses its laboratories to support and develop its priorities in program areas, and also develops and executes cross-cutting programs across the laboratories.

The Commission notes that a culture of scientific excellence, technical rigor, and mission-focused vision has defined the National Laboratories throughout their history and allowed them to serve the United States time and again. The Commission highlighted the unique and collaborative role that the National Laboratories play in solving highly complex, multi-disciplinary, long-term projects that span the basic sciences to research and development (R&D). This collaboration includes university partnerships, working with other Federal agencies, the private sector, and more than 31,000 academic and industrial scientists who carry out research at DOE's user facilities. More than 100 DOE laboratory-affiliated researchers have been awarded Nobel Prizes, and the National Laboratories have received over 800 R&D 100 Awards since 1962. Given this positive impact, the Commission concluded that sustained Federal support of R&D at the National Laboratories is critical to the future of the science and technology enterprise as well as the Nation's economy and security. By making the laboratory system as efficient as possible and ensuring that it focuses on important endeavors not otherwise being addressed, DOE can maximize the quality of these R&D accomplishments of the laboratories.

Commission Recommendations

Under the theme "recognizing value," the Commission provided the following recommendation:[2]

Recommendation 1: *The National Energy Laboratories provide great value to the Nation in their service to DOE's mission, the needs of the broader national science and technology community, and the security needs of the Nation as a whole. The Administration and Congress should provide the necessary resources to maintain these critical capabilities and facilities. It would also benefit all stakeholders if the key committees in Congress would develop a more orderly process of reviewing the National Laboratories, to replace the unrelenting pace of studies evaluating the performance of the DOE laboratories.*

Discussion

DOE agrees with the Commission's conclusion that the National Laboratories provide great value to the Nation in their service to DOE's mission, the needs of the broader national science and technology community, and the security needs of the Nation as a whole. The substance of this first recommendation involves actions by DOE and by Congress. While DOE does not have a response to the Commission's recommendations to Congress, it recognizes that DOE's actions can facilitate Congressional understanding and evaluation of the laboratories' contributions and performance.

DOE views the Commission's recommendation that it provide the necessary resources to maintain the critical capabilities and facilities of the laboratories in the broad framework of a strategic partnership with the laboratories that emphasizes performance. The following principles guide DOE's efforts to improve this partnership, so that it continues to provide value to DOE and the Nation as a whole:

- Creating an institutional environment with necessary and sufficient Federal oversight that enables laboratories to best serve the public interest with objectivity and independence and take reasonable risk in the pursuit of innovation

[2] In the body of this report, Commission recommendations are stated in summary form. The full text of Commission recommendations is provided in the Appendix.

- Encouraging laboratory employees to maintain their world-class capabilities and talents in their field(s) of expertise
- Ensuring that laboratories can provide a quick response capability to DOE and its other strategic partners
- Promoting transparency between DOE, the laboratories, the government more broadly, and the public
- Facilitating the ability of the Laboratories to perform cutting edge research for other entities in the national interest

DOE's approach, then, to implementing this recommendation is twofold. First, DOE will continue and enhance its comprehensive planning processes, including involving the laboratories in these planning efforts, to establish strategic direction and priorities, ensuring that DOE makes the most of the available resources. Second, DOE will improve transparency with Congress and with the taxpayer regarding how it is using those resources in the best interest of the Nation. The specific actions described here are intended to meet these two objectives.

Specific Actions

OBJECTIVE: Identify and provide necessary resources by conducting rigorous, comprehensive strategic planning across DOE, to include the laboratories in this process *(Recommendations 1, 20)*

Current Strategic Planning Efforts. DOE currently conducts its strategic planning through the preparation of a series of key studies and documents. They span the range from Administration-wide policy studies to program-specific strategies.

- With respect to DOE's energy programs, the foundational planning drivers for policy and programmatic decisions are the **Quadrennial Energy Review** (QER) and the **Quadrennial Technology Review** (QTR). They are designed to evaluate the current state of energy-related science and technology, policy, infrastructure, and other energy-linked challenges to the economy, environmental quality, and national security, and identify opportunities and recommendations. The QER is an Administration-wide policy process, led by the White House Domestic Policy Council and Office of Science and Technology Policy. DOE plays a critical role in the QER and is responsible for conducting the analysis, drafting the report, stakeholder outreach, and supporting interagency coordination. Unlike other Federal Quadrennial Review processes where an analysis is done every four years, the QER is conducted through installments to allow for granular analysis of key energy sub-sectors.

The QTR is a planning process specific to DOE. It explores the current state of technologies in key energy sectors and R&D opportunities present in the mid-term. It is intended to frame a blueprint for DOE energy technology development and the enabling science for future technology breakthroughs.

- With respect to DOE's national security responsibilities, the National Nuclear Security Administration (NNSA) produces two comprehensive planning documents that integrate programmatic requirements across laboratories, plants, and sites. The **Stockpile Stewardship and Management Plan** (SSMP) is DOE NNSA's 25-year strategic program of record for maintaining the safety, security, and effectiveness of the nuclear stockpile. The SSMP is published annually, in response to statutory requirements, in report or summary form, to support the President's Budget submission to Congress for Weapons Activities. As recommended by the Secretary of Energy Advisory Board (SEAB) Task Force on Nuclear Nonproliferation, a new report, **Prevent, Counter, and Respond – A Strategic Plan to Reduce Global Nuclear Threats**, articulates for the first time, in a single document, the NNSA programs to reduce the threat of nuclear nonproliferation and nuclear terrorism. As such, it serves as a companion document to the annual SSMP.
- The results from these foundational reports on DOE's energy and national security responsibilities are integrated into DOE's Strategic Plan. DOE's most recent **Strategic Plan for 2014–2018**, published in March 2014, is a comprehensive blueprint to guide the agency's core missions and provides a roadmap for the work of DOE, highlights major priorities, and provides the basis for individual DOE program plans.

<u>Future Laboratory Participation</u>. The National Laboratories are already important partners in the development of DOE's key strategic planning documents. They provide important technical input and expertise that informs DOE's analysis and planning efforts. Each of these documents will be refreshed on a periodic basis to reflect the evolving challenges, technologies, and opportunities facing DOE in the execution of its missions. As part of its efforts to strengthen its partnership with the National Laboratories, DOE will continue to engage with them in developing future updates to these documents.

OBJECTIVE: Assist Congress in its role of reviewing the laboratories by promoting greater transparency with Congress and with the taxpayer *(Recommendations 1, 2, 30, 36)*

Starting in 2016, DOE will begin providing an **annual report to Congress on the State of the Laboratory System**. The purpose of the report will be to describe key initiatives of the National Laboratories, including how the system as a whole is serving the Nation through collective and cross-cutting activities. It also will articulate DOE's operational successes and continued challenges in stewarding the laboratories, including DOE's status in implementing key actions described in this response. The first of these reports will be more comprehensive, providing a history and background on the National Laboratories and establishing a foundation for future annual updates. Developing the annual updates will be a collaborative effort among the three Under Secretary offices, facilitated by the Laboratory Operations Board (LOB). The annual report will be endorsed by the Laboratory Policy Council (LPC) and issued by the Secretary.

DOE also will continue to conduct **Lab Day on the Hill** events. The first, held in September 2014, included Laboratory Directors and representatives from all 17 National Laboratories and showcased demonstration projects across five theme areas – energy innovation and environmental sustainability, manufacturing innovations, high performance computing, national security, and discovery science. The second, in July 2015, highlighted the National Laboratory system's scientific and technological contributions towards developing America's new energy infrastructure, focusing on: grid modernization, sub-surface science, sustainable transportation, and integrated energy systems. In October 2015, Lab Day focused on the role of the National Laboratories in nuclear nonproliferation, national defense, homeland security and counter terrorism, emergency response, and stockpile stewardship. The next, Science Day on the Hill, is planned for April 2016, and an Environmental Stewardship Day on the Hill is planned for fall 2016. These events are a valuable tool not only to share the good work of DOE and its laboratories but also to raise the laboratory system's awareness of broader Congressional interests and to hear feedback from stakeholders.

2.2 REBUILDING TRUST

The Commission noted that a basic premise of the FFRDC/M&O model is trust. The Commission stated that "the government is responsible for setting the '*what*' of strategic program direction to meet the Nation's needs, while contracted university and industry partners are responsible for determining precisely '*how*' to meet the technical and scientific challenges and to carry out programs." The Commission noted that a strength of this model when it is working properly is to provide freedom to innovate without overly intrusive management. The Commission observed that trust between DOE and the laboratories has eroded, which has resulted in overly prescriptive management in some areas. The Commission also recognized, however, that "there is significant improvement being made in this area under the current Secretary and directors of the National Laboratories, and wishes to support these and other steps" including reactivating the National Laboratory Directors' Council (NLDC), the LOB, and other forums for collaboration of various groups within DOE and the laboratories.

Commission Recommendations

Under the theme "rebuilding trust," the Commission provided the following recommendations:

Recommendation 2: *DOE should delegate more authority and flexibility to the laboratories and hold them accountable for results. The laboratories must be transparent with DOE.*

Recommendation 3: *DOE and each laboratory should cooperatively develop a high level annual operating plan, and DOE should provide increased flexibility and authority to the laboratory within that framework.*

Recommendation 4: *DOE should implement greater leadership and management development for its Federal workforce, including multi-directional rotational assignments.*

Recommendation 5: *DOE should separate NETL's research and development function and consider converting it to a government-owned, contractor-operated FFRDC. NETL should increase its interactions and collaboration with universities.*

Recommendation 6: *DOE should abandon incentive award fees in the M&O contracts in favor of a fixed fee set at competitive rates. DOE should adopt a broader and richer set of incentives and consequences to motivate sound laboratory management and enforce accountability.*

Recommendation 7: *For non-nuclear, non-high- hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and national standards in place of DOE requirements. DOE should review and minimize approval processes.*

Recommendation 8: *DOE should modify its processes for developing directives, orders and other requirements to more fully engage subject matter experts and to use a risk-based model.*

Recommendation 9: *DOE should focus on making the use of Contractor Assurance System (CAS) more uniform across the laboratories, and local overseers should rely on information from the CAS systems.*

Recommendation 10: *The role of the site office should be emphasized as one of "mission support," with all staff in the site office reporting to the site office manager. DOE should devote more effort to leadership training and professional development of field staff.*

Recommendation 11: *DOE should clarify the role and authority of the support centers and align all authorities at either the site office or DOE headquarters, as appropriate.*

Recommendation 12: *All stakeholders should make maximum use of local assessments performed by site offices and laboratories.*

Recommendation 13: *DOE should establish a single point of control—within the Department or each stewarding program office—for all laboratory-directed data requests.*

Recommendation 14: *DOE and its program offices should increase the size of funding increments, extend timelines and minimize milestones for each increment, and institutionalize mechanisms for laboratory flexibility to move money between budget codes.*

Recommendation 15: *Congress should repeal Section 301(d) of the FY 2015 Consolidated Appropriations Act as soon as feasible to remedy the transactional burden it creates for OMB, DOE Headquarters, and the laboratories when operating under a continuing resolution.*

Discussion

DOE agrees with the Commission that there is a need to return to the spirit of the FFRDC model. FFRDCs enable government agencies to work with private sector partners to accomplish tasks that are integral to the mission and operation of the sponsoring agency. The FFRDC is required to conduct its business in a manner befitting its special relationship with the government, to operate in the public interest with objectivity and independence and with full transparency to its sponsoring agency. To do this, DOE and the National Laboratories must work together as partners to restore the ideal nature of the FFRDC relationship as a culture of trust and accountability. To that end, the specific actions outlined here focus on achieving three objectives: (1) implement Laboratory stewardship through partnership, (2) clarify roles and responsibilities, and (3) improve the development and implementation of requirements, as well as the laboratory oversight environment.

Specific Actions

OBJECTIVE: Implement laboratory stewardship through partnership *(Recommendations 2, 3, 4, 6, 12, 21)*

Existing Initiatives. Consistent with the FFRDC model, DOE will ensure its laboratory stewardship responsibilities are founded on the trusting partnership that must exist between Federal and laboratory leadership. Maintaining this partnership requires developing a strong set of tools that will allow all DOE programs to consistently and effectively partner with the laboratories; delegating authorities to the laboratories where warranted; and investing in leadership development for both Federal and laboratory staff. DOE has established two joint Federal-Laboratory bodies that provide the leadership and enterprise-wide coordination to effectuate this commitment to a partnership model: the LPC and the LOB.

- In July 2013, the Secretary established the **Laboratory Policy Council** (LPC) to provide a forum to include the National Laboratories in strategic discussions of DOE's policy and program planning process, and for DOE to provide strategic guidance on National Laboratory activities. The LPC, chaired by the Secretary and comprised of senior DOE leadership and the National Laboratories Directors' Council Executive Committee, convenes three times a year and serves as an important forum for exploring nascent proposals related to new research directions, building human capacity, and improving communications; discussing progress and guidance on initiatives, such as technology transition pilots and emergency response. Discussions within the LPC have focused on crosscutting Departmental initiatives, DOE-lab studies by external bodies, management challenges, and workforce and leadership diversity.
- The **Laboratory Operations Board** was chartered in October 2013, with a charge "to strengthen and enhance the partnership between DOE and the National Laboratories, and to improve management and performance." One of its early efforts illustrates the enterprise-wide impact of the group: the LOB led a first-ever enterprise wide assessment of general purpose infrastructure across all 17 National Laboratories and NNSA sites and plants, using newly-established metrics to provide a uniform assessment of infrastructure such as utilities, HVAC systems, and office buildings. This initiative provided the basis for an additional $106 million requested by DOE, and funded by Congress in the Fiscal Year (FY) 2016 appropriations, targeted for general purpose infrastructure projects. Since then, the LOB has led DOE on other operations and management issues ranging from the strategic – e.g. coordinating a similar enterprise-wide effort to provide updated assessments and prioritization of unused and contaminated "excess" facilities, to the targeted – e.g. updating Departmental policy on Strategic Partnership Projects and then building a community of practice to promulgate best practices and streamline approvals.
- The LPC and LOB have proven to be successful partnership forums where issues can be raised and solutions can be debated with relevant stakeholders engaged. These bodies will continue to play an important role in providing insight into key Departmental strategy and management issues. They are closely integrated with the laboratory leadership, as the executive committee of the NLDC sits on the LPC, and the chairs of the laboratory Chief Operating Officer and Chief Research Officer working groups are members of the LOB. The

charters of these two key leadership groups will be amended to clearly establish that a key focus area of each initiative should be to address issues counter to the DOE/laboratory partnership, and to establish mechanisms to identify and remedy those as they arise.

Increasing Flexibility and Accountability through Annual Operating Plans. DOE appreciates the recommendation from the Commission regarding **annual operating plans**, which would reflect high-level agreements on the nature and scope of the laboratory's activities. As discussed below in Section 2.3, DOE has already embarked on an effort to improve the existing annual planning process as well as the performance management process through DOE's existing annual Performance Evaluation and Management Plans (PEMPs). These improvements are responsive to some of the increased transparency, accountability, and predictability of laboratory planning that the Commission's report recommends, and DOE is currently evaluating whether existing Departmental mechanisms can be further enhanced to address the Commission's concerns. In addition to these ongoing efforts to strengthen annual laboratory planning and evaluation processes, DOE is undertaking a number of other steps.

- DOE also is evaluating whether **a pilot of the annual operating plan concept** at one or two National Laboratories (or areas within a laboratory) would result in added streamlined management without creating a duplicative process.[3] Any pilot effort would be focused on establishing a high-level understanding and agreement on the laboratory's planned work for the year, which could then be used to guide and expedite various approval processes throughout the course of the year.
- As a result of related recommendations from SEAB, DOE has initiated an **"evolutionary" working group** effort to identify specific authorities that can be delegated, on a pilot basis at Fermi National Accelerator Laboratory, to improve efficiency and reduce transactional oversight. Some of the recommendations for this group likely will lead to changes to Departmental-wide policies.
- Similarly, DOE has initiated a second **"revolutionary" working group** to examine the laboratory contract structure at the Stanford Linear Accelerator Center, with the objective of developing a more streamlined approach to improve the partnership and reduce transactional oversight.

Leadership Development Rotational Assignments. The LOB has established a working group with the DOE Chief Human Capital Officer (CHCO) to develop and implement a pilot for a

[3] In comments to DOE on the Commission report, the Executive Committee of the National Laboratory Directors' Council raised a concern that a new annual operating plan might be duplicative of current requirements such as the PEMPs.

leadership development rotational program that would offer DOE Federal and laboratory mid-level and senior employees opportunities to rotate to laboratory or Federal sites. These rotational assignments would provide opportunities for a detail to a limited-term team that is focused on a unique project or solving a complex problem; longer term assignments also would be considered on a case-by-case basis. The rotational program, to be run by the CHCO office and anticipated to begin in 2016, is intended to promote greater common understanding of the management challenges and opportunities between the laboratories and the Federal employees, and to strengthen partnership and trust.

Incentive Award Fees. With respect to the **M&O contract incentive structure**, the Commission's recommendations are most applicable to the NNSA contracts. Informed by feedback from the M&O community, NNSA is developing an M&O overarching procurement strategy guide that will include contract structure and incentive guidance for use when each specific acquisition strategy is initiated and approved for future competitions of NNSA's M&O contracts. This new contracting strategy will identify the appropriate application of incentive and fixed fee for NNSA contracts when the procurements for those contracts arise.

OBJECTIVE: Clarify roles and responsibilities (*Recommendations 5, 10, 11*)

Headquarters and Field Management. In general, program management responsibility and strategic direction reside at DOE Headquarters whereas field offices provide day-to-day implementation and are advocates for mission work at the sites. DOE is taking steps to clarify the roles and responsibilities of the headquarters, program, field, and laboratory organizations. This will help strengthen the partnership between DOE and the labs and improve the implementation of core operational mechanisms and risk management, such as the Contractor Assurance System (CAS).

A working group of the LOB is developing a **DOE/Laboratory Management Framework** document to be completed in 2016, which will describe the current operational framework across the Department, identify those parts of the framework that have added value to the DOE/laboratory relationship, and articulate core management principles relevant to the DOE/laboratory relationship to be implemented by the Under Secretaries.

Each DOE program will review its field authorities and structure as part of this effort, including to ensure that Contracting Officers report to line managers. In addition, each program will formalize a field manager training and professional development program that provides for effective workforce planning and instills an understanding of "mission support" as the primary site office role.

In particular, NNSA will execute plans to improve its governance and oversight of field operations at its laboratories, sites, and plants and clarifying roles and responsibilities. The new approach will clarify the oversight roles of headquarters and field office personnel, placing emphasis on new rigorous and dependable Contractor Assurance Systems (described below), and leveraging best practices from the Office of Science, including enhancing peer review and corporate parent involvement as appropriate for each site. In addition, to manage and eliminate duplication in field oversight, NNSA's field offices will use a Site Integrated Assessment Plan (SIAP) to identify their annual oversight requirements. This effort is intended to result in a consolidated schedule across all field offices and to assign resources based on expertise and functional area.

National Energy Technology Laboratory. The Commission also recommends for **National Energy Technology Laboratory (NETL)**, the only DOE National Laboratory that is government owned and government operated (GOGO), that there is a need for "significantly increased clarity and focus on the R&D mission for the research staff at NETL and for others outside NETL who work with them." The Commission recommends that DOE should separate NETL's R&D function from its management of Federal programs, and that the R&D function should be converted to "a government-owned contractor-operated FFRDC."

While DOE agrees there is a need for increased focus on the R&D conducted by NETL's scientists, the Department notes that there are several ways to pursue such a focus. In the near term, focus on the R&D can be better achieved by integrating and synchronizing NETL's intramural and extramural research portfolio. This integration will better focus NETL's research, enhance NETL's collaborations with researchers in academia, industry, and other National Laboratories, and increase NETL's ability to consistently provide better science and research results. The Office of Fossil Energy recognizes the need to enhance NETL parity with other GOGOs within the Federal government by giving flexibility and discretion to drive innovation through mechanisms similar to those authorized by the National Defense Authorization Act. These mechanisms permit discretionary funds to strengthen scientific and technical vitality and create a flexible personnel system (e.g., direct-hire authority for scientific and engineering positions, broad-banded pay systems, simplified job classification, contribution-based compensation system, and enhanced training and development) to attract and retain scientific and technical expertise.

OBJECTIVE: Improve the development and implementation of requirements; improve the laboratory oversight environment (*Recommendations 7, 8, 9, 13, 14, 15, 18*)

DOE has initiated a comprehensive review of **how, when, and why it establishes its own set of requirements**, with a charge to take a fresh look at mechanisms including directives, policy memoranda, and acquisition letters. A workshop with a wide set of perspectives (both Federal and laboratory) is being convened in early 2016 with the goal of identifying specific challenges to tackle; it will be sponsored by the LOB and co-chaired by a Federal and a laboratory employee. Part of that effort is expected to discuss DOE requirements that are duplicative of Federal, State and National standards and whether there are circumstances where laboratories should be able to use those standards in place of DOE requirements. The effort also will evaluate proposals to streamline the processes for developing directives and other requirements.

In addition, the Commission noted that **data calls** "can often arrive at the laboratories without being sufficiently vetted or filtered." The Commission indicated that the Office of Science (SC) has reduced the number of data calls by establishing a single point of contact for data requests for all of its 10 laboratories. Consistent with the Commission's recommendation, NNSA and the programs that oversee the applied laboratories plan to evaluate the process used in SC and determine what actions would be appropriate for their programs and their respective laboratories.

The Commission report also recommended that DOE identify opportunities to reduce the transactional burden associated with **funding allotments**, as well as to evaluate whether Congress should repeal Section 301(d) of the FY 2015 Consolidated Appropriations Act.

DOE is limited in the actions it can take without Congress to reduce the subdivision of funding into smaller "buckets." The annual appropriations act for DOE subdivides DOE's funding into more than 500 legally-binding control points, as enforced by section 301(d). Additional control points also are sometimes established administratively through the OMB apportionment process and the internal DOE funds distribution process.

DOE's Office of the Chief Financial Officer (CFO) has been working with the program offices to reduce the subdivision of funds below the Congressional control points. As the Commission points out, the DOE Office of Energy Efficiency and Renewable Energy has recently moved towards larger grants with longer periods of performance and fewer milestones and reporting requirements. In addition, increased transparency should reduce the introduction of control points.

The Section 301 (d) restriction can be troublesome during periods when DOE funding is provided through Continuing Resolutions rather than through an annual appropriations Act. Because the Continuing Resolution typically provides funding at the same level and under the same terms and conditions as the prior year appropriation, it can significantly restrict flexibility as programs transition to the new fiscal year. Also, because a Continuing Resolution is typically enacted for short periods of time, there may not be adequate time to process reprogrammings to address issues where additional program flexibility may be needed. The Administration succeeded in obtaining a waiver of section 301 for the NNSA Weapons Activities appropriation in the FY 2013 full year continuing resolution. No other DOE programs received a section 301(d) waiver in the FY 2013 continuing resolution, and reprogrammings—often requiring months for formulation and Congressional approval—were required to reallocate funds to address requirements. Congress has not waived the provision in any subsequent continuing resolutions or conference appropriations Acts. DOE would work with the House and Senate Appropriations Committees if they choose to repeal section 301(d) to develop mechanisms that will preserve Congressional oversight and ensure Departmental accountability while improving management efficiency and effectiveness. In addition, DOE is exploring mechanisms for better integrating disparate funding streams to have a larger impact, such as is being done in the Grid Modernization Laboratory Consortium.

With respect to the oversight environment, the **Contractor Assurance Systems (CAS)** will continue to serve as a system for the contractor to manage performance consistent with contract requirements. Under this system, the oversight of activities with potentially high consequences is given high priority and greater emphasis. In addition, DOE oversight programs are designed and conducted commensurate with the level of risk of the activities. A working group led by the LOB has been reviewing how the various offices operate CAS at the laboratories under their purview and is developing a policy document which articulates high-level CAS principles, to help further more uniform application across the complex. These principles of Contractor Assurance, roles/responsibilities, and levels of risk acceptance underlie DOE/laboratory interactions, and so these core CAS principles will be incorporated into the DOE/Laboratory Management Framework document described above. In addition, NNSA is in the process of updating its CAS process to more closely mirror the Office of Science model, to include using peer reviews to analyze the strength of the CAS systems.

In the areas of Federal safety and security oversight, DOE has enhanced the way oversight is conducted organizationally, procedurally, and operationally. In 2014, the Secretary established the **Office of Enterprise Assessments** to consolidate and manage all independent safety and security assessments within DOE. At the same time, the **Office of Environment, Health, Safety,**

and Security was established to serve as the organization responsible for policy development and technical assistance; safety analysis; and corporate safety and security programs. These actions provided a clear distinction between operational awareness and independent oversight responsibilities. DOE will continue to work to improve the oversight process, including addressing duplication where appropriate and sharing best practices.

2.3 MAINTAINING ALIGNMENT AND QUALITY

The Commission's report noted the critical role of DOE in providing strategic direction to the laboratory system. The Commission indicates what it finds to be a lack of a comprehensive strategic planning process across DOE, but states that it finds that the laboratories' "research programs and capabilities are generally well-aligned with DOE's missions and strategic priorities." The Commission provides recommendations for improving planning efforts at DOE, including adopting elements of the Office of Science strategic planning process more broadly across DOE.

Commission Recommendations

Under the theme "maintaining alignment and quality," the Commission provided the following recommendations:

Recommendation 16: *Other DOE program offices should adapt the procedures and processes that DOE's Office of Science has for guiding and assessing the alignment of the laboratories with DOE's missions and priorities.*

Recommendation 17: *The processes that the Office of Science has in place for assessing the quality of laboratory research and the quality of the research portfolio in each of its programs, should be adapted by the other DOE program offices.*

Recommendation 18: *There must be a government-wide reconsideration of the conference travel restrictions.*

Recommendation 19: *The Commission strongly endorses LDRD programs and supports restoring the cap on LDRD to 6 percent unburdened, or its equivalent.*

Recommendation 20: *DOE should manage the National Laboratories as a system having an overarching strategic plan that gives the laboratories flexibility. Once the research has matured to the point that a preferred or most promising approach can be identified, the Department should provide strategic oversight and guidance to coordinate and consolidate programs.*

Recommendation 21: *Congress should recognize that the technical capabilities currently housed within the NNSA laboratories are essential to the Nation. Maintaining the nuclear explosive package capabilities in separate and independent facilities has proven effective and should continue.*

Discussion

DOE agrees with the Commission that strategic planning involving both DOE and the laboratories is critical to advancing the strategic direction of the laboratory system. To that end, DOE has identified three objectives: (1) improve laboratory planning and evaluation; (2) manage the laboratories as a system, seeking to achieve maximum benefit for the Nation; and (3) beyond revising strategic planning, examine procedures to allow Laboratories flexibility to maintain excellence in the expertise of research staff.

Specific Actions

OBJECTIVE: Improve annual laboratory planning and evaluation *(Recommendations 3, 16, 20)*

The Secretary has initiated several efforts to bring more consistency to the management and oversight of the DOE laboratories, and DOE has established an Agency Priority Goal for FY 2016-FY 2017 (and related Strategy) that will ensure focus is maintained on these efforts (see box).

Agency Priority Goal: Deliver the highest quality R&D and production capabilities, strengthen partnerships with DOE headquarters, and improve management of the physical infrastructure of the National Laboratories to enable efficient leadership in science, technology, and national security.

Strategy - Develop and implement a consistent, annual process to track and assess laboratory planning and evaluation.

First, DOE has already begun to develop a consistent **annual laboratory planning approach** to track and assess laboratory planning and evaluation. In this effort, DOE is establishing a Laboratory Planning Working Group, convened by the Under Secretary for Science and Energy and with participation from NNSA and the Office of Environmental Management, to create a framework for consistent laboratory planning processes. Consistent with Commission recommendations 16 and 17, NNSA and the applied energy offices will model their revised processes using core elements and attributes from the lab planning process used by the Office of Science (SC). As is done in SC, the annual laboratory plans will inform the PEMPs, infrastructure plans, and 10-Year Site Plans. A key element for programs and Under Secretarial offices is to ensure that these annual planning efforts provide senior-level vision and direction that will help better integrate efforts rather than simply adding another process or level of review.

Second, DOE has efforts underway regarding improvements to annual laboratory planning. Specifically, NNSA is working to improve its strategic planning process and partnership efforts by establishing a laboratory strategic planning function in the NNSA Office of Policy within the Office of the Administrator. NNSA will work with each of the Lab Directors and NNSA field office managers to establish this new process, which will include an annual high-level strategic discussion at which each Laboratory Director presents his or her long-term strategic vision, to include the complex factors and competing objectives that each national laboratory balances, while continuing to assure national security mission success. The discussion will also include longer-term issues that the Director considers vital to the mission success of the laboratory.

Third, the Office of the Under Secretary for Science and Energy has initiated efforts to improve the annual lab planning processes for the applied energy laboratories under its purview. The Office is developing coordinated and uniform guidance for applied energy labs to submit an Annual Laboratory Plan which will track the process and timing used in the Office of Science. The process will also include presentations by the laboratories of its key priorities.

Finally, the Office of Environmental Management (EM), will establish an entity that is responsible for the stewardship of Savannah River National Laboratory. This entity will manage the process for annual laboratory program guidance, planning, and evaluation, and will serve as a focal point for other key laboratory stewardship activities, such as Strategic Partnership Projects (SPP) and LDRD. EM will implement a planning and evaluation process with core elements and attributes developed from the Office of Science model.

In addition to these annual lab planning improvements, DOE also has efforts underway to make the lab performance management process more uniform across DOE. In 2014, the Office of the Under Secretary for Science and Energy chartered a **Laboratory Performance Management Working Group** to better align the processes used by the program offices to annually evaluate the laboratories' performance, using the Office of Science PEMP process as a model. This group developed several recommendations that are being implemented by DOE, through the Under Secretaries, in FY 2016. The recommendations provide for: consistent annual laboratory performance plans across all laboratories with common hierarchy; standard nomenclature and definitions of terms; the identification and evaluation of a laboratory's leadership role in cross–cutting initiatives with inter-laboratory collaboration (e.g., Grid Modernization); and performance feedback from all major sponsors (both DOE and non-DOE) of work at a laboratory. In 2016, the Under Secretary for Science and Energy will integrate this ongoing effort to improve the PEMP process with the new annual laboratory planning approach described above.

OBJECTIVE: Manage the Laboratories as a system, seeking to achieve maximum benefit for the Nation *(Recommendations 17, 19)*

A number of the efforts described above go to the efforts to manage the laboratories as a system. This includes the enterprise-wide bodies that provide strategic direction and vision to improve the lab partnership–including the LPC and the LOB–as well as the cross-departmental laboratory planning and performance working group that seek to not just improve planning at a single laboratory, but to better integrate planning across the system. In addition, the Departmental reorganization of the Under Secretary offices moved the basic research and applied energy programs under the newly-established Under Secretary for Science and Energy to better coordinate lab research and development activities. DOE will use future updates of the Science and Energy Plan, the NNSA SSMP, and the report entitled "Prevent, Counter, and Respond – A Strategic Plan to Reduce Global Nuclear Threats," to articulate decisions pertaining to an appropriate level of duplication of research and synergies in the DOE-laboratory crosscuts.

Moreover, DOE will continue collaboration through **DOE-laboratory crosscuts**, and will use the enhanced lab planning approach to inform, for example, crosscutting teams, and plans and proposals submitted to the **National Laboratory Big Ideas Summit**. The Under Secretary for Science and Energy will continue to sponsor an annual National Laboratory Big Ideas Summit, which brings together subject matter experts from DOE's science and energy offices as well as the Office of Energy Policy and Systems Analysis, the NNSA, and all 17 National Laboratories (including their Directors and senior research staff) to propose and explore innovative ideas for solutions to key energy issues. The first Summit resulted in major Departmental initiatives in FY 2015 and FY 2016, including the Grid Modernization Laboratory Consortium, which is led by two Federal and two Laboratory representatives.

OBJECTIVE: Beyond revising strategic planning, examine procedures to allow Laboratories flexibility to maintain excellence in the expertise of research staff. (Recommendations 18, 19 and 21)

Through discussions with the National Laboratory Directors' Council (NLDC) and their working groups, as well as through the LPC and LOB, DOE will continue to identify additional methods and mechanisms to manage the Laboratories as a system with maximum flexibility to pursue new, mission-relevant lines of inquiry.

Of particular note, DOE welcomes the Commission's support for **LDRD programs**. The LDRD Program provides the laboratories with the opportunity and flexibility to establish and maintain an environment that encourages and supports creativity and innovation, and contributes to their long-term viability. LDRD allows DOE's laboratories to position themselves to advance the national security mission and respond to the Nation's future research needs. The Commission recommended that Congress restore the cap on LDRD to 6 percent unburdened, or its equivalent, noting that this will have the largest impact on LDRD at the NNSA laboratories. The recently-enacted FY 2016 National Defense Authorization Act increased funding for LDRD with a minimum rate of 5 percent and a maximum of 7 percent of the NNSA laboratories' operating budgets, a level more consistent with historic NNSA levels.

DOE also is working to promulgate best practices on LDRD throughout DOE. DOE will establish a best practices process in FY 2016 to help the National Laboratories improve the flow of outcomes from LDRD to missions. This working group, led by NNSA but involving the other Under Secretary offices as well, also will develop an electronic forum in 2016 to document and share best practices. In FY 2016, DOE will issue a LDRD Highlights document; NNSA also will share the individual annual lab reports with Congress and provide an annual briefing for stakeholders on the benefits realized due to LDRD investments.

In regard to **conference management** procedures, as the Commission notes, DOE has taken efforts to revise and refine the existing processes, including to streamline administrative actions and reduce transactional oversight, while meeting all legal requirements and maintaining appropriate management controls to ensure cost-effectiveness.

DOE also is streamlining its approval requirements relating to **laboratory employee benefits** to provide laboratories greater flexibility to manage their workforce. Among these changes, following the issuance of the Commission's report, in January 2016 DOE revised its process to eliminate prior approval of new or revised benefit plan changes, with the exception of changes that result in increased costs or that are contrary to Departmental policy or written instructions. DOE also agrees that the timing of its process for reviewing pension funding plans should be addressed and is working to streamline those processes.

2.4 Maximizing Impact

The Commission finds that the "National Laboratories represent a national asset of inestimable value" but notes that more can be done to tap the capabilities of the laboratories, especially in support of economic competitiveness. The laboratories interact with stakeholders beyond DOE – including other Federal agencies and the private sector. The Commission states that more can be done to broaden collaboration and to make the laboratories run efficiently and effectively.

Commission Recommendations

Under the theme "maximizing impact," the Commission provided the following recommendations:

Recommendation 22: *DOE should establish policies and procedures to make the Strategic Partnership Projects (SPP) process more efficient.*

Recommendation 23: *DOE should support efforts to strengthen the Mission Executive Council.*

Recommendation 24: *DOE and its laboratories should continue to facilitate and encourage engagement with universities.*

Recommendation 25: *DOE should fully embrace the technology transition mission and continue improving the speed and effectiveness of collaborations. Innovative technology transfer and commercialization mechanisms and best practices should continue to be pursued.*

Recommendation 26: *DOE should determine whether the annual operating plans could qualify as the "agency approved strategic plan" under the Stevenson-Wydler Technology Innovation Act of 1980, and the Fast-Track CRADA Program. For CRADAs with non-standard terms and conditions, DOE should define the acceptable range for each term and condition to greatly expedite negotiation and review/approval time.*

Recommendation 27: *Laboratories should pursue innovation-based economic development by partnering with regional universities.*

Recommendation 28: *DOE, the Administration and Congress should continue to support user facilities at the DOE laboratories, including peer review by external advisory groups.*

Discussion

DOE agrees that the laboratories' engagement with Federal and private sector partners is a vital element of their mission. The DOE laboratories are major national scientific and technical assets whose contributions to the United States at large, and in areas beyond the DOE missions, are significant. In addition, the DOE laboratories can play a regional role in supporting universities and community colleges by providing partnering opportunities and serving as a conduit to the broader laboratory network. DOE's objective in this area is as follows: enhance laboratory mission-aligned collaboration with stakeholders and the broader science and technology community.

Specific Actions

OBJECTIVE: Enhance laboratory mission-aligned collaboration with stakeholders and the broader science and technology community (*Recommendations 22, 23, 24, 25, 26, 27, 28)*

In the area of **Strategic Partnership Projects** (SPP), the Secretary recently issued an updated policy document which sets forth the principles for DOE's strategic engagement with partners from other Federal agencies and the private sector. This policy makes clear that DOE is committed to expanding the use of its laboratories and other sites for the benefit of its strategic partners. This work must be consistent with or complementary to DOE's missions or the facility to which the work is to be assigned. The work also should enhance or make use of the facility's core capabilities, but does not need to be associated with a specific mission of the "owning" program. Additionally, the work must not adversely impact DOE programs, result in direct competition with the domestic private sector, or create a detrimental future burden on DOE resources.

In addition, under the leadership of the LOB, DOE established a community of practice on SPP to ensure communication of best practices across the complex. The community of practice held its first annual SPP summit in March 2015 and continues to meet to discuss ways to enhance collaboration and streamline processes. Within NNSA, the Office of Strategic Partnership Programs has created a task force of laboratory and Federal personnel, including potential SPP partner representatives, to improve the SPP program, processes, and procedures. The task force will undertake an in depth look at the current process to identify efficiencies, an analysis of other mechanisms to place work, including umbrella agreements, and a discussion on appropriate metrics. Proposed changes to the NNSA SPP approval process are expected to be implemented in late FY 2016.

The Commission also recommends that DOE "support efforts to strengthen the MEC." The **Mission Executive Council** (MEC) was established to bring a more strategic understanding of the capabilities needed for the labs and facilities to serve the agencies' missions. While DOE is committed to the future success of the MEC, further development of this strategic concept is required, as well as the involvement and commitment of the agencies for which the DOE facilities perform their work. In addition, since the MEC only represents four agencies, it would not be the proper venue to coordinate, streamline, and execute all interagency work because many other stakeholders would not be represented. The MEC is currently pursuing an agenda focused on identifying strategic priorities and critical capabilities to address enduring national security challenges and potential technological surprises raised by the MEC Member agencies. This approach and dialogue are starting to work and will result in an actionable MEC strategic framework on specific activities for the MEC Members to execute.

DOE concurs with the Commission's recommendation on continuing to support **user facilities** at the laboratories. DOE will continue to support user facilities as a key part of its portfolio and will continue to use external peer review and external advisory groups to evaluate facility performance and help inform decisions on existing and future facilities. DOE also will ensure that best practices by the Office of Science for managing user facilities are incorporated into the management practices of other DOE program offices. In addition, DOE will include a discussion about user facilities in the Annual State of the Laboratory System report to emphasize the critical role they play.

In regard to supporting and accelerating DOE's **Technology Transfer Mission**, DOE also recognizes how technology transition activities offer ways to improve coordination of strategic activities with the laboratory enterprise. In early 2015, the Secretary established the Office of Technology Transitions (OTT) to coordinate and optimize how DOE transitions early-stage R&D to applied energy technologies through technology transfer, commercialization, and deployment activities. The OTT works with the Technology Transfer Working Group, which includes representatives from all National Laboratories, as a strategic partner providing them information about DOE activities and getting feedback from them on new technology transition programs and policies.

To further support technology transitions activities, DOE will update its 2008 Department-wide policy statement on technology transfer activities and will also develop the statutorily-required Technology Transfer Execution Plan, which will help set the strategic vision and implementation instructions for DOE. These documents will identify ways to enhance the visibility and endorse the importance of the technology transition mission. Additionally, DOE will work to provide more clarity to laboratories regarding the acceptable range for terms and conditions for non-standard CRADAs to expedite negotiation and subsequent review and approval. DOE implements both decentralized and centralized approaches to technology transfer and notes that National Laboratories currently have and employ the flexibility to interact directly with industry and negotiate agreements. DOE supports industry and laboratory interactions that are decentralized since each laboratory is unique and should develop partnerships that support the missions of DOE, and are tailored to the Laboratory's surrounding community and industry needs, including the pursuit of innovation-based economic development. Recognizing some of the constraints of existing mechanisms, DOE has over the last few years worked to provide more flexibility through the Agreement for Commercializing Technology (ACT) pilot, which will be assessed for its ability to reduce barriers to entities that access the laboratories. DOE also will continue to encourage laboratories to build on the successful innovative mechanisms identified by the Commission for engaging industry to make collaborations easier, faster, less expensive, and more effective.

With respect to **collaboration with universities**, DOE agrees that its engagement with universities is a critical part of the work of DOE and its laboratories. For instance, DOE provides direct-funded grants to universities following a competitive selection process (ranging from single-investigator awards to large multi-disciplinary efforts), and also issues subcontracts to universities. One example of ongoing engagement is through the Energy Frontier Research Centers (EFRCs), which are funded by the Office of Science, and involve partnerships among universities, National Laboratories, and private sector partners to conduct fundamental research focusing on one or more grand challenges to accelerate transformative discovery in current energy technologies. Other partnerships including Energy Innovation Hubs, which are integrated research centers that combine basic and applied research with engineering to accelerate scientific discovery, and the National Network for Manufacturing and Innovation (NNMI), which provides a manufacturing research infrastructure where U.S. industry and academia collaborate to solve industry-relevant problems.

In addition, university faculty and students are actively engaged in work at DOE's laboratories; more than half of the researchers using the Departmental scientific user facilities come from universities. Collaborations between university and National Laboratory researchers take place through mechanisms such as personnel exchanges and joint faculty appointments, research collaborations, and joint research programs.

Looking forward, there will be additional opportunities to further engage with universities and impact innovation based economic development as a result of the **Mission Innovation initiative**. At the recent COP21 meeting in Paris, the Mission Innovation initiative was announced by the President and leaders from 19 other countries. Each of these countries pledged to double their investment in clean energy R&D over the next five years. DOE's implementation of Mission Innovation will encourage greater effort and collaboration by all participants in the innovation process – including individual innovators, universities, private companies and National Labs.

2.5 MANAGING EFFECTIVENESS AND EFFICIENCY

The Commission Report addresses effectiveness and efficiency in three specific areas of DOE's enterprise: overhead rates, infrastructure, and project management. Having compared overhead rates at DOE laboratories with those of university, the Commission concluded that non-NNSA laboratory rates are comparable with university rates when both are adjusted for variability in rate structures. NNSA laboratory rates were found to be higher; however, the Commission noted that the difference was understandable given the unique mission at those laboratories. The Commission also highlights that facilities and infrastructure can have a substantial impact on laboratory research operations. The Commission concludes that laboratory facilities and infrastructure in poor condition can have inadequate functionality for mission performance; negative effects on the environment, safety, and health of the site; higher maintenance costs; and problems recruiting and retaining high-quality scientists and engineers. The Commission recommended increased investment to "...maintain and revitalize the system." Finally, the Commission indicates that project performance could be improved by imposing greater discipline in following project management guidance.

Commission Recommendations

Under the theme "managing effectiveness and efficiency," the Commission provided the following recommendations:

Recommendation 29: *DOE should continue implementing the Institutional Cost Report (ICR) and encourage additional peer reviews to help mature the ICR.*

Recommendation 30: *DOE should provide greater transparency into laboratory indirect costs and publish an annual report of the overhead rates at each National Laboratory.*

Recommendation 31: *DOE should consider whether a capital budget will better serve its internal facilities and infrastructure budgeting and management needs.*

Recommendation 32: *DOE and the laboratories should continue efforts to improve infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. DOE should work with Congress and OMB to agree upon the size and nature of the resources shortfall and develop a long-term plan.*

Recommendation 33: *DOE, the laboratories, Congress, and OMB should actively work together to identify appropriate situations and methods for utilizing innovative financing approaches.*

Recommendation 34: *DOE should maintain focus on increasing institutional capability and imposing greater discipline in project management, including peer reviews and "red teams."*

Recommendation 35: *The Commission supports the recent SEAB Task Force recommendation to put more resources into science and technology development for the EM program.*

Discussion

DOE agrees that managing effectiveness and efficiency is a critical element to a well-functioning FFRDC partnership. Recent Departmental efforts, such as the establishment of the Under Secretary for Management and Performance, the development of the LOB, and the Departmental efforts to improve project management, have focused on this issue. DOE's objectives in this area are as follows: (1) continue to maintain the Institutional Cost Report (ICR); (2) revitalize laboratory general purpose infrastructure and reduce the risk of excess facilities; and (3) improve project management.

Specific Actions

OBJECTIVE: Enhance the Institutional Cost Report (ICR) *(Recommendations 29, 30)* $

DOE will continue to work with the laboratories to refine and enhance the quality of the **Institutional Cost Report (ICR) data**. DOE initiated annual ICR reporting in FY 2011, and with the submission of FY 2015 data, will have five years of ICR data. This report provides high-level data to DOE on trends in indirect costs at the laboratories. DOE will work with the laboratories to analyze cost trends across the five years of data and continue to use the ICR data to provide supporting data, as appropriate, for DOE data calls and analyses of laboratory costs.

Detailed ICR data is shared among laboratories under a contractual term prohibiting disclosure of confidential or proprietary business information. This sharing has enabled the laboratories to perform peer reviews of the data to improve quality and consistency. Nonetheless, there are significant variations in the ICR data reflecting, in part, different accounting methods for allocation of indirect cost pools among the laboratories. DOE strongly supports the objective of improving the management efficiency of the National Laboratories through more rigorous analysis of indirect costs and actions to better control costs. The laboratory peer review process provides a needed first step, and DOE will work with the laboratories to continue and intensify the peer review process in order to gain insight into management opportunities to reduce costs. In addition, the LOB will assign greater priority to providing a forum for identifying and sharing of best practices to reduce costs across the laboratories and DOE programs consistent with relevant OMB guidance. DOE will undertake additional efforts to improve the validation of indirect cost estimates, such as crosscutting reviews of selected indirect cost categories. Such reviews will inform additional efforts by the laboratories to manage indirect costs. DOE will also work on efforts that will lead toward consistency and promote greater transparency to the public on overhead rates in the national laboratory system within legal constraints.[4]

OBJECTIVE: Revitalize laboratory infrastructure, reduce the risk of excess facilities, and improve project management *(Recommendations 31, 32, 33, 34, 35)*

The Commission's report identifies significant challenges faced by DOE and the laboratories with degrading infrastructure and deferred maintenance and "excess" facilities that were once used for the Nation's nuclear production efforts but now are sitting unused, awaiting deactivation and decommissioning (D&D). The Commission states that "The total cost of cleanup at all DOE sites was estimated to be $280 billion in 2013. As of 2015, EM has determined that 234 additional facilities meet its criteria for transfer to EM, but it does not have the funding to accept them for remediation. In addition to the issue of cost of surveillance and maintenance for the program offices, contaminated excess facilities continue to pose a risk to mission, workers, the public, and the environment." The Commission also notes that "the Department needs to build more project management and cost-estimating capacity. It also needs a more homogeneous and disciplined project/program management culture."

Recognizing these challenges, DOE has recently implemented an enterprise-wide focus on infrastructure planning and uniform assessments, and improving project management. This focus supports a specific strategy DOE has articulated under its Agency Priority Goal for the National Laboratories, to improve the percentage of DOE laboratory facilities assessed as "adequate" (see box).

First, last year, a LOB-led effort resulted in significant DOE-wide improvements to the rigor and consistency of infrastructure assessments, allowing more credible and reliable data for decision

Agency Priority Goal: Deliver the highest quality R&D and production capabilities, strengthen partnerships with DOE headquarters, and improve management of the physical infrastructure of the National Laboratories to enable efficient leadership in science, technology, and national security.

Strategy - By the end of FY 2017, the percentage of assessed DOE laboratory facilities categorized as "adequate" will increase by 2 percentage points from the FY 2015 baseline.

[4] The Commission report provided a summary comparison of indirect cost rates that illustrated the differences in the composition of indirect costs among classes of laboratories – NNSA and Non-NNSA laboratories. The Commission's analysis also suggests that total indirect costs for the non-nuclear security laboratories are commensurate with those at major research universities.

makers at all levels. This year, the focus has been on further developing an annual infrastructure status report that provides an enterprise-wide view of risks and opportunities on a timeline that will inform budget formulation and defense. Both of these efforts will continue under the leadership of the newly-formed Infrastructure Executive Committee, which consists of line managers and facilities experts from programs, labs, plants, and sites that has been charged with providing an **annual update to DOE leadership on the state of general purpose infrastructure**, and presenting an enterprise-wide list of prioritized investments. In FY 2016, the first year of this effort, Congress appropriated $106 million in new investments in critical general purpose infrastructure requested by the Administration and identified through this LOB-led process. In addition, DOE's FY 2017 budget submission proposes investments to ensure no increase in the backlog of deferred maintenance at facilities across the complex.

Within individual program offices, infrastructure efforts are now an integral part of the laboratory planning and evaluation processes described in Section 2.3, above. Specifically, annual infrastructure planning processes at each laboratory are being developed that will result in a ten-year maintenance and recapitalization plan that is integrated with and fully supportive of the Annual Lab Plans. Plans will include reduction of deferred maintenance, removal of excess facilities, and proposals for potential construction of new facilities, including consideration of innovative financing approaches as recommended by the Commission. Evaluation of laboratory performance related to infrastructure stewardship will be included in laboratory performance plans. In addition, NNSA has expanded its Asset Management Program (AMP) which uses supply chain management economies-of-scale to provide a more centralized and efficient procurement approach to replacing mission-critical aging infrastructure systems that are common throughout the enterprise, such as roof and HVAC systems.

Second, in regard to removal of excess facilities, the Secretary directed the establishment of an **Excess Contaminated Facilities Working Group**, led by the LOB. The working group developed and executed an enterprise-wide data collection effort to obtain updated cost and risk assessments to deactivate, decontaminate, decommission, and demolish excess facilities. The updated data from the working group was used to define the scope of the challenge and to identify options for how DOE may better prioritize excess facilities. The group is developing policies to institutionalize a corporate approach, and updating and validating data gathered by the working group's efforts. The group also will be finalizing a report on its work. This report will be issued in 2016, also in response to a requirement of the 2016 National Defense Authorization Act.

Third, in 2013, the Secretary established a working group to examine **project management practices** at DOE. After its review, the working group issued a report identifying ways in which project management at DOE could be improved. Following these efforts, in December 2014, the Secretary issued a Secretarial policy memorandum which included additional efforts to improve project management, including: strengthening the Energy Systems Acquisition Advisory Board, establishing a Project Management Risk Committee, and improving the lines of responsibility and the peer review process. To further strengthen the independence of the project peer review process, the Secretary directed each Under Secretary to establish, if it did not already exist, a project assessment office that did not have line management responsibility for project execution. As a result, the Under Secretary for Nuclear Security elevated the Office of Project Assessments as a direct report to the Under Secretary, and within the Under Secretary for Management and Performance, the Office of Project Management Oversight and Assessments was established as a direct report to conduct assessments of the EM portfolio of projects. The Under Secretary for Science and Energy uses the successful model employed within the Office of Science (including the comprehensive project reviews conducted by SC's Office of Project Assessment), and is continuing to expand that model to capital projects funded by the energy programs. In June 2015, a Secretarial memorandum further enhanced and clarified departmental policy related to areas of project management to include analysis of alternatives, cost estimating, planning and scheduling, and design management, among others. DOE is in the process of revising its Project Management Order to incorporate these enhancements to DOE's project management processes and procedures.

In addition, the FY 2017 DOE budget proposes to establish a statutory, DOE-wide Office of Cost Estimating and Program Evaluation (CEPE-DOE) in recognition of a gap in DOE's capacity to independently determine accurate costs of programs and acquisitions within DOE. This proposal also complements, but is not duplicative of, NNSA's Office of Cost Estimating and Program Evaluation (CEPE) established by the 2014 National Defense Authorization Act (50 USC 2411). CEPE-DOE will provide independent analytic advice on all aspects of DOE programs, including cost-effectiveness, and the development and evaluation of program alternatives.

Fourth, even with the improved planning tools noted above in place, DOE agrees with the Commission's recommendation that high levels of **deferred maintenance** and excess facilities continue to pose a challenge. The Commission recommended that DOE **work with Congress and OMB** to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long-term plan to resolve it through a combination of increased funding, policy changes, and innovative financing. DOE agrees with this recommendation, and will continue briefing Congress and OMB on the updated data on the infrastructure and excess facilities challenges identified by the recent working groups.

Further, current Federal budget statutes and policies derive from the concept of a unified Federal budget and do not provide for separate capital and operating budgets. While DOE will not pursue a capital budget, DOE CFO will work with OMB to establish a separate management information system to **report on capital investments** that it will present in its FY 2018 budget request to Congress. These efforts will both improve DOE's infrastructure and provide greater public insight into Departmental investments.

DOE also agrees that, where appropriate, **innovative financing approaches** that are consistent with relevant policies should be pursued more aggressively to address the infrastructure challenges and future needs. DOE has been working with its laboratories to intensify the review and analysis of such approaches, including non-Federal financing and enhanced use leasing, and the LOB receives a monthly update on the progress of these efforts.

Finally, with respect to **environmental management technology development**, DOE agrees with the recommendations from the recent SEAB Task Force regarding the importance of these initiatives. While EM has made significant progress in closing a number of projects, many of the most challenging projects remain and will for decades to come. To address these challenges, the Secretary established a SEAB Task Force Advisory Board to advise on opportunities and barriers for science and technology development for cleanup, as well as a recommendation on the means to implement a program to develop such technologies. EM is targeting critical, near-term technology challenges, which include the following: disposition of cesium and strontium; remediation of mercury contamination; smarter Solutions for technetium management; developing capability for radioactive test beds; and leveraging Federally-funded initiatives and advancements in robotics. EM also is analyzing its remaining mission scope to identify opportunities for infusing game-changing innovation that will help reduce the overall lifecycle cost and duration of that work. As part of this effort, DOE held a Basic Research Needs workshop (co-sponsored by SC and EM) to identify challenges germane to the clean-up, and SC has now issued a call for proposals seeking new Energy Frontier Research Centers to tackle some of the challenges. EM also will continue to identify technologies that improve upon worker health and safety as well as nuclear facility safety.

2.6 Ensuring Lasting Change

The Commission's report points out that over 50 commissions, panels, reviews and studies of the National Laboratories have been conducted over the past four decades, noting that none of those reports led to the comprehensive change necessary to address persistent challenges. The Commission report observes the lack of a standing body or internal DOE mechanism to advocate for implementation of recommended changes, perform systematic assessments, and evaluate progress over time and states that such an entity could, among other purposes, serve to evaluate whether changes to restore the FFRDC relationship are being made in substance or only cosmetically.

Commission Recommendation

Under the theme "ensuring lasting change," the Commission provided the following recommendation:

Recommendation 36: *A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly on progress, results, and needed corrective actions.*

Discussion

DOE acknowledges that in the past, certain improvements following recommendations from external bodies have not always been fully implemented or sustained. Recognizing the importance of institutionalizing ongoing and new efforts identified in this response, DOE is committed to tracking implementation of these commitments. Moreover, DOE's efforts will be guided by the overarching objectives identified in this document, so that DOE can assess not only whether the specific action was taken or not, but also whether it had the intended consequence and effectively addressed the broader goals – a signpost to guide substantive change.

Specific Actions

For the most part, the actions described in this response are to be owned and implemented by the three Departmental Under Secretaries who have line responsibility for stewardship of the National Laboratories – the Under Secretary for Nuclear Security (LANL, Sandia, and LLNL); the Under Secretary for Science and Energy (the 10 Office of Science labs, NREL, INL, and NETL); and the Under Secretary for Management and Performance (SRNL). That said, monitoring and reporting on these actions will necessarily require cross-agency collaboration. The Secretary will charge the **LOB with the responsibility to track implementation** of these actions and any other follow-on actions identified to achieve the objectives contained throughout this response. Similarly, **the LPC will be charged to serve as a steering committee for the overall effort** of re-examining the management framework and partnership for the National Laboratory system and how it can best serve the public interest. The charters for each group will be modified to reflect these roles and responsibilities. Within the next 24 months, the LOB, working with the LPC, will conduct a review to assess whether the actions articulated here have had their desired impact.

In addition, **the DOE Office of Enterprise Assessments (EA)** is the organization responsible for performance of assessments on behalf of the Secretary and Deputy Secretary in the areas of nuclear and industrial safety, cyber and physical security, and other critical functions as directed by the Secretary and his Leadership team. EA also has been charged by the Secretary with identifying best practices across the enterprise which will include interfaces with the National Laboratories.

From an independent oversight perspective, DOE believes it would be most efficient to leverage existing bodies to support the implementation of the Commission's recommendations rather than creating a new external committee. DOE also notes that the NLDC indicated in its response to the Commission's report that "we would want to guard against such a body serving as the intermediary between the laboratories, DOE and Congress." DOE plans to look to **SEAB**. SEAB is a Federal Advisory Committee, composed of external members, which provides advice and recommendations to the Secretary on DOE's basic and applied research, economic and national security policy, educational issues, operational issues, and other activities as directed by the Secretary. SEAB specifically has a Task Force on DOE National Laboratories that was created to provide advice, guidance, and recommendations on important issues related to improving the health and management of the labs. Finally, DOE will include discussion of the implementation of the key objectives and actions in the **Annual State of the Laboratory System report** described above, tying results back to the desired outcome – a robust, efficient, effective National Laboratory System in service to the Nation.

3 CONCLUSION

The Commission's report identifies strengths of the National Laboratory system and provides recommendations for improvement. DOE is committed to executing the actions identified in this response to strengthen the DOE/laboratory partnership and to nurture and sustain the unique and valuable capabilities of the DOE National Laboratories.

APPENDIX: FULL SET OF COMMISSION'S RECOMMENDATIONS

Recommendation 1: The National Energy Laboratories provide great value to the Nation in their service to DOE's mission, the needs of the broader national science and technology community, and the security needs of the Nation as a whole. The Administration and Congress should provide the necessary resources to maintain these critical capabilities and facilities. It would also benefit all stakeholders if the key committees in Congress would develop a more orderly process of reviewing the National Laboratories, to replace the unrelenting pace of studies evaluating the performance of the DOE laboratories. For example, Congress could initiate a comprehensive review of the entire laboratory system in predetermined intervals.

Recommendation 2: Return to the spirit of the FFRDC model (stewardship, accountability, competition, and partnership). DOE and the National Laboratories must work together as partners to restore the ideal nature of the FFRDC relationship as a culture of trust and accountability. DOE should delegate more authority and flexibility to the laboratories on *how* to perform their R&D, and hold them fully accountable for their actions and results. For their part, to be trusted partners and advisors, the laboratories must be transparent with DOE about their planned activities ahead of time, as well as about their actions and results as they are carried out.

Recommendation 3: DOE and each laboratory should cooperatively develop a high level annual operating plan, with specific agreements on the nature and scope of activities at the laboratory, and milestones and goals that are jointly established. Within that framework, DOE should provide increased flexibility and authority to the laboratory to implement that plan. This increased flexibility must go hand-in hand with greater transparency and accountability. The annual operating plan is not intended to be a retrospective evaluation document, such as SC's Performance and Evaluation and Measurement Plan (PEMP) or NNSA's Performance Evaluation Plan (PEP). Instead it can provide high-level perspective for such evaluation plans. In other words, as envisioned by the Commission, the annual operating plan fits between the laboratory's long term strategic plan and its evaluation plan.

Recommendation 4: To improve DOE's ability to manage the laboratories, DOE should implement greater leadership and management development for its Federal workforce, including multi-directional rotational assignments with the laboratories.

Recommendation 5: DOE should separate NETL's R&D function from its program responsibilities (and call the R&D portion—not the program activities—NETL). Furthermore, consideration should be given to converting the new, research NETL into a government-owned, contractor-operated FFRDC. Whether or not the above steps are taken, NETL should increase its interactions and collaboration with universities.

Recommendation 6: DOE should abandon *incentive* award fees in the M&O contracts of the National Laboratories in favor of a fixed fee set at competitive rates with risk and necessary investment in mind.

In addition, DOE should adopt a broader and richer set of incentives and consequences to motivate sound laboratory management and enforce accountability.

Recommendation 7: DOE should give the laboratories and M&O contractors the authority to operate with more discretion whenever possible. For non-nuclear, non-high- hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and national standards in place of DOE requirements. DOE should review and minimize approval processes.

Recommendation 8: DOE should modify its processes for developing directives, orders and other requirements to more fully engage subject matter experts for input on the benefits and impacts of the proposed requirements. When developing new requirements, DOE should use a risk-based model, ensuring the level of control over an activity is commensurate with the potential risk.

Recommendation 9: DOE should focus on making the use of CAS more uniform across the laboratories. DOE local overseers should rely on information from the CAS systems, with appropriate validation, as much as possible for their local oversight. The quality of CAS can be increased through peer reviews for implementation and effectiveness.

Recommendation 10: The role of the site office should be emphasized as one of "mission support" to the program offices at DOE and to the laboratories. The site office manager should be clearly responsible for the performance of the site office in support of the mission, and all staff in the site office, including the Contracting Officers, should report to the site office manager. Since site office effectiveness is so dependent on site office leadership, DOE should devote more effort to leadership training and professional development of field staff.

Recommendation 11: DOE should clarify the role and authority of the support centers. Wherever approval authority resides with a support center, DOE should remove it and reinstate it at either the site office or DOE headquarters, as appropriate.

Recommendation 12: All stakeholders should make maximum use of local assessments (performed by site offices and laboratories), with appropriate verification, to reduce duplicative assessments and burden on the laboratories.

Recommendation 13: DOE should establish a single point of control—within the Department or each stewarding program office—for all laboratory-directed data requests.

Recommendation 14: To reduce the number of funding buckets and minimize the accompanying transactional burden, DOE and its program offices should adopt and adhere to the following principles:

- Increase the size of funding increments through consolidation of B&R codes at the highest level possible within each program area.

- Extend timelines and minimize milestones for each increment of funding. Work breakdown structures must be formulated to focus on strategic goals rather than tactical milestones and reporting requirements.
- Within legal limits, institutionalize mechanisms for laboratory flexibility via notification, rather than formal approval, to move money between B&R codes on cross-cutting R&D objectives or closely interrelated research areas among DOE program offices.

<u>Recommendation 15</u>: Congress should repeal Section 301(d) of the FY 2015 Consolidated Appropriations Act as soon as feasible to remedy the transactional burden it creates for OMB, DOE Headquarters, and the laboratories when operating under a continuing resolution.

<u>Recommendation 16</u>: Other DOE program offices should adapt to their contexts the procedures and processes that DOE's Office of Science has in place for guiding and assessing the alignment of the laboratories under its stewardship with DOE's missions and priorities.

<u>Recommendation 17</u>: The processes that the Office of Science has in place for assessing the quality of the research being done by the 10 laboratories under its stewardship, and for assessing the quality of the research portfolio in each of its programs, should be adapted by the other DOE program offices.

<u>Recommendation 18</u>: There must be a government-wide reconsideration of the conference travel restrictions to enable conference participation at levels appropriate to both the professional needs of the existing scientific staff and to attract the highest quality staff in the future. The Commission is encouraged by DOE's recently revised guidance on conference-related activities and spending, and notes that the laboratories have been given more autonomy on this issue, while at the same time being held accountable for the appropriate use of taxpayer funds.

<u>Recommendation 19</u>: The Commission strongly endorses LDRD programs, both now and into the future, and supports restoring the cap on LDRD to 6 percent unburdened, or its equivalent. The Commission recognizes that, in practice, restoring the higher cap will have the largest impact on the LDRD programs of the NNSA laboratories.

<u>Recommendation 20</u>: DOE should manage the National Laboratories as a system having an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry, so long as the research aligns with mission priorities. Once the research has matured to the point that a preferred or most promising approach can be identified, the Department should provide strategic oversight and guidance, including expert peer review, for the laboratory system to coordinate and potentially consolidate their programs to achieve the most effective and efficient use of resources.

<u>Recommendation 21</u>: Congress should recognize that the technical capabilities currently housed within the NNSA laboratories are essential to the Nation. Maintaining the nuclear explosive package capabilities in separate and independent facilities has proven effective and should continue, thereby

providing senior decision makers the highest possible level of confidence in the country's nuclear weapons stockpile.

Recommendation 22: DOE should establish policies and procedures to make the Strategic Partnership Projects (SPP) process more efficient, especially for work that is consistent with the annual operating plans, such as institutionalizing ongoing efforts to streamline the contracting process through more consistent use of umbrella SPP agreements and oversight mechanisms dedicated to shortening the timeline of the approval process; encouraging greater use of personnel exchanges and "customer relationship managers"; and creating a central point of contact in DOE headquarters to field questions from other Federal agency customers about where specific capabilities lie within the laboratory system.

Recommendation 23: DOE should support efforts to strengthen the Mission Executive Council.

Recommendation 24: DOE and its laboratories should continue to facilitate and encourage engagement with universities through collaborative research and vehicles such as joint faculty appointments and peer review.

Recommendation 25: All DOE programs and laboratories should fully embrace the technology transition mission and continue improving the speed and effectiveness of collaborations with the private sector. Innovative technology transfer and commercialization mechanisms should continue to be pursued and best practices in other sectors, including academia, should be examined.

Recommendation 26: DOE should determine whether the annual operating plans proposed by the Commission in Recommendation 3 could qualify as the "agency approved strategic plan" under the Stevenson-Wydler Technology Innovation Act of 1980, and the Fast-Track CRADA Program, and, if not, Congress should amend the law accordingly. For CRADAs with non-standard terms and conditions, DOE should define the acceptable range for each term and condition to greatly expedite negotiation and review/approval time.

Recommendation 27: Laboratories should pursue innovation-based economic development by partnering with regional universities.

Recommendation 28: DOE, the Administration and Congress should continue to support user facilities at the DOE laboratories. Peer review by relevant external advisory groups should continue to be used to decide which facilities to build and where to put all future upgrades and new and replacement user facilities.

Recommendation 29: DOE should continue implementing the ICR as a consistent method for tracking indirect costs across all laboratories, and encourage additional peer reviews to help mature the ICR as a tool for DOE, the laboratories, and other stakeholders.

Recommendation 30: DOE should provide greater transparency into laboratory indirect costs and publish an annual report of the overhead rates at each National Laboratory.

Recommendation 31: DOE should consider whether a capital budget will better serve its internal facilities and infrastructure budgeting and management needs.

Recommendation 32: DOE and the laboratories should continue efforts to improve laboratory facilities and infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. DOE should work with Congress and OMB to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long-term plan to resolve it through a combination of increased funding, policy changes, and innovative financing.

Recommendation 33: DOE, the laboratories, Congress, and OMB should actively work together to identify appropriate situations and methods for utilizing innovative financing approaches, such as third-party financing, enhanced use leases, and other methods, including State funding, gifts, and leveraging partnerships with other Federal agencies.

Recommendation 34: DOE should maintain focus on increasing institutional capability and imposing greater discipline in implementing DOE project guidance, which is currently being incorporated into its DOE directive 413.3 B. Expanding on recent DOE efforts, there should be more peer reviews and "red teams" within DOE, among laboratories, other agencies, industry, and academia when appropriate.

Recommendation 35: The Commission supports the recent SEAB Task Force recommendation to put more resources into science and technology development for the EM program given the technical complexity of its projects.

Recommendation 36: A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly to DOE, the laboratories, the Administration, and the Congress on progress, results, and needed corrective actions. The standing body could assist congressional committees in developing a rational plan for future evaluations of the DOE laboratories.

National Laboratory Directors Council
Executive Committee
www.nationallabs.org • nldc-chair@nationallabs.org

Terry Michalske, Chair
Dan Arvizu
Bill Goldstein
Chi-Chang Kao

November 16, 2015

The Honorable Ernest J. Moniz
Secretary of Energy
U.S. Department of Energy
1000 Independence Ave., SW
Washington, DC 20585

Dear Mr. Secretary,

On behalf of the Department of Energy, National Laboratory Directors Council (NLDC) we respectfully provide the following review of the Final Report of the Commission to Review the Effectiveness of the National Laboratories (CRENEL), "Securing America's Future: Realizing the Potential of the Department of Energy's National Laboratories".

We wish to compliment the CRENEL for the extremely thorough and complete analysis that they performed. We are impressed with the time, effort, and dedication of the CRENEL members to deeply examine each of the 17 laboratories' missions, capabilities, operations, and challenges. We also appreciate the direct access and multiple discussions that the CRENEL Co-Chairs, Jared Cohon and TJ Glauthier provided to the NLDC during the course of their work.

The NLDC is strongly supportive of the overall focus, structure, and recommendations contained in the Final Report. We find that the six themes developed by CRENEL provide useful context to organize and link their thirty-six specific recommendations against the backdrop of the larger strategic objectives. Our review of the CRENEL Final Report addresses each of the six themes, focusing on specific recommendations that we feel are most significant and will require greatest care developing the response. We appreciate the opportunity to work with DOE in preparing detailed responses to each of the CRENEL recommendations, and look forward to working together on implementation.

Recognizing Value

This section provided an excellent summary of the importance and unique S&T challenges of the National Laboratories' missions and their critical role in addressing highly complex multi-disciplinary long-term R&D challenges.

While this section contains only one specific recommendation (#1), we view this as extremely important to the development of greater understanding, appreciation, and partnership across Congress, DOE, and National Labs regarding the value of DOE laboratories. We believe that the DOE / NLDC partnership to organize Lab Days has been a valuable step to increase Congress' understanding of and support for the value of the network of DOE laboratories. We support continued opportunities for Congressional

Members and Staff to see the collective value of the DOE laboratories including events such as Lab Days, Laboratory CODELs, and NLDC meetings with Congressional Committees and their Staff. Continued activities of this type will improve Congress' ability to better understand and assess the value and impact of DOE laboratories.

Rebuilding Trust

CRENEL places strong importance on the degree of trust between DOE and its National Laboratories from the point of view of current challenges and its role in underpinning our ability to address future opportunities. This section of the Final Report contains fourteen recommendations, representing nearly forty percent of the total. The NLDC supports the emphasis that CRENEL has placed on this theme. While we would agree that the overall level of trust between DOE and its National Laboratories can and should be improved, we appreciate CRENEL's recognition that the degree of trust varies across DOE programs and that some programs and their laboratories currently enjoy a high degree of trust. We support the focus of the CRENEL recommendations to create a more uniform approach across the DOE.

The NLDC strongly supports Recommendation #2, which emphasizes the need to return to the spirit of the FFRDC. In our view, this recommendation speaks to the core of the partnership and special relationship that must exist between DOE and its National Laboratories. We greatly appreciate the focus and attention that the current DOE leadership has placed on restoring this relationship and we are hopeful that this CRENEL recommendation will serve to guide the DOE / National Laboratory relationship into the future.

The NLDC believes that joint planning between DOE and its National Laboratories is one of the key factors to help build and strengthen that partnership. CRENEL's recommendations #3, #16, and #20 each speak to improvements and increased consistency in the laboratory planning process, pointing toward some of the exemplary practices of DOE's Office of Science. We believe that a process that integrates long-term strategic priorities with annual operating objectives will be most effective. Recommendation #3 calls for the creation of a high-level annual planning document that may help link the laboratory's long-term strategic plan and its annual evaluation plan. While we appreciate the intent of this specific recommendation, we are concerned that a new planning document may become duplicative with current planning documents such as PEMP. We recommend that DOE implement a planning process within each of its elements that links long-term strategy and annual operating needs, taking full advantage of the best practices in DOE's Office of Science and Nuclear Energy organizations.

Recommendation #6 provides a strong encouragement for DOE to abandon incentive award fees in the M&O contracts. The NLDC supports a move away from incentive award fee alone toward a "richer set of incentives and consequences" including extended award duration and increased authority over operations as called out in Recommendation #7 and #8. We suggest that the DOE engage a discussion with laboratory leadership, M&O contractor leadership, and DOE site and program to evaluate how best to support an effective approach to better manage risk and create incentives that encourage the highest level of performance. We note that NNSA has begun such a discussion. We further support Recommendation #9, which calls for the review of the use of CAS, and appreciate the DOE's recent decision to undertake such a review.

Given the importance of developing and sustaining a talented and diverse workforce at the DOE Laboratories, the NLDC suggests that DOE explore opportunities to provide M&O contractors with greater management flexibility aimed at increasing the National Laboratories' ability to attract and retain the current and future generation of workers.

Recommendation #5 pertains to the National Energy Technology Laboratory (NETL), the only DOE laboratory that is government owned and operated. The CRENEL observes that there is a need for "significantly increased clarity and focus on the R&D mission for the research staff at NETL and for others outside NETL who work with them." The NLDC and specifically the Director of NETL agrees there is a need for increased focus on the R&D conducted by NETL's scientists. The DOE should explore approaches to better integrate and synchronize NETL's intramural and extramural research. In addition, the NLDC recognizes the need for more flexibility in NETL's ability to invest through laboratory-directed research and development (LDRD) or other similar mechanisms.

Finally, the NLDC strongly supports Recommendation #14 calling for a reduction in the number of funding buckets. Such restrictions on the movement of resources act to impede the strategic relationship between DOE and its National Laboratories, creating a more transactional interchange. We understand that moving in this direction will require greater transparency and partnership on the part of the Laboratories. We are encouraged by the recent direction of DOE's Office of Energy Efficiency and Renewable Energy in this regard.

<u>Maintaining Alignment and Quality</u>

We are pleased that CRENEL found there was strong overall mission alignment between DOE programs and the National Laboratories. NLDC supports consistent and effective long-term and annual planning between DOE and its National Laboratories as a means to promote even greater mission alignment going forward. As called out in Recommendation #16, the planning process used by DOE's Office of Science contains elements that lead to increased mission alignment and could be adapted for use in other DOE mission areas.

The NLDC appreciates CRENEL's recognition of the important role LDRD plays in the vitality of the National Laboratories, facilitating their ability to "adapt, retool, invest in staff capabilities, and to enter new research areas". We are pleased to see and fully endorse CRENEL's Recommendation #19 to restore the cap on LDRD to six percent unburdened, or its equivalent.

The CRENEL's treatment of the appropriate levels of duplication of research addresses the inherent challenge in balancing competition for new ideas with the need to efficiently focus resources. The NLDC is supportive of recent examples such as the Grid Modernization Initiative and Big Ideas. We agree with CRENEL that these examples represent a step in the right direction. We understand that finding the right balance can be difficult and that there is most certainly not a standard approach that should be applied. It must also be recognized that establishing an efficient focus may require prioritization and partnerships across DOE program areas as well as its National Laboratories. While we agree with Recommendation #20, we would also add the need for DOE and its National Laboratories to partner together early on in the identification of highest priority focus areas for the future.

With regard to Recommendation #21, the NLDC fully endorses the CRENEL's commitment to maintaining and strengthening the unique competencies at the NNSA laboratories needed to provide the highest level of confidence in our country's nuclear deterrent.

<u>Maximizing Impact</u>

This theme in the CRENEL Final Report focuses on the broader value that the DOE National Laboratories provide through their work with entities outside DOE including other Federal Agencies, academia, and private sector commercial partners through Strategic Partnership Projects (SPP).

Overall, the CRENEL recommends greater strategic engagement between DOE and other Federal Agencies along with a streamlining of the process needed to gain approval for SPP. The NLDC is supportive of Recommendation #22 to create a more coherent interface between DOE, its National Laboratories, and other Federal Agencies. However, in responding to this recommendation we strongly caution DOE against creating a "gate keeper" function that could add additional steps and further complicate SPP.

CRENEL recognizes the high level of collaboration that exists between DOE Laboratories and universities. However, partnering with industry and transitioning technology is specifically called out in Recommendations #25 and #26 as an area where improvement is needed. While we agree with the assessment of barriers and the intent of these recommendations, we believe more is necessary to guide improvement. Recommendation #25 is not sufficiently specific to address the inconsistency among labs or program offices. Recommendation #26 is helpful, but more is needed to drive major improvement. In order for technology transfer to be a priority, each program office must clearly articulate that priority, resource it directly, and hold laboratories accountable to improve their performance.

NLDC appreciates CRENEL's call for continued support for user facilities at the DOE Laboratories (Recommendation #28).

Managing Effectiveness and Efficiency

As CRENEL points out, the DOE Laboratories are often criticized for being too expensive. We appreciate CRENEL's recognition that laboratory leadership is extremely mindful and proactive in controlling overhead rates. The CRENEL analysis shows non-NNSA laboratory overhead rates are comparable with top-funded R1 universities. The higher cost of NNSA laboratories is an understandable outcome of their nuclear and classified missions. NLDC supports continued transparency (Recommendation #29) across major sectors of the National Laboratory population.

The NLDC agrees with CRENEL that better management of DOE Laboratories' collective facilities and infrastructure is necessary. We also support recent steps taken by DOE to accurately assess the scope of deferred maintenance and associated budget shortfall. We strongly support Recommendations #32 and #33 to continue efforts to work with Congress and OMB to better understand the magnitude of the problem, develop a prioritized plan of action, and utilize the full spectrum of approaches including increased funding, policy changes and innovative financing to address the shortfall.

In many cases, large-scale projects in NNSA and EM represent one-of-a-kind programs and facilities. We agree with CRENEL Recommendation #34 to expand recent DOE efforts to place more emphasis on peer review and "red teams" to help assess risk and identify alternatives. In addition, the EM program faces significant technical challenges as it addresses the remaining, more challenging work ahead. As CRENEL points out in Recommendation #35, better scientific and technical basis will be needed to successfully address the complex problems ahead.

Ensuring Lasting Change

Perhaps the most challenging recommendation from the CRENEL Final Report is the call for a standing body to track implementation and actions in the CRENEL Report with the intent to minimize the need for new congressional commissions (Recommendation #36). The NLDC agrees with the intent of the recommendation and understands the tradeoffs regarding where such a body would be charged and housed. It is not clear to us that there is a "perfect" place for such a standing body. However, we would want to guard against such a body serving as the intermediary between the laboratories, DOE and Congress. It is the view of NLDC that open, frequent, and strategic communications between the DOE, NLDC, and Congress are the best means to ensure the greater understanding that will promote lasting change in how our country best utilizes the enormous resource that is contained in the DOE Laboratories.

It is our hope that this brief review of the CRENEL recommendations provides value to you and to the DOE. We stand ready to fully support the DOE in its development of detailed response to each of the CRENEL's recommendations. Thank you for the opportunity to provide our input on the CRENEL Final Report.

Sincerely,

Dr. Terry A. Michalske
Chair, National Laboratory Directors Council
Director, Savannah River National Laboratory

SECRETARY OF ENERGY ADVISORY BOARD (

MEMORANDUM FOR: SECRETARY OF ENERGY

FROM: Secretary of Energy Advisory Board (SEAB)

DATE: January 26, 2016

SUBJECT: Task Force comments on the *Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories*

You have charged the SEAB National Laboratory Task Force to review studies of the DOE National Laboratories as they appear and to give you advice about what your response should be to their findings and recommendations. This SEAB letter transmits the comments of its National Laboratories Task Force on the recently released report of the Commission to Review the Effectiveness of the National Energy Laboratories (CRENEL), entitled *Securing America's Future: Realizing the Potential of the DOE's National Laboratories*. That committee, co-chaired by TJ Glauthier and Jared Cohen, was formed pursuant to Section 319 of the Consolidated Appropriations Act, 2014 (Public Law No. 113-76), and was charged to evaluate the laboratories'

> "…alignment with the Department's strategic priorities, duplication, ability to meet current and future energy and national security challenges, size, and support of other Federal agencies,…the efficiency and effectiveness of the laboratories, including assessing overhead costs and the impact of DOE's oversight and management approach,…the effectiveness of the Department's oversight approach and the extent to which LDRD funding supports recruiting and retention of qualified staff[1]."

The CRENEL report is based on extensive fact finding, including significant testimony from numerous stakeholders and visits to all of the labs in the DOE complex. The final report, issued on October 28, 2015, follows the Commission's report of February 27, 2015, and contains a total of 36 recommendations across 6 primary themes: recognizing value,

[1] *Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories*, Volume 1, October 28, 2015, p 1.

rebuilding trust, maintaining alignment and quality, maximizing impact, managing effectiveness and efficiency, and ensuring lasting change. For convenience, Appendix 1 of this letter provides a copy of the tabulated recommendations from the Commission's report, grouped by theme and identifying a proposed owner for each.[2]

Overall, our SEAB Task Force endorses the CRENEL report. We find the analysis and recommendations from the Commission to be consistent with the numerous prior investigations, commissions and studies that have reviewed the Laboratories over the years. The Commission's report is well aligned in areas that overlap with previous work and recommendations from our Task Force. We comment below on several specific items but, in general, we view the Commission's report as a thorough recitation of a well-told story that repeats and reinforces important recommendations to improve the efficiency of laboratory operations, planning and research outcomes, while endorsing the value, the direction and operations of the current laboratory system. As with the majority of recent reports, the Commission decries the current environment where oversight and regulation are increasingly imposed on the national laboratories and Congress and the Department have not followed-up or implemented recommendations to streamline the process and the management of the labs. Speaking to this issue, the Commission's final recommendation states,

> A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly to DOE, the laboratories, the Administration, and the Congress on progress, results, and needed corrective actions. The standing body could assist Congressional committees in developing a rational plan for future evaluations of the DOE laboratories.[3]

Later in this letter, you will find SEAB's recommendation on how the "standing body" could be created and who should establish and maintain it.

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[2] The Commission appendix would be even more useful if the Commission suggested which office in DOE should be the "responsible actor" for each recommendation. Experience shows that absent direct secretarial intervention, bureaucratic interests greatly delay the implementation of meritorious proposals for change.

[3] ibid, p 63.

We first point out areas of emphasis in the Commission's report that reinforce points raised in your SEAB Task Force's report:

1. The Commission speaks to the need to reestablish the model in which the laboratories operate as FFRDCs and roles are appropriately established: "…the government is responsible for setting the "*what"* of strategic and program direction to meet the Nation's needs, while the contracted partners, along with the laboratories they manage and operate, are responsible for determining precisely "*how"* to meet the technical and scientific challenges and to carry out programs."[4] In particular, the Commission highlights the need to clearly establish where responsibility rests amongst the many stakeholders involved in the lab management and delivery system (the laboratory director and the director's leadership team, DOE Headquarters sponsoring program offices, DOE Site (or in the case of the NNSA, Field) Offices, DOE Service Centers, DOE operational oversight offices, the M&O contractor). This finding is directly aligned with the primary focus in our Task Force's report (Recommendation 1.1) to use the Laboratory Policy Council to clarify the roles and responsibilities for mission execution at the laboratories and direct the Under Secretary for Management and Performance to lead the Laboratory Operations Board in implementing these changes.

2. The Commission's report recommends a number of actions that can be taken to provide immediate change to the overly burdensome detailed management of the laboratories that is inconsistent with the philosophy of a Government Owned, Contractor Operated (GOCO) laboratory. The Commission endorses the recommendation of the Augustine-Mies Panel to eliminate the incentive portion of the M&O contract award, replacing it with a competitive fixed fee arrangement. We support this recommendation as a way to reduce complex bureaucracy, which is delivering limited operational performance leverage.

[4] ibid, p iv.

Other short term actions recommended in the CRENEL report are consistent with the SEAB Task Force's recommendation for laboratory management "experiments." The Commission suggests reestablishing local and rapid decision making for conference participation (which it deems vital to maintaining the intellectual excellence of laboratory staff), establishing a single point of control within the Department for all laboratory data requests, and removing approval authority from Support Centers, clearly articulating their *support* role.

Finally, it is worth noting that the Commission specifically recommends separating the National Energy Technology Laboratory (NETL), currently the only Government Owned, Government Operated (GOGO) laboratory in the system, into two independent parts – a standard GOCO to handle the research and development mission and a contracting office to handle the disbursement of funds to external partners.

We find merit in all these CRENEL suggestions.

3. As noted in numerous reviews and reports over the last decade, the Commission observes that the laboratories can make a greater contribution to the national economy and its competitiveness, if the laboratories have effective technology transfer processes in place. The Commission clearly articulates the larger view of what technology transfer means, commenting that in addition to traditional Cooperative Research and Development Agreements, Work for Others, or licensing activities, significant technology transfer occurs through the world class user facilities, through the maturing of early career research talent and through personnel flow and rotation between the laboratories, academia and industry. SEAB strongly endorses this view. However, we believe that CRENEL has failed to comment on an important issue on this topic. As the Interim Report by the SEAB National Laboratory Task Force suggests, there is some level of confusion and inconsistency about whether economic development and national competitiveness are part of the mission of National Laboratories. To address this directly, the SEAB report has recommended (#3.1) that you issue a policy statement that

creating value for the private sector through the use of technology transfer, research facilities and workforce is part of the National Laboratory mission. We continue to advocate this.

4. The Commission provides a thorough analysis of the rationale and current uses of Laboratory Directed Research and Development (LDRD) and finds clear benefits from the program for supporting high-risk, potentially high reward early-stage research, for exploring research avenues that may be new to the laboratory or the complex, and as a significant tool that ".. enables laboratories to develop and invest in its workforce for both the short and long term."[5] As with numerous recent reviews, including your Task Force, the Commission "…strongly endorses LDRD programs, both now and into the future, and supports restoring the cap on LDRD to 6 percent, unburdened, or its equivalent."[6]

5. The Commission notes positively your strongly articulated commitment and the steps being taken by the Department to ensure alignment of the laboratories in its strategic planning processes. The Office of Science (SC) process is described in detail:

   > During this Laboratory Strategic Planning process, SC requires laboratory leaders to define the long-range visions for their respective laboratories. This information provides a starting point for discussion about each laboratory's future directions, immediate and long-range challenges, and resource needs. DOE and the laboratory leaders settle on new research directions and the expected development or sustainment of capabilities. In addition, external advisory committees provide advice on establishing research and facilities priorities; determining proper program balance among disciplines; and identifying opportunities for inter-laboratory collaboration, program integration, and industrial participation.[7]

   The report further describes the effective processes SC uses to review its alignment to DOE strategy and connect both its strategic and tactical execution to its annual

[5] ibid, p 66.
[6] ibid, p 43. SEAB notes with some sadness that use of the word "equivalent" apparently conceals inability to agree on a simple and transparent method to calculate the 6% because some labs are jockeying for more complex formulae that result in greater LDRD.
[7] ibid, p 35.

Performance and Evaluation and Measurement Plan (PEMP.) The Commission calls for the adaptation of these core, successful processes to all the DOE laboratories. As you know, the SEAB Task Force made a similar recommendation and proposed that the DOE Laboratory Operations Board be charged with the task of implementing a DOE-wide effort to identify, manage, and resolve issues affecting the management, operations, and administration of the National Laboratories.

One additional point that bears mentioning is the Commission's analysis and endorsement of recommendations made by both the NRC[8] and, more recently SEAB[9], to provide a modest investment stream for science and technology development for the Environmental Management program, stating that, "Success of the cleanup effort will require significant new understanding of the science and with this understanding, development of new technology."[10]

As noted above, CRENEL calls for the establishment of a "standing body" to track implementation of the recommendations made in its report. SEAB recommends that because most of the National Laboratories are managed by their respective offices of the Under Secretaries for Science & Energy and Nuclear Security, and many of the recommendations involve management and performance, the "standing body" should be formed by the three Under Secretaries – Science & Energy, Nuclear Security and Management & Performance – with the Under Secretary for Management & Performance serving as the Chair of this standing body. The purpose of this standing body would be to track and enforce timelines and priorities to make process changes and report directly to the Secretary.

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[8] National Research Council, Committee to Evaluate the Science, Engineering, and Health Basis of the DOE's Environmental Management Program, *Improving the Environment: An Evaluation of DOE's Environmental Management Program,*" (Washington DC: NRC, 1995), 21.
[9] SEAB, *Report of the Task Force on Technology Development for Environmental Management*, (Washington, DC: DOE, 2014);
[10] *Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories*, Volume 1, October 28, 2015, p 59.

We also note a few points where we feel that the CRENEL report could have been a bit more assertive in its recommendations.

1. The Congressional charge to the Commission implicitly calls for a judgment about whether the size of the DOE national laboratory network is too big, too small, or just right given the current and future technology needs of the country in DOE's mission areas of responsibility: science, energy, national security, and environmental management. The Commission does not directly address this central question but their implicit answer is that the DOE national labs are doing their job, their effectiveness and efficiency is impaired by over regulation, and the amount of public resources is "just right" although at several points there is a hint that more resources would be welcome. This central conclusion would be more convincing if the Commission had examined a range of different organizational arrangements, quite different from the current structure, and compared the pros and cons of each.

2. The CRENEL report also does not offer a timeline for its recommendations to be implemented. Because many of the recommendations are similar to the ones offered by the SEAB Task Force, we suggest that you use the timeline offered by the SEAB Task Force report.

In summary, we find that the CRENEL Commission report provides additional support for the numerous findings and recommendations that have already been voiced about the value and performance of the DOE national laboratories. The Commission also repeats and underscores the many recommendations that have been made to streamline the management and oversight of the laboratories, thus making them more efficient and of greater value to the scientific and technological strength of the country. It is up to you and your successors to see that the meritorious suggestions for change are put into place.

Appendix 1 Summary of the Commission's Recommendation[11]

Section	Theme	Section	Theme
2	Recognizing Value	5	Maximizing Impact
3	Rebuilding Trust	6	Managing Effectiveness and Efficiency
4	Maintaining Alignment and Quality	7	Ensuring Lasting Change

Table 4. Responsible Actors for Each Recommendation and Cross-References to Volume 2

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
2.C	1	The Administration and Congress should recognize the value of the National Laboratories and provide the necessary resources to maintain their capabilities and facilities. Congress should also develop a more orderly process of reviewing the laboratories.	Administration and Congress	**1.E**
3.A.1	2	Department of Energy (DOE) and the laboratories must work together to restore the ideal Federally Funded Research and Development Center (FFRDC) relationship as one of trust and accountability. DOE should delegate more authority and flexibility to the laboratories and hold them accountable. The laboratories must be more transparent with DOE about their activities.	DOE and Laboratories	**2.C**
3.A.1	3	DOE and each laboratory should jointly develop an annual operating plan, with agreements on the nature and scope of the laboratory's activities, including goals and milestones. DOE should then provide increased flexibility and authority to the laboratory to implement that plan.	DOE and Laboratories	**2.C**
3.A.1	4	To improve DOE's ability to manage the laboratories, DOE should implement greater leadership and management development for its Federal workforce, including multi-directional rotational assignments.	DOE	**2.C**
3.A.1	5	DOE should separate the National Energy Technology Laboratory's (NETL) research and development (R&D) function from its program responsibilities. Consideration should be given to converting the new, research NETL into an FFRDC. NETL should increase its interactions with universities.	DOE and Congress	**2.C**
3.A.2	6	DOE should abandon *incentive* award fees in favor of a fixed fee set at competitive rates with risk and necessary investment in mind. DOE should also adopt richer set of incentives to motivate sound management.	DOE	**2.C**

[11] Reproduced directly from Table 4 of the *Final Report of the Commission to Review the Effectiveness of the National Energy Laboratories*, Volume 1, October 28, 2015.

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
3.B.1	7	DOE should give the laboratories the authority to operate with more discretion whenever possible. For non-nuclear, non- high-hazard, unclassified activities, DOE should allow laboratories to use Federal, State, and national standards in place of DOE requirements. DOE should review and minimize approval processes.	DOE	**3.G**
3.B.1	8	DOE should modify its processes for developing directives, orders and other requirements to get more input on the benefits and impacts of the proposed requirements. When developing new requirements, DOE should use a risk-based model, ensuring the level of control over an activity is commensurate with the potential risk.	DOE	**3.G**
3.B.2	9	DOE should focus on making the use of Contractor Assurance System (CAS) more uniform across the laboratories. DOE local overseers should rely on information from the CAS systems, with appropriate validation, as much as possible for their local oversight. The quality of CAS can be increased through peer reviews for implementation and effectiveness.	DOE	**4.D**
3.B.2	10	The role of the site office should be emphasized as one of "mission support." The site office manager should be responsible for the performance of the site office; all staff, including the Contracting Officers, should report to the site office manager. DOE should devote more effort to professional development of field staff.	DOE	**4.D**
3.B.2	11	DOE should clarify the role and authority of the support centers. Wherever approval authority resides with a support center, DOE should remove it and reinstate it at the site office or DOE headquarters.	DOE	**4.D**
3.B.3	12	All stakeholders should make maximum use of local assessments (performed by site offices and laboratories), with appropriate verification, to reduce duplicative assessments and burden on the laboratories.	DOE and External Auditors	**5.C**
3.B.3	13	DOE should establish a single point of control within the Department for all laboratory-directed data requests.	DOE	**5.C**
3.B.4	14	DOE should increase the size of funding increments by consolidating budget and reporting (B&R) codes, extending timelines and minimizing milestones for each funding increment and institutionalizing mechanisms to move money between B&R codes for related research areas.	DOE	**6.D**
3.B.4	15	Congress should repeal Section 301(d) of the FY 2014 Consolidated Appropriations Act as soon as feasible to remedy the transactional burden it creates for the Office of Management and Budget (OMB), DOE Headquarters, and the laboratories.	Congress	**6.D**
4.A	16	Other DOE program offices should adapt the processes that DOE's Office of Science has in place for guiding and assessing the alignment of the laboratories under its stewardship with DOE's missions and priorities.	DOE	**7.E**
4.B	17	The processes that Office of Science has in place for assessing the quality of the research being done by its laboratories and for assessing the quality of its research portfolio should be adapted by the other program offices.	DOE	**7.E**
4.B	18	There must be reconsideration of the travel restrictions to enable conference participation at levels appropriate to the professional needs of the existing scientific staff and to attract the highest quality staff in the future. The Commission is encouraged by DOE's recently revised guidance on conference-related activities and spending.	DOE and OMB	**7.E**
4.C	19	The Commission strongly endorses Laboratory Directed Research and Development (LDRD) programs, both now and into the future, and supports restoring the cap on LDRD to 6 percent unburdened, or its equivalent. The Commission recognizes that, in practice, restoring the higher cap will have the largest impact on the LDRD programs of the National Nuclear Security Administration laboratories.	Congress	**8.D**
4.D	20	DOE should manage its laboratories as a system having an overarching strategic plan that gives the laboratories the flexibility to pursue new lines of inquiry. Once the research has sufficiently mature, DOE should provide strategic oversight and guidance to coordinate and potentially consolidate their programs.	DOE	**7.E**

Volume 1 Chapter & Section Reference	Rec. No.	Recommended Action	Responsible Actor(s)	Volume 2 Chapter & Section Reference
4.D	21	Congress should recognize that the capabilities currently housed within the NNSA laboratories are essential to the Nation. Maintaining these capabilities in separate and independent facilities should continue.	Congress	**7.E**
5.A	22	DOE should establish techniques to make the Strategic Partnership Projects process more efficient.	DOE	**9.E**
5.A	23	DOE should support efforts to strengthen the Mission Executive Council.	DOE	**9.E**
5.B	24	DOE and its laboratories should continue to facilitate and encourage engagement with universities through collaborative research and vehicles such as joint faculty appointments and peer review.	DOE and Laboratories	**10.C**
5.C	25	DOE and the laboratories should fully embrace the technology transition mission and continue improving the speed and effectiveness of collaborations with the private sector. Innovative transfer and commercialization mechanisms should be pursued and best practices in other sectors should be examined.	DOE and Laboratories	**11.E**
5.C	26	DOE should determine whether the annual operating plans proposed by the Commission could qualify as the "agency- approved strategic plan" under the Stevenson-Wydler Technology Innovation Act of 1980, and the Fast-Track Cooperative Research and Development Agreement Program. If not, Congress should amend the law accordingly.	DOE and Congress	**11.E**
5.C	27	Laboratories should pursue innovation-based economic development by partnering with regional universities.	Laboratories	**11.E**
5.D	28	DOE and Congress should continue to support user facilities at the DOE laboratories. External advisory groups should continue to be used to decide which facilities to build and how to upgrade existing facilities.	DOE, Administration, and Congress	**12.C**
6.A	29	DOE should continue implementing the Institutional Cost Report (ICR) as a method for tracking indirect costs across the laboratories, and encourage peer reviews to help mature the ICR as a tool for DOE, the laboratories, and other stakeholders.	DOE	**13.E**
6.A	30	DOE should provide greater transparency into laboratory indirect costs and publish an annual report of the overhead rates at each individual National Laboratory.	DOE	**13.E**
6.B	31	DOE should consider whether a capital budget will better serve its internal facilities and infrastructure budgeting and management needs.	DOE	**14.D**
6.B	32	DOE and the laboratories should continue efforts to improve facilities and infrastructure by halting the growth in deferred maintenance and speeding up the deactivation and decommissioning of excess facilities. DOE should work with Congress and OMB to agree upon the size and nature of the resources shortfall for facilities and infrastructure, and to develop a long- term plan to resolve it through a combination of increased funding, policy changes, and innovative financing.	DOE, Laboratories, Congress, and OMB	**14.D**
6.B	33	DOE, the laboratories, Congress, and OMB should actively work together to identify appropriate situations and methods for utilizing innovative financing approaches, such as third-party financing, enhanced use leases, and other methods, including State funding, gifts, and leveraging partnerships with other Federal agencies.	DOE, Laboratories, Congress, and OMB	**14.D**
6.C	34	DOE should maintain focus on increasing institutional capability and imposing greater discipline in implementing DOE project guidance, which is currently being incorporated into its DOE directive 413.3 B. There should be more peer reviews and "red teams" within DOE.	DOE	**15.G**
6.C	35	The Commission supports the recent Secretary of Energy Advisory Board Task Force recommendation to put more resources into science and technology development for the EM program given the technical complexity of its projects.	DOE, Administration, and Congress	**15.G**
7.C	36	A standing body should be established to track implementation of the recommendations and actions in this report, and to report regularly to DOE, the laboratories, the Administration, and the Congress. This body could assist Congress in developing a rational plan for future evaluations of the DOE laboratories.	DOE, Administration, and Congress	**16.D**

A New Foundation for the Nuclear Enterprise

Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

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The Honorable Norman R. Augustine, Co-Chairman
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Admiral Kirkland H. Donald, U.S. Navy (Retired)
The Honorable T. J. Glauthier
The Honorable David L. Hobson
The Honorable Gregory B. Jaczko
The Honorable Franklin C. Miller
Dr. William Schneider, Jr.
The Honorable John M. Spratt, Jr.
The Honorable Ellen O. Tauscher
The Honorable Heather A. Wilson

November 2014

Preface

Section 3166 of the Fiscal Year 2013 National Defense Authorization Act establishes the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise and tasks the advisory panel to offer recommendations "…with respect to the most appropriate governance structure, mission, and management of the nuclear security enterprise." This report summarizes the panel's findings on the current health of the enterprise, examines the root causes of its governance challenges, and offers the panel's recommendations to address the identified problems. Appendix A contains the Section 3166 language on the panel's charter; the panel members' biographies are provided in Appendix B.

The panel is grateful for the support provided for this research by individuals throughout the nuclear enterprise, and for the testimony and advice provided by invited witnesses. General Larry D. Welch (USAF, ret.) and Dr. Richard A. Meserve provided very helpful comments on a draft of this report. Research, logistics, and editorial support were provided by the Institute for Defense Analyses.

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Executive Summary

The course to improve the nation's nuclear security enterprise seems clear…and the National Nuclear Security Administration has not been on it.

–Testimony to the panel (unattributed)

The Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise was tasked by the U.S. Congress to examine the mission, organization, and management of this enterprise and consider alternative governance models. The panel notes from the outset that there is no question as to the efficacy of the nuclear deterrent for the foreseeable future. The nuclear stockpile is safe, secure, and reliable, and the quality of science and research is undiminished. However, the panel finds that the existing governance structures and many of the practices of the enterprise are inefficient and ineffective, thereby putting the entire enterprise at risk over the long term. These problems have not occurred overnight; they are the result of decades of neglect. This is in spite of the efforts of many capable and dedicated people who must nonetheless function within the confines of a dysfunctional system.

This is no time for complacency about the U.S. nuclear deterrent. Nuclear forces provide the ultimate guarantee against major war and coercion, and America's allies depend on these forces and capabilities for extended deterrence. Other countries carefully measure U.S. resolve and technological might in making decisions on global and regional security matters, many of which are of vital concern to the United States. Hence, while the current viability of the U.S. nuclear deterrent is not in question, it will need to be sustained to meet future security needs and the long-term health of the enterprise is a critical necessity.

The panel's review has encompassed the communities with essential responsibilities for the nuclear enterprise: the national leadership in the Executive Branch and Congress; the relevant policy and oversight organizations within the Department of Energy (DOE) and the National Nuclear Security Administration (NNSA); the operating sites in the nuclear weapons complex; and NNSA's customers in the Department of Defense (DOD), the Department of State, the Intelligence Community, and the Department of Homeland Security.[1] Additionally, the panel

[1] The panel's fact finding was largely completed between October 2013 and February 2014. While the panel received updates on specific issues through July 2014, and it has sought to recognize some of the important changes currently underway by DOE/NNSA, the findings are necessarily focused on the situation as of early

examined the proven management practices of several high-performing, high-technology organizations both in the private sector and in government. The panel reviewed previous studies, conducted on-site visits across the nuclear weapons complex (laboratories, plants, and the Nevada National Security Site), and benefitted from the views of dozens of expert witnesses. The panel focused its attention largely (but not exclusively) on the nuclear weapons stockpile mission. This focus reflects the fundamental importance of the mission and its associated capabilities, and the judgment based on initial fact finding that there were major challenges associated with defining and executing this mission.

The findings and recommendations detailed in this report have the unanimous support of the panel members. The common belief is that significant and wide-reaching reform is needed to create a nuclear enterprise capable of meeting the nation's needs. While panel members differ on certain details, there is deep agreement on the overall direction—and urgency—of the reforms outlined here.

One unmistakable conclusion is that NNSA governance reform, at least as it has been implemented, has failed to provide the effective, mission-focused enterprise that Congress intended. The necessary fixes will not be simple or quick, and they must address systemic problems in both management practices and culture that exist across the nuclear enterprise:

- First, a lack of sustained national leadership focus and priority, starting with the end of the Cold War, has undermined the foundation for nuclear enterprise governance and contributes to virtually all of the observed problems;
- Second, inadequate implementation of the legislation establishing NNSA as a separately organized subelement of DOE has resulted in overlapping DOE and NNSA headquarters staffs and blurred ownership and accountability for the nuclear enterprise missions;
- Third, the lack of proven management practices, including a dysfunctional relationship between line managers and mission-support staffs, has undermined the management culture within NNSA;
- Fourth, dysfunctional relationships between the government and its Management and Operating (M&O) site operators has encouraged burdensome transactional oversight rather than management focus on mission execution;
- Fifth, insufficient collaboration between DOE/NNSA and DOD weapons customers has generated misunderstanding, distrust, and frustration.

2014. Thus, this report does not reflect on the leadership of the new NNSA Administrator, Lt. Gen. (ret) Frank G. Klotz, who took office in May 2014. The panel also recognizes that U.S. Secretary of Energy Dr. Ernest Moniz has been in his position only a limited time and has been actively pursuing initiatives to improve some of the identified problems. Several DOE management initiatives begun since the panel's interim report was issued in April 2014 are reported in the relevant sections of the report.

To achieve the conditions for success, the panel recommends fundamental reforms that touch on every component of the enterprise. The current senior leadership of the DOE has taken some important initial steps to rectify failings, but the enterprise as a whole continues to struggle to meet commitments and the underlying problems will not be fixed without major reform. Given the fact that many of these problems are attributable to cultural shortcomings, the solution will not be easy and will inevitably transcend any one leadership team.

A brief summary of the needed improvements suggests the depth of the challenges facing the enterprise. The details of the panel's findings and recommendations are provided in Chapters One to Five in the body of this report. The Table of Recommendations lists the panel's specific recommendations.

Strengthen National Leadership Focus, Direction, and Follow-Through

(Recommendations 1 and 2)

At the root of the challenges faced by the nuclear enterprise is the loss of focus on the nuclear mission across the nation and within U.S. leadership as a whole since the end of the Cold War. Every aspect of the enterprise is colored by the fact that, bluntly stated, nuclear weapons have become *orphans* in both the Executive and Legislative branches. This has been reflected by the lack of an urgent and clear mission and lack of follow-through in assuring adequate performance to modernize the nuclear stockpile on schedule and on budget. Nowhere is this more evident than among those working in the nuclear enterprise, many of whom feel that they are in a declining career field. Although the national leadership has provided high-level policy statements and substantial sums of money to the enterprise, the results achieved by the enterprise have frequently been unacceptable. Sustained and focused national commitment is required.

The panel recommends that the President and Congress adopt a number of new mechanisms designed to set enterprise priorities and program expectations, demand feasible customer-driven plans for the enterprise, assure the adequacy of assigned resources, and advance needed governance reforms. The panel believes that expanding the existing annual Office of Management and Budget (OMB)/DOD budget/program review to include the nuclear weapons portfolio would reinforce this and could help synchronize the nuclear security programs and budgets across the two Departments. The panel further recommends that Congress adopt mechanisms to strengthen committee oversight and unify support for the enterprise. Such efforts should seek improved coordination across missions as well as between authorizers and appropriators, and thus synchronize the work of the multiple cognizant subcommittees to provide a more focused jurisdiction.

Solidify Cabinet Secretary Ownership of the Mission

(Recommendations 3–5)

Despite the intent of the NNSA Act to create a *separately organized* NNSA *within* DOE, the Act as implemented did not achieve the intended degree of clarity in enterprise roles and mission ownership. NNSA was not provided the line-management authority necessary to integrate safety, security, and environmental concerns into the decision making for executing NNSA's missions; nor was an effective policy implementation framework established. The Act, as implemented, made organizational changes designed to insulate NNSA from DOE headquarters without specifying the Secretary's roles, without stipulating the relationships between NNSA and DOE headquarters staffs, and without requiring actions to shift the Department's culture toward a focus on mission performance. The panel concludes that the relationships among NNSA, the Secretary of Energy, and the DOE headquarters are not properly aligned with mission needs today and are therefore in need of major reform.

As directed by Congress, the panel explored a range of options for an organizational structure that would address the problems created in establishing NNSA. The panel concludes that the nuclear enterprise would be most effective in performing its missions if it were led by a knowledgeable, engaged Cabinet Secretary and if ownership of the mission were Department-wide. Hence, the solution is not to seek a higher degree of autonomy for NNSA, because that approach would only further isolate the enterprise from needed Cabinet Secretary leadership. Instead, it is recommended that Congress place the responsibility and accountability for the mission squarely on the shoulders of a qualified Secretary, supported by a strong enterprise Director with unquestioned authority to execute nuclear enterprise missions consistent with the Secretary's policy direction.

Every alternative to this approach has significant weaknesses:

- The panel first considered the option of reorganizing DOE/NNSA to strengthen NNSA's autonomy within the Department of Energy (effectively, an improved status quo). This was rejected because numerous studies and the panel's own fact-finding revealed that DOE's current *separately-organized* approach is fundamentally flawed, and that adjustments would not be sufficient to correct either the structural or cultural problems.
- The panel also explored the model of NNSA as an independent agency. The panel concluded that a mission this important to U.S. national security requires Cabinet-level ownership and support.
- The panel further evaluated three variants of a greater role for the Department of Defense. In each case, given the magnitude of DOD's existing challenges, there is considerable uncertainty about DOD's willingness and ability to integrate and support an organization with a very different scientific and civilian culture.

To achieve the right leadership structure—a Cabinet Secretary who sets policy and a Director who is empowered to implement the policy—the panel recommends amending the NNSA Act to replace the “separately-organized” NNSA with a new Office of Nuclear Security (ONS) within the Department charged with performing the missions currently performed by NNSA. (Proposed statutory language is provided in Appendix C.) The proposed legislation includes new confirmation and reporting requirements to underscore the Secretary’s enterprise leadership roles and accountability and to emphasize the qualifications needed to lead the enterprise. It also assigns a new name—The Department of Energy and Nuclear Security (DOE&NS)—to highlight the prominence and importance of the Department’s nuclear security missions (over 40 percent of the Department’s budget is for nuclear security) and to stress the importance of the needed cultural change.[2]

Central to this reform is to establish the Director of ONS as the unquestioned line-management authority for safe, secure, and environmentally responsible mission execution. The Director’s qualifications, authorities, and accountability must be carefully stipulated. In the panel’s proposed formulation

- The Director must possess strong technical management capabilities.
- For leadership and continuity, the Director’s position should be an executive schedule II with a tenure of at least six years (subject to Presidential review).
- The Director has direct access to the President on issues critical to ONS’s missions (nuclear stockpile safety, security and reliability, non-proliferation, etc.).
- The Director has direct access to the Secretary on all ONS matters.
- The Director is assigned risk acceptance responsibility and authority on ONS matters, taking full responsibility and accountability for executing the Secretary’s policies for the nuclear security missions safely, securely, and environmentally responsibly.
  - Mission-support staffs advise the Director on risk-acceptance decisions.
  - Any disagreements between line managers and mission-support staffs are quickly raised through a clearly defined appeals process.
- The Director has full authority to shape and manage the ONS technical staff.[3]

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[2] In this report, when referring to the present, the terms DOE and NNSA are used. In the panel’s recommendations and in referring to the future, the panel’s recommended names, DOE&NS and ONS, are used.

[3] Recognizing the constraints of the civil service system, all nonadministrative ONS personnel should be from the Senior Executive Service or the Excepted Service in order to permit the Director this necessary authority.

The panel judged these attributes of the Director to be paramount in empowering a leader capable of executing all aspects of the mission and reforming the enterprise's culture. The panel recommends that the Director serve concurrently as a second Deputy Secretary in the Department or as an Under Secretary. While the panel did not agree on the appropriate rank, it does agree that this question of rank is less essential for success than is establishing an effective working relationship with a knowledgeable, engaged Secretary and providing the Director all the necessary authorities as described above. As a result, the panel notes the potential options but offers no recommendation on this one specific issue.

The strengthened roles of the Secretary and Director will be enhanced by the complementary and combined effects of increased focus and follow-through from the White House and Congress and the adoption of proven leadership and management processes. If for any reason the nation's leadership is not prepared to require the Secretary to possess the qualifications demanded by the nuclear security mission, or to provide the Director the necessary mission execution authorities, then only one option remains: an autonomous organization to replace some or all of the functions of NNSA. This is viewed by the panel as a clearly inferior choice.

Adopt Proven Management Practices to Build a Culture of Performance, Accountability, and Credibility

(Recommendations 6–13)

NNSA, and associated policy and oversight organizations within the Department, reflect few of the characteristics of the successful organizations benchmarked for this study. Participants at all levels report that DOE/NNSA is an organization with many pockets of talented, technically competent people operating within a culture that lacks a unifying focus on mission deliverables, is risk averse, has poorly defined chains of command, and has inadequate personnel management. A major overhaul will be needed to transform the organization into one with a mission-driven management culture.

The panel identifies a number of management best practices, based on high-performing benchmarked organizations that, if implemented effectively, would bring about the needed reforms. Prominent among them are a capable, empowered leadership with well-defined roles and responsibilities; clear plans with careful analysis of the resources needed to succeed; a clear line-management structure; strong program managers focused on mission deliverables; effective communications; a focus on conveying effective incentives to suppliers; and clear accountability. The panel's recommendations would establish proven practices in each of these areas. Aggressive implementation would significantly improve performance in the near term, thus addressing well-known morale issues and, in time, reshaping the management culture.

Maximize the Contributions of the Management and Operating (M&O) Organizations to the Safe, Secure Execution of the Mission

(Recommendations 14–17)

The open communication and collaboration on program and technical matters that historically existed between the M&Os and Federal officials has eroded over the past two decades to an arm's length, customer-to-contractor and, occasionally, adversarial relationship. In the case of the laboratories, this has led to a significant loss in their contributions historically stemming from the special Federally Funded Research and Development Center (FFRDC) relationship. The erosion of trust—a critical element in the FFRDC relationship—observed by the panel was also highlighted by a recent National Research Council of the National Academies study.[4] The panel concurs that the special relationship of trust between the government and the three NNSA laboratories has been eroded by unclear accountability for risk and a fee structure and contract approach that invites detailed, tactical, and transactional oversight rather than a strategic, performance-based management approach. Excessive and fragmented budget control lines also confound effective and efficient programmatic management, erode flexibility, and undermine the sense of trust.

The panel recommends a major reform of existing incentives and relationships, building on steps already begun by the current leadership. Award fees have diverted substantial energy and resources from mission execution; these fees should be replaced by fixed fees that fairly compensate the M&O organizations for their investments in the enterprise and their risks (both financial and reputational). Contract term extensions should be the main vehicle used to encourage M&O performance. DOE must define a collaborative relationship that attracts the best performers and emphasizes taking full advantage of the M&Os' ability to provide skilled personnel and strong management cultures, as well as proven systems, processes, and practices for effective and efficient mission execution.

Strengthen Customer Collaboration to Build Trust and a Shared View of Mission Success

(Recommendations 18 and 19)

The nuclear enterprise cannot succeed if participants are distrustful of one another and are seen to be divided on major goals and priorities. The trust issues identified by the panel are mainly with the Department of Defense nuclear weapons customers who have repeatedly seen NNSA over-promise and under-deliver. These DOD customers lack confidence in NNSA's ability to execute warhead life extension programs (LEPs) and major nuclear facility

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4 National Research Council, *The Quality of Science and Engineering at the NNSA National Security Laboratories* (Washington, DC: National Academies Press, 2013), 72.

modernization projects. This is both a cultural and communications divide. A fundamental void is the lack of an affordable, executable joint DOD-DOE vision, plan, or program for the future of nuclear deterrence capabilities. Although the customers in other mission areas from DOD, the Intelligence Community and elsewhere appear to be satisfied, here, too, a more strategic approach would strengthen both capabilities and the services provided.

The Secretary and Director must take a strong lead in building a culture focused on meeting customer needs. The panel recommends steps to strengthen DOE-DOD collaboration at the level of the Secretaries to align the planning, programming and execution of sustainment and modernization programs for nuclear weapons and their delivery platforms. More generally, the process for NNSA *Interagency Work* should be simplified and streamlined to enhance efficiency.

Conclusion

The panel concludes that the needed leadership for executing this mission is best provided by an engaged Cabinet Secretary with national security qualifications, and with effective execution led by a qualified, empowered Director focused on mission deliverables. After an extended gap in the permanent leadership team, the NNSA now has two very experienced top executives in place. The panel's report outlines a vision and reform agenda for the Secretary and this new team. Given that the disorders observed are more cultural than structural, organizational reform and revision of the NNSA Act, while essential, are only a first step in the actions needed to achieve success. Even with an effective Departmental team in place, success is imaginable only with the strong and active support of the White House and Congress. The panel, therefore, attaches great importance to sustained White House and Congressional focus in ensuring successful implementation of these reforms.

If action is reasonably prompt, measurable progress should be observed very quickly—in a matter of a few months. The panel's final recommendation, as described in Chapter 6, is that a follow-on review be conducted two years from now to assess the status of reform. This review should focus on certain concrete indicators of change such as the following:

- Presidential guidance is in place addressing an executable, funded long-term plan for modernizing the nuclear deterrent capabilities, aligned with DOE&NS and DOD and updated annually, for platform modernization, warhead life extension, and infrastructure recapitalization; DOE&NS and DOD programs are in place to execute this plan
- Highly qualified experts from the National Security Council staff are routinely engaged in policy development and nuclear enterprise oversight and strategic direction
- Congress supports the panel's approach by amending the NNSA Act to clarify the roles of the Secretary, and provide the Director, ONS with the authorities needed to succeed
- Congressional committees and associated staffs are well versed and routinely engage in matters pertaining to the nuclear security enterprise and they are working in a

collaborative manner that ensures consistent, efficient, and effective authorization, appropriation, and oversight

- A strong DOE&NS and ONS leadership team is in place; Congress agrees that political appointments for the Secretary and Director be confirmed by both the Senate Energy and Natural Resources and Armed Services Committees
- The DOE&NS has clearly delineated and documented the authorities of the Director, ONS and his or her relationship with other senior DOE&NS officials, including managers responsible for mission-support functions
- A *risk management* culture has replaced the existing *risk aversion* culture; technical competence is restored within the workforce to address safety issues raised by the Defense Nuclear Facilities Safety Board (DNFSB)
- Internal management reforms have substantially reduced excessively burdensome budgeting detail and transactional oversight, and have led to substantial staff realignments and a performance-based approach; a Federal staff right-sizing plan is in place and being executed
- Warhead Life Extension Program and Infrastructure Modernization Program Managers are established in ONS with control over program resources and accountability for delivering on agreed schedules
- Cost-estimating and resource management staffs are in place, and work is underway to develop needed management tools and data
- The Director, ONS has developed an executable plan to build needed new facilities, reduce maintenance backlogs, and eliminate outmoded facilities
- Mechanisms for strategic dialogue have been instituted and the government-M&O/FFRDC relationships have been restored
- Laboratory Directors, plant managers, and M&O leadership have developed, and are executing, plans that provide for clear identification of required technical work and infrastructure sustainment, accurate and transparent cost accounting, and initiatives to continuously improve value performance
- Contracts with the M&Os have been revised to provide incentives focused on mission success, replacing large award fees with fixed fees and the potential for contract extensions
- ONS customers express satisfaction with collaboration, information sharing, and business practices, as well as performance in delivering on their needs

Demonstrated performance is the ultimate measure of success and the foundation for credibility and trust. The panel believes that its recommendations, as summarized in the Table of Recommendations, if fully and effectively implemented, provide the best chance for a reformed Department and new Office of Nuclear Security to be able to carry out its mission and thus restore trust and credibility with customers and national leaders. If, based on independent oversight, attention to implementation is lacking, and significant progress is not made within the next two years, then the panel believes the only course of action—and a clearly inferior one—is to remove ONS from the Department and make it an independent, autonomous agency.

Table of Recommendations

Strengthen National Leadership Focus, Direction, and Follow-Through

1. The President should provide guidance and oversight sufficient to direct and align nuclear security policies, plans, programs, and budgets across Departments.

1.1 The President should reaffirm the importance of the mission and align DOE&NS and DOD priorities through an expanded President's annual stockpile guidance.

1.2 The President should require annual OMB joint budget reviews to shape and align DOE&NS and DOD programs and budgets.

1.3 The President should require annual NSC joint program reviews to shape and align DOE&NS and DOD programs and policies.

2. Congress should establish new mechanisms to strengthen and unify its leadership and oversight of the nuclear enterprise and its missions.

2.1 Congress should add Senate Armed Services Committee approval to the confirmation and reporting requirements for the Secretary and Deputy Secretary of DOE&NS (and continue to have the Director, ONS be approved by the Senate Armed Services Committee).

2.2 Congress should require the Secretary to testify annually on the health of the enterprise, and on progress in reforming its governance, to the Senate Energy and Natural Resources and Senate Armed Services Committees, and to the House Energy and Commerce and House Armed Services Committees.

2.3 Congress should implement information sharing and collaboration mechanisms to unify and strengthen its mission-focused oversight across cognizant committees and to better harmonize direction and oversight across the enterprise's mission areas.

Solidify Cabinet Secretary Ownership of the Mission

3. Congress should amend the NNSA Act and related legislation to clarify Departmental leadership roles.

- **The Secretary "owns" the nuclear enterprise missions, sets Departmental policy for the nuclear enterprise, and is accountable to the President and Congress for the enterprise.**
- **The Director, Office of Nuclear Security (ONS) has full authority to execute the nuclear enterprise missions consistent with the Secretary's policy.**
- **Departmental mission-support staffs advise and assist the Director in executing enterprise missions.**

3.1 The amended legislation should specify the Secretary's leadership responsibilities and define duties that underscore the Secretary's accountability for the nuclear enterprise and its missions.

3.2 The amended legislation should create the Office of Nuclear Security (ONS) within the Department to perform the missions currently assigned to NNSA.

3.3 The amended legislation should designate a Director, Office of Nuclear Security with full authority to execute nuclear enterprise missions under the policy direction of the Secretary. The

Director should have tenure of at least six years, be compensated at the rate of Executive Schedule Level II, and hold the Departmental rank of a Deputy Secretary or Under Secretary.[5]

3.4 The amended legislation should assign risk acceptance authority and accountability to the Director for ONS mission execution.

3.5 The amended legislation should grant the Director authority to appoint senior officials in ONS, including the conversion of three Senate-confirmed direct-report positions (Principal Deputy, Assistant Secretary for Defense Programs, and Assistant Secretary for Non-Proliferation Programs) to Senior Executive Service or Excepted Service positions.

3.6 The amended legislation should emphasize the importance of the nuclear enterprise missions, by changing the name of the Department to the "Department of Energy and Nuclear Security."

4. The Secretary should implement Departmental management processes that specify the Director's authorities for executing nuclear enterprise missions. These authorities include:

- **Line management authority for the safe, secure, and environmentally responsible execution of nuclear security missions**
- **Management authority for mission-support staffs assigned to the Office of Nuclear Security**
- **Concurrence authority for Departmental rulemaking on ONS matters**

4.1 The Secretary should establish decision-making practices among the senior headquarters staffs that codify the Director's authority to execute the nuclear security missions consistent with the Secretary's policies.

4.2 The Secretary should establish a matrix management structure that
- Aligns and codifies roles, responsibilities, authority, and accountability
- Specifies the Director's leadership authority over line-management and mission-support ("functional") staffs assigned to ONS
- Eliminates overlapping headquarters staffs

4.3 The Secretary should adopt processes defining the Director's role in ensuring applicable DOE&NS policies, rules, and orders are compatible with the operating circumstances of the nuclear security enterprise.

4.4 The Secretary should designate those senior headquarters positions that have line-management decision authorities and those that are responsible for mission-support functions.

5. The Secretary and Director should reform DOE regulation to strengthen risk management.

5.1 The Secretary should strengthen the Department's analytical expertise and processes for assessing risks, especially for nuclear and other high-hazard functions.

5.2 The Secretary should direct a comprehensive review and reform of the Department's ES&H and Security Orders and Directives to reflect best industry practices.

5.3 The Secretary (with Congressional concurrence) should establish a mechanism to improve the Department's ability to respond to inquiries, findings, and recommendations of the Defense Nuclear Facilities Safety Board.

[5] The panel recommends the Director hold either the rank of Deputy Secretary or Under Secretary, but did not agree on a specific rank.

Adopt Proven Management Practices to Build a Culture of Performance, Accountability, and Credibility

6. To begin reforming the DOE&NS culture, the Secretary and Director should develop within six months a plan for continuous management learning and improvement, including an implementation plan for the panel's recommendations with milestone target dates.

6.1 The Secretary and Director should urgently develop a more robust, integrated DOE&NS/ONS-wide process to provide accountability and follow-up on findings and recommendations from studies and reviews, both internal and external.

6.2 The Secretary and Director should establish management metrics for assessing and improving enterprise management.

6.3 The Secretary and Director should routinely survey personnel to gauge morale, assess cultural changes, and identify the results of efforts to change management practices.

6.4 The Secretary and Director should aggressively communicate reform plans and objectives.

7. The Secretary and Director should implement industry best practices for shaping and building the enterprise workforce.

7.1 The Secretary and Director should establish strong career and leadership development programs, require rotational assignments, and place greater emphasis on continuing education and professional certifications.

7.2 The Secretary and Director should reshape staffs as needed to implement governance reforms.

7.3 The Secretary and Director should conduct a zero-based personnel review to right-size government staffs consistent with recommended reforms and changing workload since the end of the Cold War; this review should include the consolidation of headquarters activities across DOE&NS's Forrestal headquarters, the Germantown campus, and the Albuquerque complex.

8. The Secretary should establish trusted Cost Analysis and Resource Management staffs, tools, and data; the Director should be responsible for this process in ONS.

8.1 The Secretary and Director should strengthen the Department's efforts to develop independent cost and resource analysis capabilities.

8.2 The Secretary and Director should employ a rigorous Analyses of Alternatives process during program formulation as the basis for assessing and validating program requirements.

8.3 The Secretary and Director should take advantage of established DOD resource analysis capabilities in establishing DOE's cost analysis and resource management capabilities.

9. The Director should establish a simple, clear line-management operating structure that both synchronizes activities across programs, mission-support functions, and operating sites and provides leadership focus for key programs.

9.1 The Director should create operational mechanisms to perform the key synchronization functions that used to be performed by the Albuquerque Operations Office.

9.2 Deputy Directors should be designated to lead in the integrated planning and execution of programs in their mission areas of responsibility.

9.3 The Deputy Director responsible for Life Extension Programs, working with DOD, should create a long-term operating plan to support the nation's warhead modernization strategy; this plan should be designed to create a relatively stable, long-term workload.

10. The Director should establish program managers who are provided necessary authorities and resources, and who are held accountable for major mission deliverables.

10.1 The Director, in coordination with the responsible Deputy Director, should designate program managers for each Life Extension Program and major construction project.

10.2 Program managers should be held accountable to employ effective management practices.

10.3 The Director should delegate to the program managers control of any funds identified as uniquely required to execute their programs.

10.4 The Director should delegate control over personnel assigned to their programs to the program managers.

11. The Congress, Secretary, and Director should adopt a simplified budget and accounting structure (by reducing budget control lines) that aligns resources to achieve efficient mission execution while providing sufficient visibility to enable effective management oversight.

11.1 Congress should reduce the number of Congressional budget control lines to the number of major programs plus major mission-support functions.

11.2 The Director should reduce ONS's internal budget control lines to the minimum number needed to assign funding for major programs and mission-support activities across the sites.

11.3 Infrastructure funding that is uniquely required for the execution of Life Extension Programs should be integrated into the portfolio of the Deputy Director for Defense Programs.

12. The Director should develop a strategy and plan to reshape the weapons complex to meet future needs.

12.1 The Director should ensure that the strategy and plan identify and address the deferred maintenance backlog.

12.2 The Director should ensure that the strategy and plan match (and, in many cases, reduce) the infrastructure needed to meet requirements.

12.3 The Director should ensure that the strategy and plan identify investments in the needed skills in the workforce.

12.4 The Director should ensure that the strategy and plan specify investments in capabilities, including the sites' use of internally directed research and development. The panel recommends Laboratory Directed Research and Development (LDRD) funding of no less than 6 percent, which is needed to sustain leadership in nuclear science, engineering, and manufacturing.

13. The Secretary and Director should continue ongoing efforts to improve construction project management capabilities (at all levels) by introducing disciplined management practices in order to recapitalize infrastructure on time and on budget.

13.1 The Director should strengthen infrastructure project management skills, tools, and the collection and analysis of data.

13.2 The Director should build on recent efforts to adopt best practices for managing infrastructure projects, especially the use of external peer review.

13.3 The Secretary and Director should hold managers accountable for adopting the effective practices detailed in the Department's directive on project management (Order 413), consistent with the principles provided in OMB Circular A-11 in infrastructure projects.

Maximize the Contributions of the Management and Operating (M&O) Organizations to the Safe, Secure Execution of the Mission

14. The Director should reform M&O contracts, replacing the award fee structure with fixed fees for longer (multi-year) award terms and linking performance incentives to the contractual period of performance.

14.1 The Director should adopt market-based fixed fees for new M&O contracts commensurate with M&O-borne risks, M&O investments in the enterprise, and the scale of the undertaking.

14.2 Where practicable, the Director should convert existing contracts to similar fixed fee arrangements.

14.3 The Director should base decisions to extend an M&O contract's period of performance primarily on contributions to mission performance; unsatisfactory performance should lead to early termination.

14.4 The Director should seek greater standardization of contract provisions across similar entities.

15. The Secretary and Director should reinforce the M&O parent organizations' obligations to contribute to enterprise management improvement initiatives.

15.1 The Director should create collaborative mechanisms to strengthen the joint contributions of the M&O organizations in improving the effectiveness and efficiency of enterprise operations.

15.2 The Director should task M&O organizations to identify and assess management improvement opportunities, both for mission execution and for mission-support functions.

16. The Secretary and Director should eliminate wasteful and ineffective transactional oversight.

16.1 The Secretary and Director should direct a reduction in the number of audits, inspections, and formal data calls, and better synchronize those that remain.

16.2 The Secretary and Director should eliminate transactional oversight in areas where there are better mechanisms for certifying contractor performance, to include reform of the field office's staffing levels and performance criteria.

17. The Secretary, Director, and the National Laboratory Directors should adopt management practices that serve to rebuild the strategic Government-FFRDC relationship.

17.1 The Secretary and Director should continue to reinvigorate the strategic dialog with the Laboratory Directors.

17.2 Leaders in both the government and M&Os should prescribe and enforce behaviors that rebuild credibility and trust.

17.3 The appropriate government officials (e.g., Deputy Directors, program managers) should meet at least monthly with the M&O leadership, and preferably have daily informal interactions.

Strengthen Customer Collaboration to Build Trust and a Shared View of Mission Success

18. The Secretary should collaborate with the Secretary of Defense to better align the planning, resourcing, and execution of sustainment and modernization programs for nuclear weapons and their supporting infrastructure with DOD's delivery platforms.

18.1 The Department Secretaries should direct activities that foster collaboration and communications among the principals and staffs supporting the Nuclear Weapons Council (NWC).

18.2 The Department Secretaries, supported by the chairman and members of the NWC, should reinvigorate its working-level elements.

18.3 The Department Secretaries should establish transparent information sharing mechanisms and increase direct staff collaboration on a daily basis to address persistent communications and trust issues.

18.4 The Department Secretaries should confer on each Department's proposed co-chair to the Standing and Safety Committee (SSC), which reports to the NWC.

18.5 The Department Secretaries should involve the NWC in drafting and reviewing the annual assessment to the NSC of progress on meeting Presidential guidance.

18.6 The Director should strengthen the roles, responsibilities, and accountability of the senior military officer assigned to ONS in order to improve DOE&NS-DOD collaboration.

19. The Secretary and Director should align and streamline processes for collaboration with Interagency customers.

19.1 The Secretary, working through the Mission Executive Council, should improve coordination for planning and executing Interagency Work.

19.2 The Mission Executive Council should annually conduct a review of the execution of Interagency Work across the nuclear security enterprise to identify improvement opportunities in working relationships, collaborative mechanisms, and management practices.

Introduction

There are few undertakings more important, more demanding, or less forgiving than those pursued on a daily basis by the Department of Energy and the National Nuclear Security Administration (NNSA) in addressing current and future U.S. nuclear security requirements. The consequences of failure are enormous, potentially placing large numbers of lives at risk and even changing the course of history. But concerns with the health of the enterprise, and notably the NNSA, are widespread and persistent; the basis of these concerns must be understood and the causes addressed with urgency.

Now is no time for complacency about this enterprise and the missions it supports. The United States and its allies are in a complex nuclear age, with several potential adversaries modernizing their arsenals, new nuclear technologies emerging, and potential new proliferants—as well as regional challenges—raising significant concerns. Each successive administration since that of President Dwight D. Eisenhower has reaffirmed the need to sustain a credible nuclear deterrent that is safe, secure, and reliable. America's allies depend on U.S. forces and capabilities for extended deterrence. Other countries carefully measure U.S. resolve and technological might in making decisions on global and regional security matters, many of which are of vital concern to the United States. Nuclear forces provide the ultimate guarantee against major war and coercion, serving both to deter the use of weapons and to support nonproliferation initiatives. Hence, while the current viability of the U.S. nuclear deterrent is not in question, now would be a dangerous time for the enterprise to stumble.

While the United States has dramatically reduced the inventories of nuclear weapons since the end of the Cold War, the importance of maintaining a safe and secure stockpile has not diminished, and additional challenges have emerged. The missions of NNSA, established in the 1999 NNSA Act,[6] highlight the broad range of critical national security needs that are served by this enterprise. These include

- To enhance U.S. national security through the military application of nuclear energy

[6] NNSA Act, Title XXXII of the National Defense Authorization Act for Fiscal Year 2000, Pub. L. No. 106-65 (1999).

- To maintain and enhance the safety, reliability, and performance of the U.S. nuclear weapons stockpile, including the ability to design, produce, and test, in order to meet national security requirements
- To provide the U.S. Navy with safe, militarily effective nuclear propulsion plants and to ensure the safe and reliable operation of those plants
- To promote international nuclear safety and nonproliferation
- To reduce global danger from weapons of mass destruction
- To support U.S. leadership in science and technology

These statutory missions draw on a core set of science, engineering, manufacturing, and construction capabilities that have been developed through decades of investment, largely to meet the required competencies of the nuclear weapon programs. Indeed, NNSA is solely qualified to fulfill its missions to sustain the nuclear stockpile and provide naval nuclear power, while it is one of several contributors in the other mission areas. As illustrated in Figure 1, NNSA's missions are fundamentally interrelated: the core nuclear weapons capabilities (shown in the bottom row, along with nuclear propulsion) form the foundation of the nuclear enterprise, enabling the execution of the full range of NNSA missions. The middle rows provide examples of missions assigned to NNSA, such as intelligence support, nonproliferation, and control of nuclear weapons (to minimize the threat of "loose nukes"), which rely on these nuclear capabilities. The top row provides examples of other missions that benefit from these capabilities.

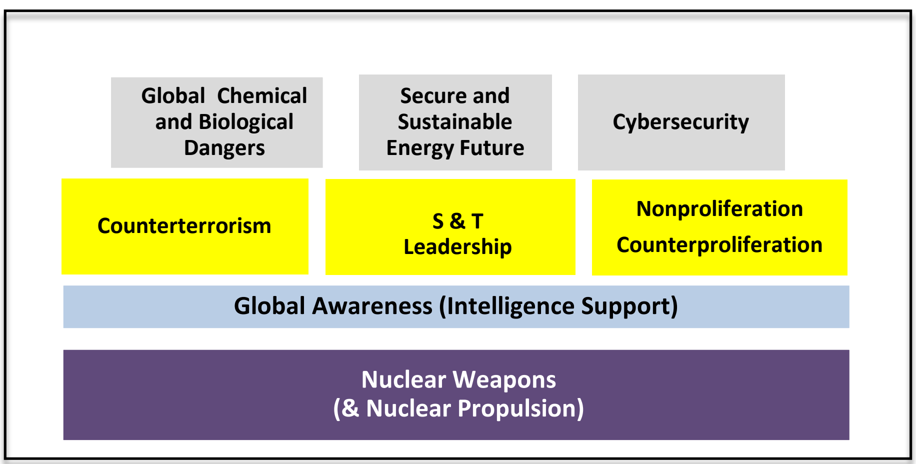

Figure 1. NNSA's Interrelated Missions

The panel focused its attention largely (but not exclusively) on the nuclear weapons stockpile mission. This focus reflects the fundamental importance of the mission and its associated capabilities, and the judgment based on initial fact finding that there were major challenges associated with defining and executing the needed program of work in this area. The panel recognizes, however, that each of the assigned missions is vital to the nation's security—the enterprise must succeed with every mission and no mission can, or should, take exclusive priority over the others. In practice, the challenge is to balance the allocation of limited resources to address the nation's needs. The relative resource priorities assigned to the missions by the national leadership may shift over time; hence, ongoing strategy reviews and trade-offs across portfolios are appropriate and necessary.

Congress tasked this panel to examine current governance practices and to offer recommendations for, among other things, a significantly improved governance system. The panel's work has relied on its twelve members' broad experience as legislators, scientists, and senior military officers, as well as senior government and industrial executives. The findings and recommendations detailed in this report have the unanimous support of the panel members. The common belief is that significant and wide-reaching reform is needed to create a nuclear enterprise capable of meeting the nation's needs. While panel members differ on certain details, there is deep agreement on the overall direction—and urgency—of the reforms outlined here.

Since September 2013, the panel has examined the major components of the nuclear enterprise. Through fact-finding visits and testimony, the panel has heard from and examined the roles and contributions of national leadership activities in the Executive Branch and Congress, the Department of Energy (DOE) and NNSA (both headquarters and field), the operating sites of the weapons complex, and the major customers. (Table 1.)

The panel visited each of the facilities comprising the NNSA weapons complex (Figure 2) to gain the field-level perspectives of both the M&O operators and the NNSA field office personnel at each site. This fact finding provided important lessons regarding the interdependencies among the sites and across the missions of NNSA. It also provided perspectives on the government-M&O relationships at each site, as well as between the field and headquarters. The panel members heard testimony from a wide range of experts, both inside and outside of government (Appendix D). In addition, the panel examined the operations of several high-performing, high-technology organizations that promised to offer lessons for sound management. (This work is summarized in Appendix F.)

Table 1. Major Components of the U.S. Nuclear Enterprise

<table>
<tr><th colspan="2">The Nuclear Enterprise</th></tr>
<tr><td>National Leadership</td><td>Executive Branch
National Security Council (NSC) Staff
Office of Management and Budget (OMB)
Office of Science and Technology Policy
Legislative Branch
Senate
House of Representatives
Independent Agencies
Nuclear Regulatory Commission
Defense Nuclear Facilities Safety Board (DNFSB)
Occupational Safety and Health Administration (OSHA)</td></tr>
<tr><td>DOE & NNSA</td><td>DOE headquarters
NNSA headquarters
NNSA field activities</td></tr>
<tr><td>The Weapons Complex (and their Management and Operating (M&O) organizations)</td><td>Laboratories (Los Alamos, Lawrence Livermore, Sandia)
Production Sites (Pantex, Kansas City, Oak Ridge [Y-12], Savannah River)
Nevada National Security Site (NNSS)</td></tr>
<tr><td>Principal Customers</td><td>Department of Defense (DOD)
Intelligence Community (IC)
Department of State (DOS)
Department of Homeland Security (DHS)
Federal Bureau of Investigation (FBI)</td></tr>
</table>

Although the panel's purpose is to identify existing governance problems, examine options, and formulate recommendations for reform, it is important for context to acknowledge the achievements of the individuals and organizations working within the enterprise. Some of the noteworthy accomplishments include

- A Nuclear Stockpile Maintenance program that has delivered W87 and W76 Life Extension Program (LEP) warheads
- A Science-Based Stockpile Stewardship program that has yielded
  - Vigorous processes for two decades of successful annual certification of the stockpile
  - World-leading scientific advances, such as significantly improved understanding of weapons' physics, aging, and material properties
  - Leadership in high-performance computing
  - Successful completion of new manufacturing and experimental facilities
  - Dismantlement of thousands of warheads since the end of the Cold War

- Environmental cleanup and management of many Cold War facilities and sites
  - Reduced footprints and redundant facilities across sites under the Complex Transformation initiative
  - Tri-lab competition and collaboration (W76 dual-revalidation, Reliable Replacement Warhead competition)

- A Naval Reactors program that has successfully sustained and advanced technologies for ship propulsion

- Continued scientific and product development in the mission areas of non-proliferation, counter-proliferation, and nuclear counterterrorism

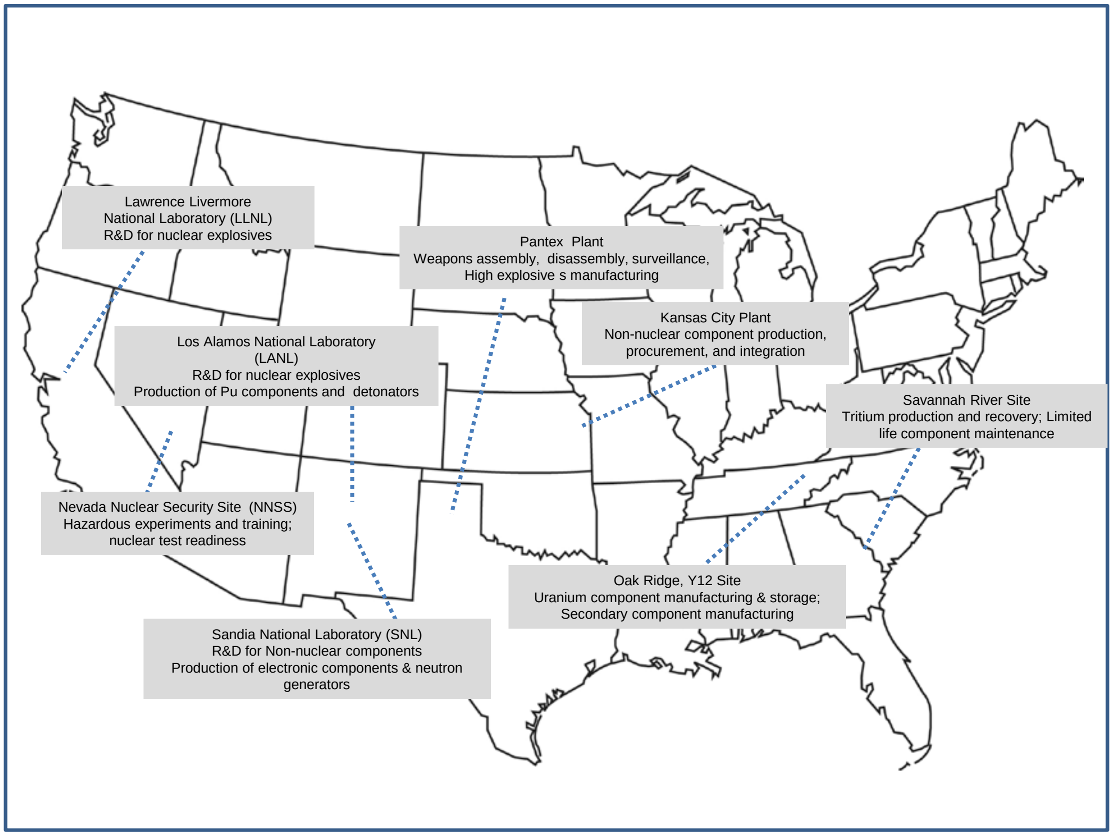

Figure 2. The NNSA Weapons Complex

Many customers report they are satisfied with their working relationships with the laboratories and plants, as well as with the products and services they obtain from the enterprise.

While these accomplishments are impressive, they do not excuse the significant governance and management shortcomings across the enterprise, nor do they diminish the risks of continuing with the same flawed management system. Concerns regarding the functioning of the enterprise are widespread and persistent. The first five chapters of the report describe the interrelated, systemic disorders impeding the enterprise along with the panel’s recommended remedies:

- First, a lack of sustained national leadership focus and priority, starting with the end of the Cold War, has undermined the foundation for nuclear enterprise governance and contributes to virtually all of the observed problems;
- Second, inadequate implementation of the legislation establishing NNSA as a separately organized subelement of DOE has resulted in overlapping DOE and NNSA headquarters staffs and blurred ownership and accountability for the nuclear missions;
- Third, the lack of proven management practices, including a dysfunctional relationship between line managers and mission-support staffs, has undermined the culture for executing NNSA's missions;
- Fourth, dysfunctional relationships between the government and its M&O site operators has encouraged burdensome transactional oversight rather than performance-based management;
- Fifth, insufficient collaboration with DOD customers and the tendency of NNSA to promise more than it delivers has generated misunderstanding, distrust, and frustration.

The telling symptoms of distress described here were confirmed through many sources and are consistent with the findings of numerous earlier studies.[7] Unfortunately, there is no perfect solution to all these challenges—but there are significant opportunities for improvement.

The concluding chapter briefly addresses implementation issues. It is the panel's judgment that lasting solutions require fundamental reform from the top to the bottom of the enterprise. The panel's recommendations, if implemented, will unleash the talented individuals and entities found within the current nuclear security enterprise to effectively carry out their extraordinarily important responsibilities to the nation. But, the viability of the recommended approach will depend significantly on the capabilities and experience of the individuals assigned to leadership positions, and their ability to follow through with the necessary changes. Structural change through an amended NNSA Act represents an essential step, but only an initial step, toward the

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[7] Appendix G identifies a number of important prior studies. Among the major findings and recommendations of these earlier studies: Congress's inability to rely on cost and schedule estimates when it provides funds; major customers' lack of information and access to decision making; costs that are excessive and estimates that are unreliable; and mission needs that are not being filled in a timely fashion. In addition, earlier studies note that national leadership has not delineated clear program direction. The consequent lack of mission focus has resulted in unjustified risk-averse behavior within DOE, which is exacerbated by vague roles and responsibilities within the Department. Effective resource management is significantly hindered by budgetary fragmentation, which is worsened by excessive costs for compliance-focused and duplicative monitoring. Oversight too often consists of perfunctory checks of compliance with regulations rather than assessments of mission outcomes. All of the above has led to the erosion of the traditional collaborative relationship and trust between NNSA and its field components (the national security laboratories, production facilities, and the NNSS) and between NNSA and its DOD weapons customers.

cultural change necessary for success. This enterprise is in dire need of sustained, bold leadership.

1. Strengthen National Leadership Focus, Direction, and Follow-Through

Vision without action is a daydream. Action without vision is a nightmare.

–Japanese proverb

CHALLENGES

Since the end of the Cold War, the need for strong national leadership for the nuclear enterprise has grown as the global security environment has evolved and the complexity of nuclear security missions has increased. Despite this growing need for leadership, many factors have served to weaken the focus, direction, and follow-through of the leadership provided to the nuclear enterprise.

Every aspect of the enterprise is colored by the fact that, bluntly said, nuclear weapons have become *orphans* in both the Executive and Legislative branches. Interest, understanding, and support across the U.S. government have grown increasingly weak and diffuse. The decline in national leadership attention flows down, eroding the attention given to nuclear security issues by senior executive leadership, both civilian and military—across both past and present Administrations and Congresses. In recent years, Presidential program guidance and resource direction has not been sufficient to resolve prioritization issues among the customers of the enterprise. Within Congress, there are multiple challenges. A dwindling number of Members of Congress advocate for the needs of the enterprise or involve themselves in the enterprise's mission. In both the Senate and the House of Representatives, the panel found varied and disparate perspectives and uneven communication among legislators, as well as among their staffs. These communication challenges are further compounded by multiple committee jurisdictions over the missions assigned to the enterprise, in addition to the different perspectives and approaches of authorizers and appropriators. Despite these impediments, a number of committed legislators and staffs continue to seek to bring focus to these issues—and they need support.

In addition, the failure of Congress to confirm nominees to important leadership positions in a timely manner is extremely damaging. NNSA was without a permanent Administrator from

January 2013 until April 2014—some fifteen months—when Lieutenant General Frank G. Klotz (USAF, ret.) was confirmed for the position.[8] Madelyn Creedon was nominated to be Principal Deputy Administrator on 7 November 2013, and was not confirmed until 23 July 2014. Such gaps in leadership positions, unimaginable in industry, hinder others already working within the organization to effect necessary changes pending the arrival of new leadership, and ultimately risk reducing the number of well-qualified leaders who are willing to subject themselves to this process.

There remains a relatively small community of experts focused on nuclear deterrence matters. These entities and individuals tend to be isolated in organizations with broad portfolios. DOE has a broad span of civilian responsibilities in addition to the nuclear security programs, and few principals in DOE headquarters, outside of NNSA, focus on nuclear weapon issues.[9] As for DOD, key senior staffs and analytical activities focused on these issues have been eliminated, significantly reduced, or assigned additional responsibilities (e.g., chemical and biological).[10] This has resulted in serious erosion of advocacy, expertise, and proficiency in the sustainment of these capabilities.

Absent strong national leadership, the nuclear enterprise has been left to "muddle through." Numerous reports over the last decade have documented the erosion in institutional capabilities resulting from the significant decline in leadership focus on nuclear strategy and security.[11] Studies and after-action reviews of operational lapses, too, find that oversight mechanisms, leadership decisions, and workforce attitudes have been undermined over time by the weakened leadership focus on nuclear weapons.[12]

8 Former Administrator Tom D'Agostino departed in January 2013; Neile Miller, the former Deputy Administrator, served in an acting capacity from January to June of 2013, at which point Bruce Held took over and served, again, in an acting role from July 2013 to April 2014.

9 As also noted in the Executive Summary, this report refers to DOE and NNSA when addressing the present day; when discussing the future, it refers to the Department of Energy and Nuclear Security (DOE&NS) and the Office of Nuclear Security (ONS), the panel's recommended new names.

10 DSB, *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills* (Washington, DC: DOD, 2008).

11 Earlier studies, spanning more than a decade, have underscored this problem, including: Chiles Commission, *Report of the Commission on Maintaining United States Nuclear Weapons Expertise* (Washington, DC: DOE, 1999); DSB, *Report of the Defense Science Board Task Force on Nuclear Capabilities* (Washington, DC: DOD, 2006); and DSB, *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills*.

12 Examples include the July 2012 Y-12 security incident in DOE (when three people, including an octogenarian nun, penetrated the Y-12 security barrier) and, in DOD, the unauthorized, inadvertent transfer of nuclear-armed Advanced Cruise Missiles from Minot Air Force Base (AFB) to Barksdale AFB, the mistaken shipment of Intercontinental Ballistic Missile (ICBM) warhead non-nuclear components to Taiwan and recently reported cheating in Air Force and Navy nuclear proficiency tests. Two major reviews following the unauthorized movement of nuclear weapons from Minot AFB to Barksdale AFB drew connections between the specific incident and the broader national environment. See Larry D. Welch, Chairman, The Defense Science Board

The panel finds that the governance of the nuclear enterprise suffers from this lack of strong, focused political leadership in at least three ways.

Lack of a Unifying Narrative Clarifying Resource Priorities

The nuclear enterprise depends on the national leadership to perform the essential roles of establishing strategy, guidance, and resources, as well as communicating a consistent narrative to shape relationships among the Departments responsible for executing the enterprise missions. To be sure, high-level policy guidance has been articulated, for example through the 2010 *Nuclear Posture Review,*[13] subsequent work leading to the Nuclear Weapons Employment Policy in June 2013,[14] Presidential speeches, the *2014 Quadrennial Defense Review,*[15] and the annual *Nuclear Weapons Stockpile Memorandum*. Such policy statements and guidance provide needed top-level support and policy for NNSA's missions, but they do not resolve and delineate program and resource priorities among those missions.

Consequently, the panel has found there is no actionable direction and little agreement on priorities across the government regarding the roles of the nuclear enterprise.[16] For many, the core mission is nuclear weapons stewardship. Others place non-proliferation programs as the top priority.[17] Another view is that leadership in nuclear security science and engineering, not the nuclear force itself, is the core capability that underwrites deterrence. These views compete in setting programmatic and resource priorities. Priorities are matters that must be resolved among the most senior leaders in the Executive Branch and Congress. As further discussed in Chapter 5 on NNSA's collaboration with its customers, Agency-level coordinating mechanisms such as the Nuclear Weapons Council (NWC) and the Mission Executive Council (MEC) cannot substitute

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Permanent Task Force on Nuclear Weapons Surety, *The Unauthorized Movement of Nuclear Weapons* (Washington, DC: DOD, April 2008 (revised)), and James R. Schlesinger, Chairman, Report of the Secretary of Defense Task Force on Nuclear Weapons Management, *Phase II: Review of the DOD Nuclear Mission* (Washington, DC: DOD, December 2008).

13 DOD, *Nuclear Posture Review Report* (Washington, DC: DOD, 6 April 2010).

14 An overview of this policy is provided in Office of the Press Secretary, The White House, "Fact Sheet: Nuclear Weapons Employment Strategy of the United States," 19 June 2013, http://www.whitehouse.gov-the-press-office/2013/06/19, accessed April 30, 2014.

15 DOD, *2014 Quadrennial Defense Review* (Washington, DC: DOD, 4 March 2014).

16 The most wide-ranging and comprehensive recent document on the lack of consensus can be found in Stephanie Spies and John K. Warden, *Forging a Consensus for a Sustainable U.S. Nuclear Posture* (Washington, DC: Center for Strategic and International Studies, April 2013). See, in particular, pages 10 and 11 on the need for a unifying, lasting consensus among America's national leadership. See also Strategic Posture Commission, *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States* (Washington, DC: United States Institute of Peace, 2009).

17 For example, non-proliferation objectives are highlighted in the 2006 *National Security Strategy*, as pointed out in Schlesinger, *Phase II: Review of the DOD Nuclear Mission*, 5.

for national leadership in setting priorities, defining the national enterprise's needs, and identifying resources to support those needs.

Lack of an Executable Plan

Lacking national direction and clear priorities, there has been no mechanism for NNSA and its customers to converge on executable plans to chart the path ahead within or across mission areas. With respect to the nuclear stockpile, the DOD-DOE Nuclear Weapons Council's evolving *baseline* plan and DOE's *Stockpile Stewardship and Management Plan* (SSMP) describe the overall direction, but these plans are not reconciled to be mutually consistent. What is essential now and into the future is to establish executable plans and programs that reconcile customer needs, NNSA plans and capabilities, and, importantly, resources—and thus serve to harmonize efforts within and across mission areas.

Whatever funds are planned, they must match the objectives. Today, the nuclear forces modernization plans in both DOD and DOE/NNSA are significantly underfunded relative to identified needs. A rough estimate, based on assessments by DOD's Cost Assessment and Program Evaluation (CAPE) Office and the Congressional Budget Office, is that the aggregate NNSA program, as was structured in its *FY2014 Stockpile Stewardship and Management Plan*, was at least $10 billion under-funded over the coming decade.[18] Either a new plan, additional funding, or both, are needed. The recently released *FY2015 Stockpile Stewardship and Management Plan* adjusts schedules to more accurately reflect reduced funding over the next decade, and as a result, proposes significant delays in the delivery of several major LEPs and nuclear facilities, as depicted in Figure 3 (drawn from that document).[19]

The revised *FY2015 Stockpile Stewardship and Management Plan* takes an important step forward in reconciling timelines with expected resources; but it also underscores several issues that still will need to be addressed in establishing a stable, executable plan consistent with customer needs:

- Not only are the major facilities upgrades pushed beyond the planning horizon, but both the Uranium Processing Facility (UPF) and Chemistry and Metallurgy Research Replacement (CMRR) facility projects have been suspended pending further assessment.

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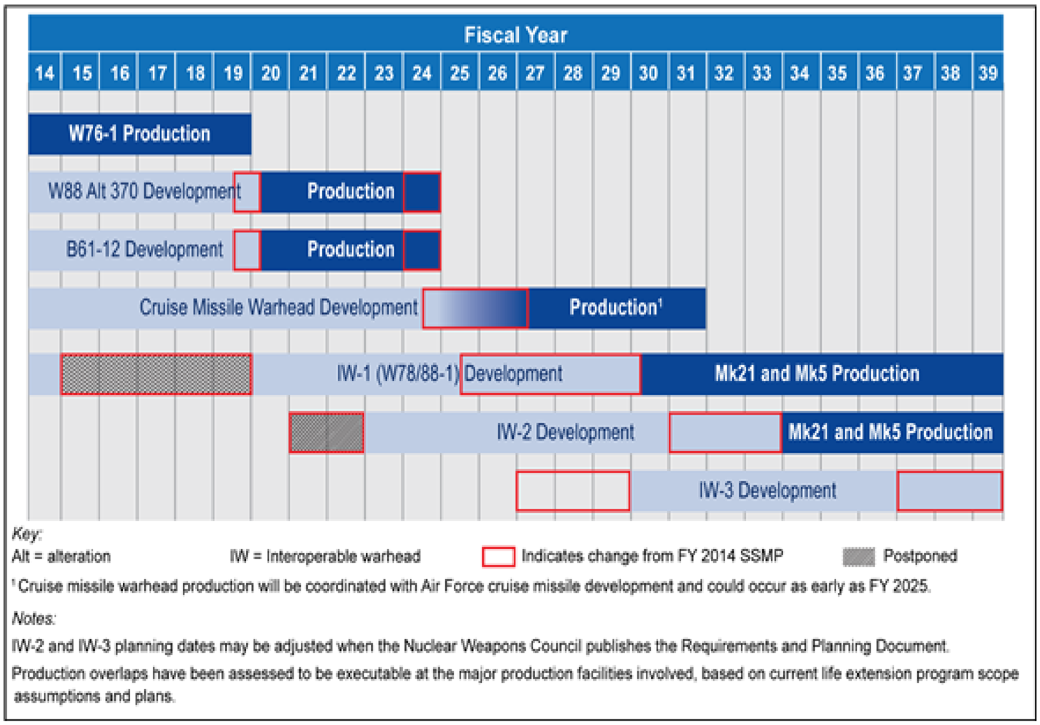
18 This shortfall does not include the full cost of deferred maintenance estimated at about $3.5 billion (see Chapter 3). OSD Office of Cost Assessment and Program Evaluation, "NNSA Governance Discussions: Briefing to the Advisory Panel" (Washington, DC: DOD, December 2013); and Congressional Budget Office (CBO), *Projected Cost of U.S. Nuclear Forces, 2014 to 2023* (Washington, DC: CBO, December 2013**).**

19 U.S. Department of Energy (DOE), *FY2015 Stockpile Stewardship and Management Plan* (Washington, DC: DOE, April 2014).

- The SSMP plans for only limited progress toward reducing the estimated $3.5 billion in facilities maintenance backlog.
- The delivery timelines, as shown in Figure 3, continue a history of frequent revisions and remain significantly in flux; in short, the plan is viewed widely as a qualitative description of programs rather than an executable plan.
- NNSA plans and LEP timelines are still not synchronized with DOD's delivery platform modernization program timelines.
- The SSMP assumes a budget that may not be achievable.



Source: U.S. Department of Energy, *FY2015 Stockpile Stewardship and Management Plan: Report to Congress* (Washington, DC: Department of Energy, April 2014), 2–4.

Figure 3. Current Timeline for NNSA Life Extension Activities

Federal budgeting uncertainties, of course, complicate planning. While the management problems caused by delayed and contentious Congressional budgeting practices are not unique to DOE/NNSA, the budget process has seriously challenged NNSA's ability to plan and manage its array of interrelated activities. Figure 4 shows that since FY01 the Energy and Water appropriation has been passed only twice and signed into law within a month into the new fiscal year. Moreover, in FY09, FY11, and FY13, this did not occur until March or April of the following year. In March of FY13, sequestration cuts came into play. These challenges undermine the ability to manage effectively, but at the same time, an uncertain future makes thoughtful contingency planning even more important. The lack of executable plans with associated resources and mission priorities is a fundamental weakness in NNSA governance.

Fiscal Quarter (& Month) of Budget Approvals Since 2001

	1st Qtr			2nd Qtr			3rd Qtr			4th Qtr		
Fiscal Year	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sept**
FY01	X											
FY02		X										
FY03					X							
FY04			X									
FY05			X									
FY06		X										
FY07					X							
FY08			X									
FY09						X						
FY10	X											
FY11							X					
FY12			X									
FY13						X	Sequestration Cuts →					
FY14				X								

Source: Jay Johnson and K. Aaron Menefee, "LANL Resource Management," 19 November 2013 (updated).

Figure 4. Congressional Appropriations Delays, FY01–FY14

Absence of Follow-Through for Governance Reform

After reviewing the findings and recommendations of the many past studies and reports, the panel finds that there has been no shortage of ideas and initiatives for reform. The problem has been the lack of follow-through. Proposals for personnel reforms, Federal workforce initiatives, re-sizing or re-shaping of the complex's infrastructure, and the enforcement of accountability are examples of well-understood ideas that have not been acted on. Of particular relevance to the panel's work are the detailed internal NNSA plans that were developed but not implemented in the years following the NNSA Act for new governance structures, roles and responsibilities, and staff restructuring.[20] There are no doubt many reasons why all these recommendations and

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[20] NNSA, "Standing up the New NNSA: Management and Organizational Changes," 20 December 2002. Briefing provided to the panel, June 2014.

reform plans were disregarded, but one lesson seems abundantly clear: top-level, national leadership is a critical element necessary for success.[21]

As the following chapters of this report make clear, there are many opportunities available to substantially improve the performance of the nuclear enterprise. Few will be possible without strong national leadership and follow-through. To achieve reform, it will be necessary to consolidate and focus available support to establish the nuclear security missions as a continuing national priority.

RECOMMENDATIONS

To achieve reform and operate successfully, the nuclear enterprise will require focused, consistent leadership and direction from both the Executive and Legislative branches. An effective national leadership construct would generate coherent expectations for the enterprise, reconcile the competing demands across mission areas and agencies and overcome the natural frictions and institutional interests that create divisions. Outlined here are several possible actions the President and Congress could take to better fulfill the needed leadership roles.

Recommendation

1. The President should provide guidance and oversight sufficient to direct and align nuclear security policies, plans, programs, and budgets across Departments.

Presidential guidance to the enterprise is needed in sufficient detail to define objectives within each of its mission areas consistent with customer needs, as well as to balance resources and efforts across missions. The panel therefore sees the need for the NSC and OMB to take a more proactive role in formulating Presidential guidance and shaping budgets for nuclear enterprise programs. A primary objective would be to assure that future budgets and schedules for DOE&NS programs and DOD programs are aligned. This step is especially important to address the strained DOD-DOE relationship that is discussed in some depth in Chapter 5. Parallel actions to strengthen guidance and reviews would be desirable for non-proliferation and other mission areas as well.

Action Items

1.1 The President should reaffirm the importance of the mission and align DOE&NS and DOD priorities through an expanded President's annual stockpile guidance.

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[21] See, for example, DSB, *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills*; and Spies and Warden, *Forging a Consensus for a Sustainable US Nuclear Posture*.

The Nuclear Weapons Stockpile Memorandum and Plan (NWSM/NWSP) has not been provided since 2011 (a 2015 NWSM is in draft). The panel recommends restoring and expanding annual guidance and making it sufficiently robust to convey priorities for the enterprise.

The President's NWSM, when issued, has been narrowly focused on Presidential direction for the specific make-up of the stockpile, delineating numbers and types of warheads. The policy guidance the panel recommends (perhaps in the form of a Presidential Policy Directive) needs to go much further than the current NWSM, directing specific stockpile stewardship work, LEP deliverables, and infrastructure recapitalization as well as recapitalization and modernization work required for DOD's delivery platforms.

The process by which the NWSM is drafted currently involves both Departments; in fact, the process is guided by the statute describing the role of the Nuclear Weapons Council,[22] which the panel recommends be continued in the crafting of this new or expanded directive.

The panel envisions an expansion of the annual directive to specify milestones for progress on life-extended weapons and facility construction projects, linked with the required progress in recapitalizing the strategic ballistic missile submarine, intercontinental ballistic missile, strategic bomber, and dual-capable tactical aircraft forces. Such direction would serve to guide development of the President's Budget, and be reflected in DOD's Future Years Defense Program (FYDP), DOE&NS's Future Year Nuclear Security Plan (FYNSP), and the *Stockpile Stewardship and Management Plan*.

1.2 The President should require annual OMB joint budget reviews to shape and align DOE&NS and DOD programs and budgets.

Combining a review of the DOE&NS nuclear weapons modernization program with the existing OMB joint review of DOD's strategic nuclear modernization programs would assist in synchronizing the programming and budgeting of warheads, delivery platforms, and enterprise capabilities. Linked with the Presidential policy guidance, this review would significantly increase the alignment of plans, programs, and budgets for these complementary programs across Departments.

An OMB review should also serve to end the recent practice of *transferring* top-line budget authority between the DOD and DOE. As is discussed in Chapter 5, these

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[22] Per 10 U.S.C., § 179, para (d)1, "The Council shall be responsible for . . .(1) Preparing the annual Nuclear Weapons Stockpile Memorandum"

transfers have been a source of extraordinary misunderstanding and friction between the two Departments over the past several budget cycles.

OMB should extend this approach to address the nonproliferation and counter-proliferation programs of the DOE&NS, DOD, DHS, and State. These programs have frequently been cited as overlapping and insufficiently coordinated.[23]

1.3 The President should require annual NSC joint program reviews to shape and align DOE&NS and DOD programs and policies.

Similar to the joint OMB budget review, an NSC-led joint program review would help set highest-level policy guidance and priorities for the enterprise. An NSC-led review would help align and synchronize policy and programs, as well as raise the visibility of this mission with both Departments' Secretaries.

Recommendation

2. Congress should establish new mechanisms to strengthen and unify its leadership and oversight of the nuclear enterprise and its missions.

The panel recommends several mechanisms that would strengthen Congressional support and oversight, and better align the efforts of cognizant committees responsible for the nuclear enterprise and its missions. Recommended actions include involving committees with mission responsibilities in confirmation proceedings; involving mission committees in joint reviews of enterprise plans, programs, and budgets; conducting joint committee oversight reviews to ensure effective execution of the budgets, and demanding needed governance reforms with follow-through to support their implementation.

In acting on these recommendations, the panel recommends a Congressional focus on high-level issues affecting the nuclear enterprise, acting in effect as a Board of Directors.

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[23] Government Accountability Office (GAO), *Nuclear Nonproliferation: Further Actions Needed by U.S. Agencies to Secure Vulnerable Nuclear and Radiological Materials* (Washington DC: GAO, 2012), 12–14; and GAO, *Nuclear Nonproliferation: Action Needed to Address NNSA's Program Management and Coordination Challenges* (Washington DC: GAO, 2011), 43–46.

Action Items

2.1 Congress should add Senate Armed Services Committee approval to the confirmation and reporting requirements for the Secretary and Deputy Secretary of DOE&NS (and continue to have the Director, ONS be approved by the Senate Armed Services Committee).

Of foremost importance to the enterprise is the need to establish strong Department leadership in national security for the enterprise. Congress can help ensure this by requiring nominees for the Secretary and Deputy Secretary positions to testify before and be approved by the Senate Armed Services Committee, in addition to the Senate Energy and Natural Resources Committee. The existing process of approval by the Senate Armed Services Committee should be continued for the Director, ONS.

2.2 Congress should require the Secretary to testify annually on the health of the enterprise, and on progress in reforming its governance, to the Senate Energy and Natural Resources and Senate Armed Services Committees, and to the House Energy and Commerce and House Armed Services Committees.

Each of the following chapters of this report identify needed reforms that will require significant national-leadership commitment and follow-through. While much of the difficult work to correct fundamental cultural problems will fall on the shoulders of the enterprise leadership, the most significant reforms will also require strong backing for tough and sometimes politically difficult actions. No approach to reform can succeed without engaged national leadership.

Senate and House Armed Services Committee testimony would help to unify support for needed reforms. Such testimony also would reinforce the Secretary's national security leadership roles outlined in Presidential Policy Directive (PPD)-1.[24] It also would help align the Congress' national security oversight of the enterprise.

2.3 Congress should implement information sharing and collaboration mechanisms to unify and strengthen its mission-focused oversight across cognizant committees and to better harmonize direction and oversight across the enterprise's mission areas.

The nuclear security enterprise would benefit greatly from unified Congressional leadership that sets program direction and provides commensurate resources. Toward this end, the panel has identified a number of potential actions Congress could take to better harmonize its activities. Without endorsing any particular approach, the panel

[24] As stipulated in PPD-1, *Organization of the National Security Council System* (Washington, DC: The White House, 13 February 2009), the Secretary of Energy is a member of the National Security Council and of the NSC Principals Committee.

believes that Congress should act aggressively in its oversight roles to unify priorities, as well as to align plans with resources, across the enterprise mission areas and involved Departments.

First, greater focus could be achieved if involved Members of Congress were to form a community of interest. Such a community could comprise a coalition or a caucus consisting of Members whose committee assignments involve national security or intelligence-related issues, who have other legislative responsibilities or interests that overlap with the enterprise, or who have enterprise facilities in their State/district.

A successful community of interest could expand the number of legislators who can provide informed advocacy and could strengthen coordination among multiple communities. Informal coalition/caucus-led events could enhance interactions among Members and enterprise leaders, outside of the formal hearing process.

In addition, the relevant authorizer and appropriator subcommittees could also exercise the accepted practice of inviting coalition/caucus members to hearings as another tool to deepen awareness and knowledge among a larger number of legislators as well as across jurisdictional lines.

Second, Congress could strengthen information-sharing and collaboration across mission areas by formally designating a limited number of joint committee memberships across responsible authorization and appropriations subcommittees. As an example, this practice in the past has served to help increase the coordination of priorities for the Intelligence Community among the Defense and the Intelligence subcommittees. Among the Energy and Water and the Defense Appropriations subcommittees for nuclear enterprise issues, this practice has produced stronger involvement of legislators in, and understanding of, the mutually-dependent relationships of the two Departments. Formalizing this practice of dual-assigning legislators would encourage what is now a useful, but informal, practice.

Third, a stronger form of collaboration could be achieved if Congress were to conduct annual joint authorization and appropriations subcommittee reviews of major nuclear security programs. Joint reviews would enhance communication and improve the coordination of policy and appropriations guidance and oversight. Such a joint review could be a key mechanism to align congressional positions and to follow up on enterprise reforms. This review process could also culminate in a meeting of the Chairman and Ranking Member of each pair of subcommittees to resolve any substantive differences before the authorization bill and appropriations bill go to full committee.

Fourth, and finally, many experts have advocated shifting appropriations authority for nuclear weapons programs and Naval Reactors to the Defense subcommittees of the House and Senate Appropriations Committees. The alignment of appropriations jurisdiction would help to synchronize the major modernization investments that

DOD will make for delivery platforms with the DOE&NS investments needed to modernize warheads.

The panel took differing views on the fourth idea. The Proponents note that this approach is consistent with previous actions where Congress has realigned committee jurisdiction to unify the oversight of important activities. For example, congressional appropriators, seeing the compelling need to align and synchronize the resourcing of all U.S. development efforts overseas, galvanized by ongoing development campaigns in Afghanistan and Iraq, brought together in one subcommittee what was previously bifurcated appropriations authority for funding the State Department and "Foreign Operations" (security assistance, foreign military funding, and development assistance). This action served to enhance the cooperation and collaboration underway by State and Defense assets on the ground. The resulting Senate and House "State, Foreign Operations, and Related Programs" appropriations subcommittees are evidence of successful jurisdictional shifts to unify two Departments' efforts to meet emerging needs. In a similar way, there would be significant advantages in joint congressional oversight for the nation's strategic nuclear weapons and platforms in combination with DOD's conventional space, cyber, non-proliferation, and missile defense programs. Such integration would better synchronize the resourcing of weapon systems and warheads as part of the larger national security portfolio.

The opponents to the fourth idea were of the view that this action would create a seam between the weapons programs and other DOE programs, which would be counter to the goal of solidifying the Department's ownership of the nuclear security missions. The panel therefore includes this step as a consideration, along with all the potential actions Congress could take, rather than as a specific recommended action.

2. Solidify Cabinet Secretary Ownership of the Mission

Diversity in counsel; unity in command.

–Cyrus the Great

CHALLENGES

Despite the intent of the NNSA Act to create a *separately organized* NNSA *within* DOE, the Act as implemented did not achieve the intended degree of clarity in enterprise roles and mission ownership. NNSA was not provided the line management authority necessary to execute NNSA's missions; nor was an effective policy implementation framework established.[25] In retrospect, this outcome perhaps should come as no surprise: no Cabinet Secretary could be expected to relinquish control over a mission that constitutes over 40 percent of his or her Department's budget; that presents significant environmental, safety, and security risks associated with potential management failures; and that produces a nationally strategic capability—a capability for which he or she is personally responsible to annually certify its safety, reliability, and performance to the President.[26]

An important weakness of the Act is that it proposed organizational changes designed to insulate NNSA from DOE headquarters without specifying the Secretary's ownership roles, without stipulating the relationships between NNSA and DOE headquarters staffs, and without requiring actions to shift the Department's culture toward a focus on mission performance.[27] The

[25] "…NNSA and DOE have not fully agreed on how NNSA should function within the department as a separately organized agency. This lack of agreement has resulted in organizational conflicts that have inhibited effective operations." GAO, *National Nuclear Security Administration: Additional Actions Needed to Improve Management of the Nation's Nuclear Programs* (Washington DC: GAO, 2007).

[26] In accordance with § 3141 of the FY03 NDAA, each of the three nuclear Laboratory Directors and Commander, U.S. Strategic Command are required to provide a letter with their assessment of the safety, reliability, and performance of each type of weapon in the nuclear stockpile. The Secretary of Energy and Secretary of Defense must forward these letters to the President unaltered, and must also provide their conclusions on these three factors. As noted in GAO, *Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile* (Washington, DC: GAO, February 2007).

[27] During the establishment of NNSA, the leadership undertook to draft a Functions, Roles, and Authorities Manual to clarify how the NNSA management system should work. A draft was completed in 2005, but it has

panel concludes that the relationships among NNSA, the Secretary of Energy, and the DOE headquarters are not properly aligned with mission needs today, and are in need of major reform. As implemented, the NNSA Act has actually been counter-productive. The problems fall into three main areas.

Overlapping DOE and NNSA Headquarters Staffs

As the result of the Department's implementation decisions, DOE headquarters mission-support staffs have continued to exercise oversight of NNSA—acting in parallel with the counterpart staffs in NNSA. The NNSA Act specified that NNSA would be "separately organized," in order to provide the NNSA Administrator with headquarters staffs independent from those in DOE. NNSA staffs were established in functional areas such as General Counsel, Human Capital management, Public Affairs, Legislative Liaison, Chief Financial Officer, Environment, Safety and Health (ES&H), Security, and Chief Information Office.

Despite the creation of NNSA's parallel staff structure, the DOE established management processes requiring that major NNSA decisions and initiatives would remain subject to myriad DOE headquarters staffing processes.[28] This was possible because, despite the legislative intent to insulate NNSA from DOE headquarters staffs, the legislative provisions provided the opportunity for the Department to adopt its own interpretation of the Act.[29] Members of both the DOE headquarters and NNSA staffs point to the inefficiencies this creates.[30]

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not yet been adopted. See, NNSA, "NNSA Matrix of Functions and Activities by Location (Revision 3)," February 2005. Briefing provided to the panel, June 2014.

28 Unlike the Executive Order for Naval Reactors, the NNSA Act does not provide a blanket exemption of NNSA from DOE orders and directives, nor does it clearly designate NNSA as the risk acceptance authority for nuclear enterprise activities. For instance, the DOE order known as the *Departmental Directives Program* (DOE O 251.1C) requires policies, orders, notices, guides, and technical standards to be reviewed by a Directives Review Board chaired by the Director of the Office of Management. Senior representatives from the three Under Secretarial offices, the Office of General Counsel, and the Office of Health, Safety and Security (HSS) all serve as members whose concurrence is needed before final issuance. Should the review board be unable to reach consensus, the Deputy Secretary decides whether to approve or disapprove the position proposed by the directive's responsible staff office. See U.S. Department of Energy, *Departmental Directives Program*, DOE O 251.1C (Washington, DC: Office of Management, 15 January 2009).

29 DOE and NNSA define and govern their relationship based on legislation that does not unequivocally assign policy and risk acceptance authority. Section 7144 of 42 U.S.C. Chapter 84 reads, "The Secretary shall be responsible for establishing policy for the National Nuclear Security Administration" and "The Secretary may direct officials of the Department…to review the programs and activities of the Administration and to make recommendations to the Secretary regarding administration of those programs and activities, including consistency with other similar programs and activities of the Department." Section 7144(a) further states that, "The Secretary shall be responsible for developing and promulgating the security, counterintelligence, and intelligence policies of the Department." These statutes conflict with § 2402(b) of 50 U.S.C. Chapter 41, which declares, "The Administrator has authority over, and is responsible for, all programs and activities of the Administration…including…(2) Policy development and guidance…(6) Safeguards and Security…(9)

Confused Roles, Responsibilities, Authorities, and Accountability

Officials working within DOE and NNSA have cited the corrosive effects that result from the lack of understanding of responsibilities among DOE, NNSA headquarters, the field offices, and the M&Os. In sum, the current structure is one where many people can say no, but too few can say yes. Some mission-support organizations view their role as a mission rather than as important support functions to facilitate safe and secure mission achievement. As a consequence, some organizations responsible for mission-support functions often operate independently of line management. As one field representative put it, "We suffer in a regulatory framework where there are no clear lines of appeal or decision making and no integrated place for the cost-benefit analysis to be done. For example, regarding facility safety and operational infrastructure, I get direction from the Office of Acquisition and Project Management, the Defense Programs leadership, the leadership for infrastructure management, DOE headquarters…. How am I to do my job when getting direction from five different organizations?" Outcomes often are determined through interactions among competing interests. One illustrative example is Sandia's Building 840, which was re-purposed for B61 LEP testing support and evaluation. During just one year of this effort, January 2012 to January 2013, the funding profile was modified five times by various DOE/NNSA authorities, frequently resulting in inefficient work stoppages.[31]

The operational consequences are magnified by a risk-averse culture in which the penalties of being responsible for a wrong (albeit well-intentioned) decision are far greater than any rewards for taking initiative. Because issues and decisions are staffed through multiple layers of headquarters staffs pending resolution, at a pace set by the staffs, the staffing structure itself tends to skew incentives toward delay and excessively conservative approaches at the DOE headquarters level. As noted in a recent report of the National Research Council, mission-support personnel are able to assess the risk of doing an experiment, but are not able to balance this against the countervailing risk of *not* doing an experiment.[32] This tendency is amplified in those areas where mission-support organizations improperly view their role as a mission rather than as an important support function to facilitate safe and secure mission achievement. The combined effect is to create strong and counter-productive incentives to delay action and to

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Environment, safety, and health operations" and § 2402(d), which states "the Administrator can establish NNSA-specific policies unless disapproved by the Secretary."

30 Earlier studies arrived at this conclusion as well. "Implementation of the NNSA Act failed to achieve the intended autonomy of NNSA within DOE." Elizabeth Turpen, *Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century* (Washington, DC: Stimson, 2009). "The governance structure of the NNSA is not delivering the needed results. NNSA has failed to meet the hopes of its founders. It lacks the needed autonomy." Strategic Posture Commission, *America's Strategic Posture*.

31 Sandia, *Building 840 Approval Process* briefing during the panel's fact-finding visit to Sandia.

32 National Research Council, *The Quality of Science and Engineering at the NNSA National Security Laboratories*, 3.

eliminate all risks—large and small—rather than seeking to effectively manage the most important ones.

Given the sensitivity of nuclear activities in such areas as security, safety, health, and environmental stewardship, it should be emphasized that the panel's intent is to strengthen these aspects, not diminish them. It does so by proposing that line management be held responsible for these activities, in addition to producing primary mission deliverables. In doing so, line management is to be supported by specialists, but not subject to their direction.

Flawed DOE Processes for Risk Management

Because DOE regulates a wide variety of operations, its orders are often written broadly to apply to both nonnuclear and nuclear activities even though each may demand special considerations. Consequently, DOE orders for ES&H and security often lack the precision, consistency, and clear implementing guidance necessary to translate the order's intent into practice. Not all sites have the same version of DOE orders for ES&H and security policy reflected in their contracts. Indeed, there are sites that have both NNSA and DOE orders in their contract covering the exact same ES&H topic; although these orders may be similar, they can contain subtle, but crucial, differences.[33]

The ambiguity in applicable standards is compounded by the Department's lack of a clear mechanism for defining and accepting risks. In the current DOE/NNSA structure, there is no clear mechanism or single responsible official (below the Secretary) for assessing and accepting risk. In contrast, other more formally structured regulatory bodies, such as the Nuclear Regulatory Commission or the Occupational Safety and Health Administration, have processes for clarifying the intent of their regulations and resolving operational issues as they arise, including disciplined risk analysis and risk acceptance procedures. Field participants see the lack of such processes in DOE and NNSA as a key impediment. As one laboratory participant stated, "Even if the lab has a rock-solid technical justification for its design, there is not a central point of contact in NNSA for adjudicating and getting a final decision on a safety-based design change." The frustration is evident: "This process takes a long time; it shouldn't be this hard. And, in this process, there is never any link to cost or mission."

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33 For example, DOE O 473.3 Attachment 3, *Physical Protection*, states that corrective maintenance of security system elements must be initiated within specified times frames depending on their level of importance and degree of deterioration. NNSA NAP 70.2 *Physical Protection*, while overall levying many of the same requirements as DOE 473.3, requires instead that the contractor just develop a maintenance prioritization plan. An additional example can be found in exemptions to nuisance and false alarm rates. DOE O 473.3 allows minimum nuisance and false alarm rates to be exceeded, "if the alarms can be assessed at all times, either visually or by CCTV" and "do not degrade system effectiveness." NAP 70.2, despite having the same minimum rates as DOE O 473.3, does not contain this exemption.

The Department's inability to deal analytically with risk acceptance decisions is sharply illustrated by a case involving the Microsystems and Engineering Sciences Application (MESA) complex at Sandia. In this case, there are well-established commercial standards for occupational exposure limits to arsine, a hazardous gas, which is common in such fabrication facilities. When practical, MESA has set gas monitors to alarm at levels below accepted industrial standards in order to increase safety margins. In 2007, when MESA lowered its detection limit for arsine by an order of magnitude, frequent false alarms soon occurred, which resulted in building evacuations that significantly impacted operations. Consequently, Sandia proposed to raise the detection limit to a value that was still both code compliant and within the stable operating space of the gas monitors. In the end, it took more than a year and thirteen false alarms before DOE accepted this revised detection limit.

Such weaknesses in risk analysis and risk acceptance decision making also have significantly undermined the DOE/NNSA's ability to engage effectively with the Defense Nuclear Facilities Safety Board. Congress chartered the DNFSB to provide independent nuclear safety oversight, by identifying safety concerns and raising issues with respect to the DOE's implementation of its own orders. At the same time Congress has recently stated that, "it is incumbent upon the Secretary to reject or request modifications to DNFSB recommendations if the costs of implementing the recommendations are not commensurate with the safety benefits gained." [34] Given the statutory role of the DNFSB to identify any shortcomings in implementation, and the seeming lack of a DOE analytical capability to effectively evaluate options to respond to the Board's findings or recommendations, the DNFSB exerts a dominant influence over DOE's risk management in nuclear safety policies and programs. In essence, it becomes a de facto regulatory arm. Even when the DNFSB engages informally, it exerts enormous influence, which can cause DOE staff to over react.[35]

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34 "Joint Explanatory Statement to Accompany the National Defense Authorization Act for Fiscal Year 2014," Congressional Record 159: 176 (12 December 2013), H7968.

35 One example of a costly DOE interpretation of requirements can be found in the categorization of the Joint Actinide Shock Physics Experimental Research (JASPER) facility as a nuclear facility. JASPER was developed by Lawrence Livermore National Laboratory (LLNL) at the Nevada National Security Site (NNSS) to conduct shock physics experiments to explore the fundamental properties of plutonium including its equation of state. JASPER is a two-stage, light-gas gun that shoots projectiles at plutonium targets at a velocity of 1–8 kilometers/second, inducing very high pressures in the material. JASPER supports the stockpile stewardship program by providing important physics data regarding nuclear warhead primary certification, dynamic materials properties, and pit lifetime studies.

Experiments at JASPER typically employ targets using a few tens of grams of plutonium. The target is enclosed in a Primary Target Chamber (PTC) that is designed to entomb the expended material while surviving the resulting stresses so that receipt of data from the experiment is assured. A Secondary Confinement Chamber (SCC) provides a redundant, engineered passive safety feature to preclude the release of radioactive material should the PTC fail to contain radioactive debris.

JASPER began operations in 2000 as a radiological facility. In 2007, after some debate within the DOE and with DNFSB staff (albeit not based on a DNFSB finding), the facility was categorized as a higher-risk Hazard

RECOMMENDATIONS

As directed by Congress, the panel explored a range of options for an organizational structure that would address the problems created in establishing NNSA. Several alternative structures were developed and assessed. (A discussion of the structural options considered by the panel is provided in Appendix E). The panel concludes that the nuclear enterprise would be most effective in performing its missions if it were led by an engaged Cabinet Secretary with strong national security credentials. Hence, the solution is not to seek a higher degree of autonomy for NNSA, because that approach would further isolate the enterprise from needed Cabinet Secretary leadership. Instead of attempting to more completely insulate the nuclear enterprise from the Department, or place the enterprise elsewhere in the government, it is recommended that Congress place the responsibility and accountability for the mission squarely on the shoulders of the Secretary, supported by a strong, well-qualified enterprise Director with unquestioned authority to execute nuclear enterprise missions consistent with the Secretary's policy direction—with accountability for doing so clearly delineated throughout the enterprise.

Every other alternative has significant weaknesses.

- The panel first considered the option of reorganizing DOE/NNSA within the Department in order to strengthen NNSA's autonomy (effectively, an improved status quo). This was rejected because numerous studies and the panel's own fact-finding revealed that the current *separately-organized* approach, as implemented, is fundamentally flawed, and that adjustments to this model are not sufficient to correct either the structural or cultural problems.
- The panel also explored the model of NNSA as an independent agency. The panel concluded that a mission of this importance to U.S. national security requires Cabinet-level ownership and support.
- The panel also evaluated three variants of a greater role for the Department of Defense. In each case, there is considerable uncertainty about DOD's willingness and ability to integrate and support an organization with a very different scientific and civilian culture.

Category 3 nuclear facility. Apparently, this determination was based on the quantity of "material at risk," not taking into account the use of the facility and the redundant containment during experiments. As a result, the facility incurred increased costs from additional quality assurance needs for equipment and extensive new safety basis requirements, which, absent increased funds, resulted in reduced scientific output. In 2011, the NNSA decided to review its 2007 decision and consider the recategorization of JASPER as a radiological facility to save costs while providing an opportunity to carry out more experiments. That review, so far, has not resulted in any changes.

Categorization of JASPER as a nuclear facility must be questioned. Adherence to standards and controls that are time consuming to implement and that must be applied to the entire facility add significant operational costs without commensurately enhancing the safety of the public or experimental personnel.

As discussed in the following recommendations, it will be vital to clarify this Director's line-management authority by making it abundantly clear that mission direction and risk acceptance authorities are to be vested with the Director. This option also assumes fundamental management reforms are achieved within DOE, along with changes beyond DOE and NNSA—including within the White House and Congress.

An approach to achieve these objectives is outlined in the panel's recommendations (3, 4 and 5). The proposed roles and authorities of the Secretary and Director are summarized in Table 2 and detailed in Appendix C.

Recommendation

3. Congress should amend the NNSA Act and related legislation to clarify Departmental leadership roles.
- **The Secretary "owns" the nuclear enterprise missions, sets Departmental policy for the nuclear enterprise, and is accountable to the President and Congress for the enterprise.**
- **The Director, Office of Nuclear Security (ONS) has full authority to execute the nuclear enterprise missions consistent with the Secretary's policy.**
- **Departmental mission-support staffs advise and assist the Director in executing enterprise missions.**

A range of actions are outlined to ensure appropriate leadership and to provide key authorities and statutory responsibilities.

Action Items

3.1 The amended legislation should specify the Secretary's leadership responsibilities and define duties that underscore the Secretary's accountability for the nuclear enterprise and its missions.

The amended legislation should stipulate that the Secretary sets Departmental policy and priorities for the mission, while conveying full authority to the Director for executing the mission. Further, the Secretary should be responsible to ensure that Departmental mission-support staffs serve the Director effectively in the execution of the mission.

The Secretary must possess a national security background sufficient to be confirmed by both the Senate Energy and Natural Resources and Senate Armed Services Committees. The Secretary's accountability is emphasized by stipulating annual mission reviews with Presidential staff and oversight committees of Congress.

3.2 The amended legislation should create the Office of Nuclear Security (ONS) within the Department to perform the missions currently assigned to NNSA.

In establishing ONS, the "separately organized" provisions in the NNSA Act should be removed. This will enable the Secretary to eliminate the overlapping DOE and NNSA headquarters staffs, and create a more effective and efficient ONS. Key to the success of this structural change is the clear understanding that a single set of DOE&NS mission-support staffs will serve the ONS mission, but will serve under the operational leadership of the Director. In addition, this approach will require the clear delineation of the responsibilities and authorities of the Secretary and Director, ONS as summarized in Table 2, and explained in the other recommendations and action items in this Chapter.

3.3 The amended legislation should designate a Director, Office of Nuclear Security with full authority to execute nuclear enterprise missions under the policy direction of the Secretary. The Director should have tenure of at least six years, be compensated at the rate of Executive Schedule Level II, and hold the Departmental rank of a Deputy Secretary or Under Secretary.

If the Director is to succeed with the ONS organizational structure, roles and authorities need to be made crystal clear. The panel sees several attributes as essential for success: To provide needed seniority and continuity of leadership, the Director should have the rank of Deputy Secretary or Under Secretary, be compensated at the rate of Executive Schedule Level II with a minimum six-year term. The Director should have full authority and accountability for the ONS mission, consistent with the Secretary's policy, including serving as the risk acceptance authority for environment, safety, health, and security matters. The Director should have direct and unfettered access to the Secretary as required to execute the ONS mission. The Director should also have direct access to the President on matters critical to the ONS's missions, such as the safety, security, and reliability of the nuclear stockpile, non-proliferation, and counter-proliferation concerns.

The panel judged these attributes of the Director to be paramount in empowering a leader capable of executing all aspects of the mission and reforming the enterprise's culture. The panel recommends that the Director serve concurrently as a second Deputy Secretary in the Department or as an Under Secretary. While the panel did not agree on the appropriate rank, it does agree that this question of rank is less essential for success than is establishing an effective working relationship with a knowledgeable, engaged Secretary and providing the Director all the necessary authorities as described above. As a result, the panel notes the potential options but offers no recommendation on this one specific issue.

Table 2. Proposed Departmental Roles and Authorities

Secretary of Department of Energy and Nuclear Security (DOE&NS)
• The Secretary is assigned full ownership of and accountability for the nuclear security missions • The Secretary sets Departmental policy and priorities for executing nuclear security missions, conveys full authority to the Director for executing the missions, and ensures Departmental mission-support staffs serve the missions effectively • The Secretary's nuclear security roles and needed background are emphasized by requiring confirmation hearings with both the Senate Energy and Natural Resources and Senate Armed Services Committees • Annual mission reviews with Presidential staff and oversight committees of Congress emphasize the Secretary's accountability • The importance of the enterprise and its missions is signified by renaming the Department the Department of Energy and Nuclear Security
Director, Office of Nuclear Security (ONS)
• The Director has full authority to execute the nuclear security missions under the policy established by the Secretary, and therefore must possess strong technical management capabilities • For leadership and continuity, the Director's position is an executive schedule II with a tenure of at least six years (subject to Presidential review); The Director shall be assigned the rank of Deputy Secretary or Under Secretary of DOE&NS. • The Director is provided direct access to the President on issues critical to ONS's missions, such as nuclear stockpile safety, security, and reliability; non-proliferation, etc. • The Director is provided direct access to the Secretary on all ONS matters; he advises the Secretary on all Departmental policies as they affect the nuclear security missions and recommends responses to findings and recommendations of advisory/oversight groups • The Director is assigned risk acceptance responsibility and authority on ONS matters, taking full responsibility and accountability for executing the Secretary's policies for nuclear security missions o Mission-support staffs advise the Director on risk-acceptance decisions o Any disagreements between line managers and mission-support staffs are quickly raised through an appeals process to the Director for adjudication and decision (and in rare cases where resolution is not reached, to the Secretary) • The Director has full authority to shape and manage the ONS technical staff; Existing political appointments beneath the Director are converted to Director-appointed Senior Executive Service or Excepted Service positions • To eliminate redundancies, ONS receives mission support from Department headquarters staff functions; the Director provides input on performance evaluations for mission-support staff personnel.

3.4 The amended legislation should assign risk acceptance authority and accountability to the Director for ONS mission execution.

The Director must ensure there is a formal, documented process for assessing and accepting risks in implementing the Secretary's policies. In addition the Director must inform the Secretary of any high-risk conditions. This process should result in consistent implementation of the Secretary's policies, while allowing for informed and purposeful risk acceptance decisions by the Director. Similarly, the Director must be accountable to inform the President of any high-risk conditions relating to the safety, security, or reliability of the stockpile.

The Director should establish an analytical capability for evaluating reasonable risk-reduction alternatives in executing missions, so that informed decisions are made and those decisions can be documented. (See Action Item 5.1)

3.5 The amended legislation should grant the Director authority to appoint senior officials in ONS, including the conversion of three Senate-confirmed direct-report positions (Principal Deputy, Assistant Secretary for Defense Programs, and Assistant Secretary for Non-Proliferation Programs) to Senior Executive Service or Excepted Service positions.

Congress should grant the Director full authority over the key, senior management positions in ONS. These include the direct reports to the Director: the Deputy Directors and the government field office managers.

To enact this recommendation and to ensure the Director has unambiguous authority and accountability for execution of the nuclear security mission, Congress should **e**liminate the Presidential appointment and Senate confirmation of the Principal Deputy Administrator (NA-2), the Deputy Administrator for Defense Programs (NA-10), and the Deputy Administrator for Defense Nuclear Nonproliferation (NA-20). These positions should be restructured as Senior Executive Service or Excepted Service positions and filled under the sole authority of the Director.

The ONS should adopt, whenever permitted by law, the personnel management philosophy and practices observed in the successful organizations benchmarked for this review. In such organizations, recruitment, career management, and the growth and development of future leaders is a top leadership priority.

3.6 The amended legislation should emphasize the importance of the nuclear enterprise missions, by changing the name of the Department to the "Department of Energy and Nuclear Security."

The new name highlights the prominence and importance of the Department's nuclear security missions, recognizes that greater than 40 percent of the Department's budget is devoted to these missions, and stresses the importance of the needed cultural change. The Secretary of Energy would similarly be renamed the "Secretary of Energy and Nuclear Security." The intangible value of this recognition of reality will, in the panel's view, far outweigh the financial costs of its implementation.

Recommendation

4. The Secretary should implement Departmental management processes that specify the Director's authorities for executing nuclear enterprise missions. These authorities include:

- **Line management authority for the safe, secure, and environmentally responsible execution of nuclear security missions**
- **Management authority for mission-support staffs assigned to the Office of Nuclear Security**
- **Concurrence authority for Departmental rulemaking on ONS matters**

In addition to the legislative actions outlined in Recommendation 3, it will be essential for the Secretary and the senior Departmental leadership to create an effective management structure. Decision-making structures are needed that ensure the Director has the authorities necessary to execute his responsibilities for the nuclear missions.

Action Items

4.1 The Secretary should establish decision-making practices among the senior headquarters staffs that codify the Director's authority to execute the nuclear security missions consistent with the Secretary's policies.

The Secretary owns the nuclear security missions within the Department and sets policy. The Secretary's actions must reinforce the authority of the Director, who is responsible for implementing that policy.

A management system is needed that will codify the Director's authority to execute the Secretary's policies without undue intervention or interference from other senior officials. This will require the incorporation of three attributes:

- The Secretary conveys to the Director and his ONS line managers the authority to execute nuclear enterprise programs in accordance with the Secretary's policies. In executing their mission responsibilities, the line managers are responsible for meeting the Department's policies and standards for all the mission-support functions, including such areas as ES&H, security, financial integrity, and personnel management.
- The Director and the ONS line managers must seek the support and advice of mission-support functional experts in executing ONS responsibilities, but remain responsible to make the decisions on program execution and the acceptance of risk and program decisions.

- Where disagreements arise between line managers and mission-support functional experts, a structured process is established to raise the issue for disagreement—first to the Director and senior mission-support officials and then, if need be, to the Secretary.

The current DOE organization chart in Figure 5 identifies the major senior officials who must be considered in establishing the needed decision-making process. Roles and authorities (and issue resolution mechanisms) must be made clear with respect to the four most senior officials reporting directly to the Secretary, including the Deputy Secretary and three Under Secretaries. Mechanisms also must be put in place to ensure each mission-support function effectively supports ONS. Several mission-support officials are placed under the Under Secretary for Management & Performance, including in the functional areas of policy making for environmental, safety, health, and security matters; human capital management; and the Chief Information Officer. Other officials head mission-support functional offices reporting directly to the Secretary, including General Counsel, Chief Financial Officer, Intelligence and Counterintelligence, Public Affairs, and Congressional Liaison.

In presumably rare cases where major conflicts exist between line management's decisions and the staff element's view of its responsibilities, the issue should be promptly elevated to the Director, ONS for resolution. This will reduce the number of personnel who can delay or stop mission execution and enhance risk-informed decision-making at the lowest appropriate management level.

In establishing these headquarters management practices, the Department could benefit from the examples of successful organizations benchmarked for the panel's review. The best practices employed in the benchmarked organizations include a senior management process that codifies roles and relationships among the top officials and their staffs, ensures the free flow of information up and down the chain of command, identifies issues requiring top management attention, and fosters the timely, decisive adjudication of issues.

4.2 The Secretary should establish a matrix management structure that

- **Aligns and codifies roles, responsibilities, authority, and accountability**
- **Specifies the Director's leadership authority over line-management and mission-support ("functional") staffs assigned to ONS**
- **Eliminates overlapping headquarters staffs**

An essential step in establishing the needed matrix management structure is the alignment and systematic documentation of roles, responsibilities, authority, and accountability. Individuals at all levels should understand their roles and their contributions to mission execution. This should be done in a manual available to everyone working within the nuclear security enterprise.

The Secretary should stipulate that the Director, ONS shall receive support from the Department's mission-support staffs in order to eliminate redundancies, reduce costs, and leverage best practices. To make this approach work effectively, the Secretary must establish suitable management structures and processes to ensure that the Director can interact with and draw upon the skills and expertise across line-management staffs and these DOE&NS mission-support elements.

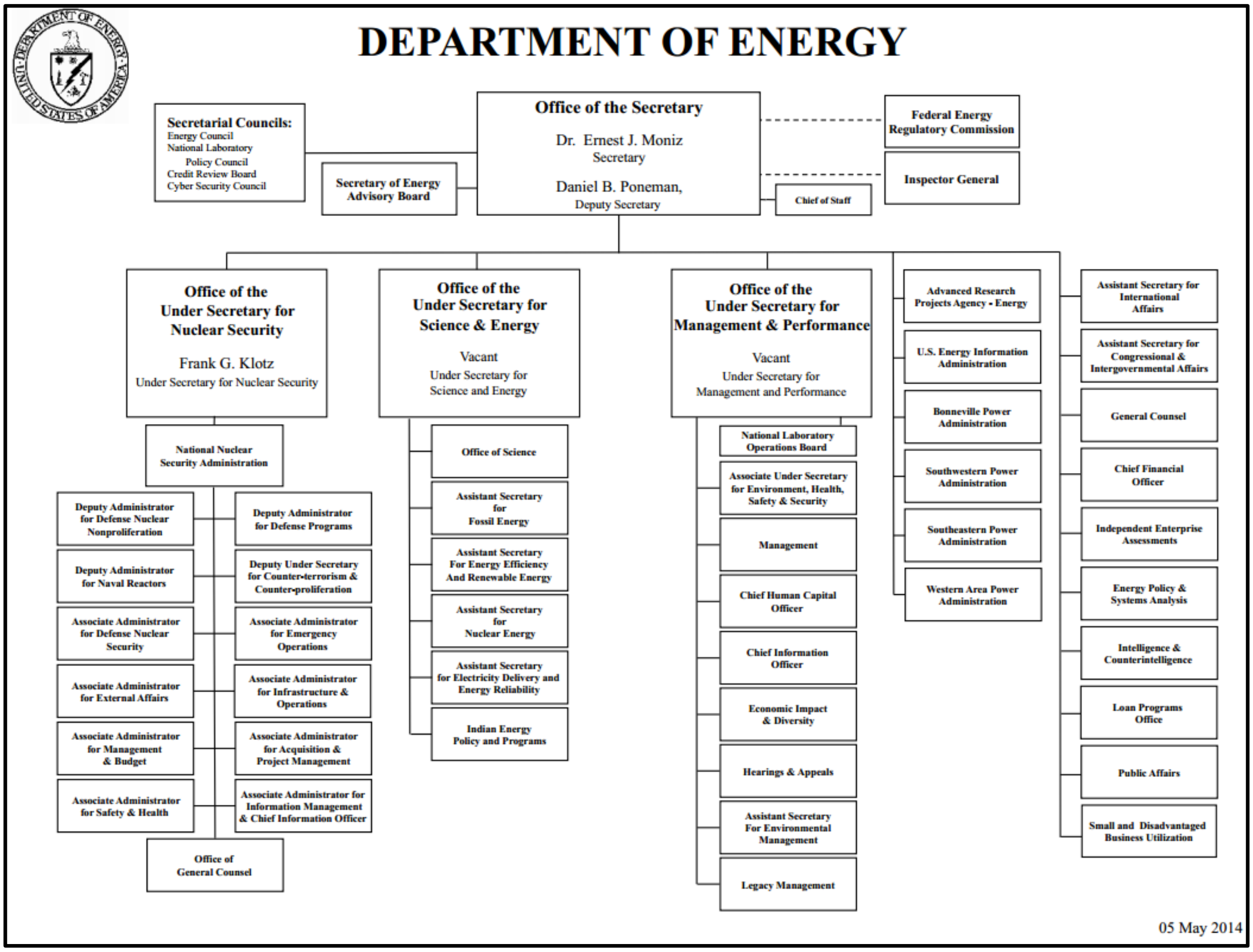

Figure 5. Current Department of Energy Organization

An effective personnel management system is essential. The Director should have input on performance evaluations for those mission-support staff personnel assigned to assist ONS. The Director further should have the authority to approve or dismiss assigned individuals. In addition, those DOE&NS functional staff directors responsible for the functional communities who provide matrix support to ONS must be accountable to the Secretary to ensure their organizations' responsibilities are executed in support of nuclear security missions.

While mission-support staffs serve primarily to support and advise line managers, there must be a mechanism that allows functional experts to question and appeal the decisions of the line managers. Such a mechanism needs to elevate issues quickly to the appropriate authorities for resolution, as described in Action Item 4.1.

4.3 The Secretary should adopt processes defining the Director's role in ensuring applicable DOE&NS policies, rules, and orders are compatible with the operating circumstances of the nuclear security enterprise.

Decision-making mechanisms should provide the Director a role in reviewing and approving all Departmental policies affecting ONS and enterprise missions, especially ES&H and security rules. As a model for this, the Department can build on its recent initiative to create a committee to coordinate the development of security policy.[36] Structured effectively, this committee should enable the Secretary to unify overall security strategies and policies, while allowing the tailoring of requirements to unique operating environments. By adopting a similar review and tailoring of policies and regulations across all mission-support functional areas, the Secretary could ensure that rules and orders applicable to the nuclear enterprise are subjected to careful analysis, with the goal of providing strong regulatory standards consistent with the effective and efficient operations of the enterprise.

4.4 The Secretary should designate those senior headquarters positions that have line-management decision authorities and those that are responsible for mission-support functions.

To complement the decision mechanisms outlined in Action Items 4.1, 4.2, and 4.3, the Department will need to create a manual that clearly defines and codifies roles, responsibilities, authorities, and accountability.

Recommendation

5. The Secretary and Director should reform DOE regulation to strengthen risk management.

It is imperative that existing rulemaking practices and execution oversight be overhauled so that risk is better assessed and balanced with the needs of mission execution.

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[36] DOE's recent reorganization established a Chief Security Officer for each of the Under Secretaries with the responsibility for implementing security policy in their respective facilities. These Chief Security Officers will form a new Departmental Security Committee responsible for developing the Department's security strategies and policies. The goal is to establish common rules and orders with tailoring as needed to fit unique operating circumstances.

Action Items

5.1 The Secretary should strengthen the Department's analytical expertise and processes for assessing risks, especially for nuclear and other high-hazard functions.

The Secretary should ensure that the Department has strong, technically qualified mission-support staff and should expand that capability if needed in order to make risk-informed decisions in line with mission execution, and to properly consider external oversight and advice (such as that of the DNFSB) during decision making.

5.2 The Secretary should direct a comprehensive review and reform of the Department's ES&H and Security Orders and Directives to reflect best industry practices.

The purpose of the recommended review is to clarify roles and responsibilities; remove ambiguity from requirements; expand the use of national- or international-consensus standards (e.g., International Organization for Standardization [ISO] certifications, OSHA, National Industrial Security Program) where appropriate and not already in use. The orders and directives should account for unique nuclear and high-hazard conditions and requirements that may demand special consideration or instructions (e.g., in the use of beryllium); and they should establish performance-based, risk-informed guidelines.

5.3 The Secretary (with Congressional concurrence) should establish a mechanism to improve the Department's ability to respond to inquiries, findings, and recommendations of the Defense Nuclear Facilities Safety Board.

The DNFSB serves an important external advisory function for the Secretary and Congress. The Department needs to improve its ability to interact effectively with the board. To this end, Congress should amend legislation governing the forwarding of Recommendations from the DNFSB (as described in 42 U.S.C. Sections 2286a and 2286d (2006)) to require that DNFSB recommendations relating to ONS activities be transmitted to the Director at least thirty days before the recommendations are transmitted to the Secretary, unless the DNFSB determines that a safety issue needs the immediate attention of the Secretary.

3. Adopt Proven Management Practices to Build a Culture of Performance, Accountability, and Credibility

Culture eats strategy for breakfast.

–Peter Drucker

CHALLENGES

In addition to the leadership and structural challenges outlined in the preceding chapters, the nuclear enterprise is greatly burdened by DOE/NNSA's counter-productive management culture. One senior NNSA official summed up the current situation as follows: "An effective management system is timely, accurate, and simple; our NNSA system is none of these." Participants at all levels report that DOE/NNSA lacks a unifying focus on mission deliverables. Much of the dysfunctional behavior reported to the panel reflects an absence of trust and mutual respect, internal and external to the enterprise. Until effective management practices are institutionalized and such counter-productive behaviors are reversed, narrow bureaucratic interests will dominate, "turf battles" will persist, and the morale of the workforce will continue to erode.[37] To begin the process, a major cultural overhaul will be needed to align the structure, resources, and decision processes with mission priorities.

To assess the current situation, the panel identified a number of proven management characteristics common to successful high-risk, high-technology operations. These characteristics, summarized in Table 3, draw on benchmarking activities documented in Appendix F.

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37 See, for example, Sonja B. Haber et al., "An Evaluation of Organizational Safety Culture at the U.S. Department of Energy National Nuclear Security Administration" (Washington, DC: Defense Nuclear Facilities Safety Board, 2 July 2013), 4, 26; and Partnership for Public Service, *The Best Places to Work in the Federal Government, 2013 Rankings*, which ranked DOE overall 17 of 23 among mid-size agencies and noted a steady decline in its rating compared to the mid-agency average since 2009. Moreover, NNSA ranked 249th out of 300 agency subcomponents in this same survey, available at http://bestplacestowork.org/BPTW/rankings, accessed 5 August 2014.

Table 3. Criteria for Success in High-Reliability, High-Technology Organizations

Mission-Driven Culture	• Universally understood and accepted purpose • Effective culture developed over many years by transformative leadership and maintained by mentoring carefully selected personnel • Qualified, empowered leadership
Competent Personnel	• Long-tenured senior leadership • Technically proficient and accomplished staff • Exceptional candidates recruited early to instill and sustain culture • Professional development programs emphasizing problem identification/solving, continuous learning in part through rotational assignments, leadership, and the employment of best practices
Disciplined Planning and Budget	• Work scope and funding is aligned and reserves are provided for contingencies • Single strategic planning reference document guides all decisions • Unwavering adherence to a disciplined planning and budget process, which is comprehensive and detailed • Systematic planning and budgeting for needed facilities and infrastructure
Clear Line-Management Structure & Decision-making	• Clearly established, codified, and reinforced lines of authority, responsibility, and accountability • Formal, inclusive, decisive, prompt, and documented decision-making processes • Deliberative body, such as a Board of Directors or Management Council, which obliges the organization to collectively engage in a timely fashion in risk-based resource allocation decisions to accomplish the mission • Mission and support functions are separate, but line management is responsible for both
Accountable Program Managers	• Program managers command the resources and authority needed to manage their programs • In a government operation, government program managers oversee efforts, but contractors execute the work within established policies • Lean and authoritative field offices have sufficient technical and operational expertise to effectively oversee the work • Stakeholders are included early in project life cycle and strive to understand all requirements and regulations upfront • Technical and financial elements of programs are scrutinized in order to validate efforts and control costs • The more hazardous the operation, the more safety is considered integral to mission performance • Specialized ES&H and security standards are used only when more generally accepted standards (e.g., industrial standards, OSHA standards) are shown to be inadequate
Proactive Communi-cations—Internally and Externally	• Organization priorities are aligned with mission and frequently communicated by senior leadership • Information flows freely and quickly up and down the organization, and decisions are made at the appropriate levels • No obstacles (people or processes) prevent bad news from moving up the chain of command • Mechanisms exist for field oversight offices and site managers to communicate regularly and directly with the head of the organization • Adequate visibility by external stakeholders

Mission-Focused Contracts and Incentives	• Contract fees primarily focused and evaluated on overall costs and mission performance rather than on mission-support compliance • Contracts consolidated, where appropriate, to achieve economies of scale • Contracts are competed to yield market-based fixed fees • Contractor incentives provided in the form of possible award term and/or contract extensions • Magnitude of fixed fee determined by investment (personnel, culture, processes, financial) of contractor resources and risks involved (including reputational)

Prominent among the characteristics of successful organizations are a mission-driven management culture with capable, empowered leadership; clear plans with careful analysis of the resources needed to succeed; a clear line-management structure; strong program managers focused on mission deliverables; effective communications; a focus on conveying effective incentives to suppliers; and clear and meaningful accountability.

This is no more than a collection of sound management principles, yet in many of these areas DOE/NNSA has fallen short. The panel's findings on each of the areas listed in Table 3 are presented here (with the exception of contractual incentives, which are discussed in Chapter 4.)

Lack of a Mission-Driven Culture

A common definition of management culture is, "This is how things are done here." In a healthy organization, management practices and culture are mutually reinforcing in creating productive behaviors: management practices shape the culture; the culture shapes behaviors and reinforces the management practices. Successful organizational cultures share two common attributes: leadership and accountability. First, each person feels accountable, and is held accountable, for his or her contribution to the mission—high quality deliverables, on schedule, and on budget. Teamwork and peer pressure create incentives to "not let my team down." NNSA staff are among those who widely report that this sense of mission focus is missing in the organization.[38] Second, effective leaders provide a clear, consistent vision that is effectively

[38] See, for example, the document prepared for NNSA by Haber et al., "An Evaluation of Organizational Safety Culture at the U.S. Department of Energy National Nuclear Security Administration" 4, 16–17. While this study focused on the safety culture, many of its findings—including on accountability—addressed perspectives within the organization more broadly. In the summary, the survey team reported the following:

"There is a lack of trust and respect for NNSA senior leadership by many employees across the organization. Individuals described not feeling valued or respected for their professional expertise and being instructed about what to do by leaders who generally do not understand the various functions that NNSA is responsible for. A lack of engagement by senior leadership of the staff combined with the perception of favoritism for a small group, contributes to the unfavorable perception held by many of the senior leadership team. The behaviors exhibited by senior leadership could be labeled as a 'culture of entitlement' and a 'culture of non-inclusion' for NNSA staff.

The NNSA organization does not effectively manage change. There is no systematic organizational change management process. Several major changes were recently made without a clearly communicated strategy, without anticipation of the potential consequences of changes in roles and responsibilities, especially in the communicated throughout the organization. Everyone understands the mission, and focuses on his or her part in fulfilling it. Such communication, as discussed later, has not been effective in NNSA.

In the absence of a unifying culture, enterprise participants report there are significant divisions within NNSA. Entrenched organizational relationships and loyalties inhibit an enterprise-wide team approach. Distinct communities and subcultures create splits between mission managers and mission-support personnel, between headquarters and the field, and between the government and the M&Os. As noted in Chapter 1, these internal divisions within NNSA stem, in part, from the lack of clear national direction. Individuals and groups within the organization are left to compete in setting priorities, vying for resources and attention. Such divisions also reduce the incentives to cooperate, such that the leverage from joint efforts across the mission areas is often lost. Reestablishing a unifying sense of purpose will be essential for building a cohesive mission-driven culture.

The delay in filling top leadership positions in NNSA has contributed to these problems. As noted already, NNSA has suffered from a fifteen-month gap in permanent leadership until recent months when Congress confirmed NNSA's fourth Administrator and his Deputy. Contrast this with the leadership continuity provided in the generally high-performing Naval Reactors program, where the previous three commanders were each in position for eight years—without any leadership gaps or lapses in continuity.

Weak Career and Leadership Development

The purposeful development of leaders, managers, and staffs is essential to any governance system. Committed, well-trained, and experienced personnel can overcome organizational deficiencies, but no organizational improvements can compensate for uncommitted, ill-trained or inexperienced people. The effective organizations benchmarked for this study focus on personnel management to create a reinforcing virtuous cycle: proven leaders emerge from careful selection and decades of experience involving assiduous development and screening. Such leaders make a

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areas of safety and security, and without the necessary formalization ahead of the change to facilitate an effective transition. All the changes have resulted in frustration among the workforce because of confusion in responsibility, uncertainly in authority, and a questioning of value of to the mission.

Participants in this assessment clearly indicated that they believe that there are …work environment issues across the NNSA organization. Results from the electronic survey, discussions, … respondents who chose the Prefer Not to Respond category …, … Hotline inquiries and requests … are all indicators of a fear of reprisal for raising potentially negative concerns …. These behaviors are also related to the … Cultural Styles that employees perceive are needed in order to succeed, or in some cases to survive, in the NNSA organization."

system work. They also attract and inspire other high-caliber people to join and stay in their organizations.[39]

NNSA has not instituted the personnel programs needed to build a workforce with the necessary technical and managerial skills. There is a nearly complete absence of career development programs, rotational assignments, and professional certification requirements. Too little emphasis is placed on technical training, experience, and accomplishments. Some motivated individuals take the initiative to grow and develop on their own within the NNSA system, but there is no systematic process in place to develop and reward a "professionalized" career workforce.

Additional skilled personnel will be needed in several management disciplines, including cost and resource analysis and program management. Another key staffing issue for NNSA is the shortage of headquarters personnel with operational understanding, experience, and awareness. Now, as the United States embarks on an intensive series of warhead LEPs covering the entire stockpile, a leadership team with deep experience and continuity (such as had developed during the Cold War) will be essential for managing the enterprise. Building the needed workforce will take time and a focused effort. Creating and sustaining a personnel management system to build the needed culture, skills, and experience is a vital component of governance reform.

Absence of Trusted Cost and Resource Analysis

NNSA's inability to estimate costs and execute projects according to plan has been a major source of dissatisfaction among the national leadership and customers and has significantly undermined NNSA's credibility. The panel understands that there are external and internal factors that have influenced NNSA cost estimates. Nevertheless, initial cost estimates for major NNSA programs have been found to be underestimated not by 10 to 20 percent but by factors of two to six:

- B61 LEP: An initial estimate (2010) assumed that the cost would be comparable to that of the W76 LEP, in the range of $4 billion. However, lab experts, when engaged by NNSA, concluded that the B61 LEP would be much more complex than the W76. When

[39] At benchmark organizations, the new entrants are carefully screened and selected, in part based on suitability for long-term careers within the organization. Employees tend to spend long careers within the organization. Promotion to the most senior levels is usually from within, and these organizations favor those with broad-based career experience within the organization. As one example, the current Director of Navy Strategic Systems Programs (SSP) started his career within that organization as a junior officer, and almost all of his subsequent assignments have been within that command. In addition to deep familiarity resulting from a long career with the same organization, long command tours provide needed continuity and allow the Director to promulgate and sustain the desired culture. Recently, the tenure of the SSP's Director was extended from about four years to eight years to strengthen this benefit.

the *final* B61 LEP cost report was completed, the estimate rose to $8 billion. DOD's CAPE then reviewed the program and explored alternative assumptions on program schedule and salary growth. Based on its review, CAPE assessed costs of roughly $10 billion. At present, the B-61 is progressing, albeit with another six month delay, according to the *2015 Stockpile Stewardship and Management Plan*.

- Los Alamos CMRR facility: An initial estimate (2005) placed the ceiling at $975 million; by 2010, NNSA estimated the cost to range from $3.7 to $5.8 billion, a nearly six-fold increase with a three to seven year delay. [40] Now, the project is being deferred five years, and the design is being reconsidered.
- Y-12 highly enriched uranium processing facility (UPF): An initial estimate (2004) placed the maximum at $1.1 billion; this was raised to $3.5 billion (2007), and then to $6.5 billion (2010). An independent review by the Army Corps of Engineers, commissioned by the Secretary's oversight office, placed the maximum cost at $7.5 billion (2011). The FY13 National Defense Authorization Act capped the UPF at $4.2 billion for the first of its phases. Recently discovered re-design requirements to accommodate production equipment (the ceiling is too low and the concrete foundation and walls are not thick enough) add an additional $0.5 billion. Now, the project is being delayed and the design is being reconsidered. NNSA did not include the cost of the total project in its FY14 budget "because planning for these phases [phases II and III] is still in the early stages."[41]
- Savannah River plutonium disposition facility (the Mixed-Oxide Fuel Fabrication Facility, or MOX): DOE approved a cost estimate of $4.8 billion (2007) and start of operations in September 2016. Although construction began in August 2007, NNSA subsequently increased the estimate to $7.7 billion (2012) with the start of operations delayed to November 2019. Now the project is in a strategic pause as DOE evaluates other options for plutonium disposition.

In too many cases, the cause of the change in planning estimates has not been promptly communicated by NNSA to the Congress or customers, such as when the duration of a construction project is doubled or when the safety requirements are changed during the planning or design stages.

Clearly, changes in a project's plans and estimates of the scale described here suggest more fundamental challenges than can be remedied by simply hiring more, or better, cost estimators.

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40 GAO, *Modernizing the Nuclear Enterprise: New Plutonium Research Facility at Los Alamos May Not Meet All Mission Needs* (Washington, DC: GAO, March 2012), 9.

41 GAO, *Modernizing the Nuclear Enterprise: NNSA's Budgets Do Not Fully Align with Plans* (Washington, DC: GAO, December 2013), 27.

The experience with these programs suggests fundamental weaknesses in the analysis of alternatives underlying program plans, requirements setting, configuration management, and certainly, execution. Too often, programs have been started, and substantial financial commitments made, with a limited understanding of total program scope and complexity and only a cursory review of possible alternative approaches. In some cases, programs have had only limited DNFSB involvement in the early planning, with the result that significant changes have been required later to address issues that might have been identified and addressed much sooner and at much less cost if the DNFSB had been involved earlier in the process. For example, in recent years, substantial construction rework was required for the PF4 security system at Los Alamos, as well as for the uranium storage facility at Oak Ridge, Y-12.

A major hurdle for defining and estimating costs is the lack of an *activity-based* cost accounting methodology that is capable of distinguishing the incremental costs of activities from baseline capability sustainment costs in the weapons complex. In NNSA, as in most government activities, costs are accounted for by major input category, rather than by the product or activity supported. Consequently, it is difficult (if not impossible) to measure the true costs of activities or products.

A capability for independent cost estimates and for conducting Analyses of Alternatives (AOA), coupled with a disciplined cost reporting system, is essential to effective program scoping and initiation, resource planning, source selection, and contract oversight and management. NNSA needs a significant infusion of expertise, data, and tools for independent costing, requirements evaluation, program planning, and scheduling. Both NNSA and DOE are engaged in initiatives to create these needed capabilities.[42]

The Lack of Focus on Mission Deliverables

In effective organizations, program managers are assigned to deliver strong focus to meeting customer needs by aligning resources and accountability with key customer deliverables. In the peak years of the nuclear weapons program, the operational core of the nuclear enterprise was located in the Albuquerque Operations Office (ALOO). This office synchronized the cycle of design-test-build-maintain-dismantle throughout the Cold War, until 1992, when the production of new weapons was suspended. ALOO was officially disbanded ten years later, in 2002; however, many mission-support staff personnel and administrative functions were retained in the Albuquerque facility. NNSA headquarters absorbed Albuquerque's operating functions, which were greatly diminished by then since the United States had just

[42] NNSA recently has developed a plan for creating the needed capabilities. See briefing for Congress, "Cost Estimating and Program Evaluation (CEPE) Implementation Plan," September 2014. Under this plan, CEPE will increase staff from two government and three contractor personnel to about twenty-five total staff over the next three years, drawing on support for training and mentoring from DOD's CAPE organization.

completed a modernization cycle and had no requirements to produce warheads. Decades of operational experience, knowledge, and technical expertise resident within ALOO were lost in the reorganization as little of that expertise moved to headquarters.

The panel recognizes the steps being taken to introduce decision-making rigor and increase the program manager's authority, at least for the B61 LEP, as described below. But, testimony to the panel indicates that NNSA still lacks an effective line-management structure able to plan for integrated operations, as well as to ensure operational information is shared, problems are surfaced early, and timely decisions are made. In short, the panel found many capable individuals trying to accomplish needed tasks, but no effective structure focused on executing programmatic work.

To understand the weaknesses at the individual program level, consider the question of who has responsibility for the B61 Life Extension. For technical management, there is a well-defined set of responsibilities and accountability for managing individual LEPs, and a well-defined process—the 6.X process—that guides LEP development and production:

- Los Alamos (LANL) is responsible for the B61 physics package. The laboratory is responsible for managing activities to generate the physics and engineering design, development and testing for the nuclear explosive package. This involves close coordination with the production facilities and subsequent delivery to Pantex.
- Sandia (SNL) is responsible for the nonnuclear component design, development, and testing and for integrating the nuclear explosive package and non-nuclear components into the bomb. This involves close coordination with LANL as well as component production activity at Sandia and Kansas City, and delivery of data and products to Pantex for assembly. For the B61 LEP, Sandia is also responsible for technically integrating the bomb with the DOD-provided bomb tail-kit assembly.

While the laboratories are responsible for technical integration, a government program manager is needed to synchronize B61 LEP activities across (up to) eight facilities, to oversee the progress of the labs and plants; to take responsibility for integrating safety and security requirements within programs; and to ensure that funds are allocated as needed to meet inevitable operational contingencies.

Although NNSA designates government program managers for each major program, their authorities have been very limited. Most importantly, they have lacked control over resources necessary to exercise needed leadership. In practice, they could more accurately be described as program coordinators than as program managers.

In general, NNSA program and project management has not been supported at the staffing and funding levels that the private sector and other agencies have demonstrated are necessary to assure success, especially in the field. For example, the B61 program office has fewer than a dozen staff. Funding levels for reserves and contingencies have not been provided until FY14 and remain quite small relative to levels that have been demonstrated to be necessary for major projects, especially recognizing the unique technical nature of many of NNSA's undertakings. When projects or programs proceed from design stages to production stages, there is not adequate configuration control of designs and too many nonessential subsequent changes are allowed.

The management practices for infrastructure upgrades and major facilities construction are also problematic. DOE's guidance for such projects is contained in DOE Order 413, which aligns with the management practices prescribed in OMB Circular A-11 for Capital Acquisition Projects.[43] OMB requires agencies to establish a disciplined capital programming process that addresses project prioritization between new assets and maintenance of existing assets; risk management and cost estimating to improve the accuracy of cost, schedule, and performance estimates provided to management; and the other difficult challenges posed by asset management and acquisition. However, although compliance with DOE Orders is mandatory, in practice, Order 413 has been viewed only as guidance, and adherence and enforcement have been weak. For instance, rigorous planning processes at the front end of a project, such as an Analyses of Alternatives, are lacking. In establishing its Acquisition and Project Management Office, NNSA is trying to bring such discipline to NNSA project management. Department-wide recommendations for improved project management rigor and oversight are now being considered.

New Limitations on Internally Directed Research and Development

Both Laboratory Directors and production plant managers have testified to the importance of discretionary funding for attracting and retaining skilled experts, for promoting cutting-edge work, and for maintaining needed scientific, engineering, and manufacturing capabilities. One function of Laboratory Directed Research and Development (LDRD), as established in its current configuration in 1991, has been to give the laboratories the flexibility to address continuing work-force management challenges—both attracting and retaining high-quality personnel. At the outset, it represented about 2 percent of the each lab's operating budget, grew to 8 percent, but has since been declining, with the current Congressional mandate that it not exceed 6 percent. This downward trend has been exacerbated by the elimination of another source of discretionary funding, Weapons-Related Research, a gap that has been filled by LDRD at least at LANL and LLNL.[44] It should be noted that such internally directed funding is applicable not only to the laboratories. For example, NNSS devotes 2 percent of its budget to

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[43] OMB, *Preparation, Submission, and Execution of the Budget*, Circular A-11 (Washington, DC: Executive Office of the President, July 2013).

[44] National Research Council, *Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories* (Washington, DC: National Academies Press, 2013), 19–20.

Site-Directed Research and Development and similarly notes its importance for recruiting and retaining personnel with critical skills and enhancing core competencies.[45]

Any enterprise dedicated to cutting-edge science, engineering, and manufacturing needs to be able to support long-term research efforts focused on exploring new frontiers. This is also essential in preparing these institutions to face the technical challenges ten–twenty years in the future, a future that no one can predict. FFRDCs, both inside and outside of NNSA, routinely are provided discretionary funds to encourage such exploration. The panel consistently heard from site personnel about the motivating effect of LDRD work and that the availability of LDRD has been a factor in their recruitment and retention at the lab.

The National Research Council study of the laboratories cited earlier, reports several statistics indicating that LDRD contributes significantly to the intellectual environment. For example, 20–25 percent of external publications for the three laboratories in the mid- to late-2000s were supported by LDRD funding.[46] Across the three labs, LDRD was responsible for the majority (58–70 percent) of all their "R&D100" awards during FY09–13, and for 22–46 percent of the patents issued to the three labs during FY08–12.[47]

The *Strategic Posture Commission Review* also noted LDRD's importance for the national security laboratories.[48] In addition, LANL identified the indirect and direct value of LDRD on the "nuclear security mission," noting that in FY12, more than $40 million of its LDRD-supported projects directly addressed this mission area and another $50-plus million supported projects to invest in the underlying science, technology, and engineering for nuclear security.[49]

Shortfalls in Facilities and Infrastructure Modernization

Much of the weapons complex was built for, and scaled to the needs of, the Cold War. The United States accumulated an inventory of several tens of thousands of nuclear weapons, and at its peak produced over 1,000 new nuclear weapons a year. Today's needs have changed radically: both inventories and throughput are an order of magnitude lower today. The nation faces a situation where the complex is not well matched with future needs: in many respects the

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45 Presentation during the panel's fact-finding visit, 3 February 2014.

46 National Research Council, *Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories*, 84–85.

47 Carol J. Burns, "Building Capabilities: Los Alamos National Laboratory," 19 November 2013, briefing to the panel fact-finding team.

48 *Strategic Posture Commission Review*. More recently, the Secretary has convened a study on LDRD under the Secretary of Energy Advisory Board.

49 Ibid.

weapons complex is both too old, and too big—a situation that presents significant challenges for the governance of the enterprise.

The nuclear enterprise is failing to provide for needed nuclear facilities and infrastructure modernization. Aside from capital investments in major nuclear facilities, discussed previously, there is an ongoing need to maintain, upgrade, and modernize facilities across the operational sites. The DOE/NNSA enterprise comprises 2,160 square miles, roughly the size of Delaware, with 8 million feet of fencing and 2,540 total lane-miles of paved road. It includes approximately 3,800 facilities, about 54 percent of which are over forty years old, 29 percent are over sixty years old, and 12 percent are still in place but no longer in use.

While customers of the enterprise widely recognize the need to recapitalize NNSA's equipment and facilities, investments in infrastructure often do not receive the same consideration as program work. The enterprise's deferred maintenance and long-delayed capital construction projects are looming problems. Current estimates place immediate deferred maintenance requirements at $3.5 billion. Throughout the enterprise, the panel heard evidence of failing infrastructure, lack of sufficient funding, and practices that will inevitably increase future costs. Neglect of facilities also contributes to workforce morale and impacts hiring and retention. Examples include:

- The Sandia Silicon Fabrication Replacement (SSiFR) project is scheduled to replace the existing and obsolete 6 inch wafer equipment with 8 inch wafer equipment. Trusted, radiation-hardened semiconductor silicon chip production is needed for the B61, W88 ALT, and every stockpile system. The SSiFR project replaces older tools with newer generation tools that are able to use both 6 inch wafers (for the B61 and W88ALT) and 8 inch wafers that will support the needs of the LEP mission beyond FY19. In FY13 and 14 combined, a total of $50 million of the $150 million required was provided, but there is no funding in the FY15 budget. The remaining $100 million is included only in the FY16–20 FYNSP.
- The Tonopah Test Range in Nevada has a communications hub in need of upgrading. The hub is critical to systems testing, including for the B-61 LEP. Should this hub fail before completion of the upgrade, the B-61 schedule will be further delayed.
- The Weapons Evaluation Test Laboratory, a Sandia facility at Pantex, has two thirty year centrifuges, one of which is broken. Being the only two centrifuges of their kind, replacing them will require new design, which will take both money and time. The centrifuges are used for the stockpile surveillance program and, with only one of them functioning, NNSA's surveillance program has fallen behind schedule.
- The Perimeter Intrusion Detection and Assessment System (PIDAS) at Pantex needs updating. The fence, light poles, and communication cabling are failing and sensors are obsolete. Effective security at Pantex is essential for all stockpile work. The current plan is estimated to cost about $350 million.

- The Extended Core Facility (ECF) at the Naval Reactors facility, Idaho National Laboratory requires recapitalization. This facility receives, stores, analyzes, and packages for long-term dry storage all spent nuclear fuel for the U.S. Navy's nuclear powered fleet. ECF is over fifty years old and in degraded material condition. It represents a single point of failure because if, due to material failure, it cannot accept future spent fuel shipments, Navy ship refueling and defueling in Naval shipyards will be at risk, with consequent major impact on fleet operations. Full funding for this recapitalization has been proposed in the President's budgets but has been repeatedly deferred by Congress. This action has further affected DOD in that DOD has been, and will continue to be, required to purchase temporary storage equipment (M-290 shipping containers) to accommodate future spent fuel shipments in excess of existing facility capacity. Additional cost to the government has been on the order of $100 million per year for the procurement of the temporary storage containers. The increased construction costs due to the deferrals are in addition to this figure.

The panel notes the Secretary's recent guidance to propose a budget that begins to reduce the deferred maintenance backlog. One workaround for modernizing infrastructure is private, third-party financing for new facilities that are operated under long-term leases. This approach was employed to acquire the new production facility for the Kansas City Plant and two new office buildings at the Y-12 site. The complexity of ongoing modernization requirements, coupled with addressing safety, security, and environmental issues in an increasingly austere budget environment, requires holistic and integrated decision-making mechanisms to meet operational requirements and find cost-saving solutions across the enterprise.

An Inflexible Budget Structure that Undermines Mission Execution

The challenges in exercising line-management control and synchronizing execution across sites and programs are amplified today by NNSA's attempt to manage the operating sites from headquarters using detailed budgets and milestones. Some of this growth in budget control lines has been mandated by Congress. At the time NNSA was established, the detail of congressional budgeting was increased by a factor of nearly four—from nine to thirty-four funding categories in FY01—and roughly one-third of the funding was shifted out of program-related budget categories into mission-support budget categories.[50] NNSA today has eighty-two congressional budget control lines. But NNSA, in turn, imposes even more internal controls. For example,

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[50] In FY98, there were only nine congressional budget control lines. The five top-level categories in the budget were programmatic in focus. They were program direction, production and surveillance, research and development, testing, and inertial confinement fusion. By FY01, the number of budget categories had increased to thirty-four. The top-level categories were modified and expanded to seven and modified to include several mission-support functions. In addition to program direction, directed stockpile work, and campaigns, the top-level categories now included infrastructure, safeguards and security, and transportation safeguards.

LANL reported that NNSA funds are provided with over 500 budget reporting lines and associated milestones; Pantex reported 225. Other sites have comparable controls. And, in the case of Directed Stockpile Work (DSW), NNSA has some 1,000 budget reporting lines.

No doubt this provides a degree of *control* for NNSA offices, but it also creates a high degree of complexity and constraint for operations managers at all levels.[51] Control of these funds is dispersed across NNSA headquarters organizations, with different responsibilities and priorities.

Ineffective Communications

Despite noted efforts (e.g., the annual *Stockpile Stewardship and Management Plans*), the current DOE/NNSA culture inhibits the communication of a coherent, unified message—to national leaders, customers, and internally. As a result, there can be many competing and inconsistent messages.

Among many Members of Congress and their staffs, the perception prevails that NNSA has lost credibility. Congressional staff members choose to, or are driven to, engage a number of sources throughout the enterprise to obtain accurate information about programs and issues; they have cited a need to *pull* for information, because there is insufficient effort by NNSA to *push* information. Hill staff members also indicate that the information that they do receive is often inconsistent from one source to the next. Staff members in the Executive Branch shared similar concerns as did DOD representatives.

Lines of communication are not always respected in NNSA's external relationships. Interviewees from Capitol Hill and inside DOE indicated that leaders in field operations, including M&O leadership, sometimes interact directly with Members of Congress without headquarters coordination. While the M&O leadership is not required to do so, advance notice to DOE headquarters prior to contacts with legislators or Hill staffs would foster an improved relationship and is a simple matter of professional courtesy. Legislators also indicate they have been surprised during formal hearings with new information about cost projections and budget requirements. In addition, enterprise customers spoke of the need to go directly to field staff to learn about a program's status instead of learning it from NNSA headquarters.

Similarly, the panel found problems in communication within the NNSA, both upward and (especially) downward. People in the field noted difficulties in obtaining decisions from headquarters, such as needing to obtain program requirements directly from customers instead of from headquarters. Field staff also described instances when headquarters officials reached down

[51] National Academy of Public Administration, *Positioning DOE's Lab's for the Future: A Review of DOE's Management of Oversight of the National Laboratories* (Washington, DC: National Academy of Public Administration, 2013).

to the working level, circumventing the field managers, to provide instruction, with little regard or appreciation for the implications that such direction would have for the overall program or for management discipline. In turn, headquarters staffs spoke of difficulties caused when NNSA field staff or the M&O organizations have not shared information or have circumvented headquarters.

Such poor communication and failure to adhere to lines of authority run starkly counter to the practices of the successful organizations studied by the panel. These organizations stress the importance of quickly sharing information, especially if it is bad news. Indeed, high-performing organizations enforce discipline in *promoting* effective communications—if there is a penalty to be paid, it occurs principally when a subordinate *fails* to report bad news.

For the enterprise workforce, there is a need to clearly communicate mission and objectives, to include how enterprise missions are knit together around a central nexus of national security. A recent in-person visit by a key NNSA leader to a number of field sites was described as the first time in many years that any leader of such stature had made time to visit worksites and talk to rank-and-file workers. More generally, the panel notes the recent efforts of the current NNSA and DOE leaders to engage the workforce and communicate priorities, which are clearly welcome developments.

RECOMMENDATIONS

DOE must transform its culture to focus on executing an ambitious program of work across its missions, while modernizing key facilities. The panel describes the needed culture as one focused on performance, accountability, and credibility. The panel's recommendations are intended to adapt management best practices from high-performing benchmark organizations to the operational environment of the nuclear security enterprise. The proposed actions will improve performance in the short run, and thus bolster morale, and in time, create the needed culture.

Recommendation

6. To begin reforming the DOE&NS culture, the Secretary and Director should develop within six months a plan for continuous management learning and improvement, including an implementation plan for the panel's recommendations with milestone target dates.

Achieving the necessary changes in DOE&NS culture must begin with the adoption of the management reforms the panel proposes. For ONS, the Director, in consultation with the Secretary, should devise a rapid transition to realign ONS authorities, resource allocation mechanisms, decision-making processes, and staffs to achieve mission focus, as outlined in the panel's recommendations. Focused on the longer-term, the Director should establish a management system for identifying and adopting management improvements.

Action Items

6.1 The Secretary and Director should urgently develop a more robust, integrated DOE&NS/ONS-wide process to provide accountability and follow-up on findings and recommendations from studies and reviews, both internal and external.

As the panel has noted, there have been literally scores of previous studies with numerous valid recommendations, many of which are offered in this panel's assessment as well. However, there is not a well-established process for reviewing these recommendations, performing root cause analysis of them, taking corrective action where appropriate, and then following up to ensure that the corrective actions are institutionalized.

6.2 The Secretary and Director should establish management metrics for assessing and improving enterprise management.

Systematic management metrics will help assess management performance across the nuclear enterprise, and provide the informational basis necessary for reform. With respect to the nuclear weapons complex, the emerging Contractor Assurance Systems, which provide extensive data on contractor operations, should provide a starting point for developing effective metrics.

6.3 The Secretary and Director should routinely survey personnel to gauge morale, assess cultural changes, and identify the results of efforts to change management practices.

Feedback from staff, both at headquarters and in the field (to include the M&Os) can provide the best gauge of what is working and what is not within the enterprise. Routine surveys would also contribute to improved communications and situational awareness among the staffs.

6.4 The Secretary and Director should aggressively communicate reform plans and objectives.

The Secretary and Director should execute a coherent strategic communications strategy to external and internal audiences. For external audiences, this plan should be designed to convey the Director's commitment to executing the national strategy and collaborating with customers to understand and meet their needs. For internal audiences, this plan should be designed to communicate how and why structures and practices are changing, explain the alignment of organizations and personnel, enlist support for the new approach, and set expectations for individual success within the new approach.

Recommendation

7. The Secretary and Director should implement industry best practices for shaping and building the enterprise workforce.

In parallel with changes in the management system, the necessary changes for a new DOE&NS culture will require persistent leadership. This will require major reform of the personnel system to place the emphasis on building technical and managerial expertise, senior leadership development, and continuity. The panel finds some specific shortfalls in critical skills for program management, cost estimation, and resource management. Simultaneously, the panel foresees that the consolidation of parallel headquarters staffs, coupled with the consequent reductions in transactional oversight functions, will entail rightsizing and the retraining of many employees within the workforce. Reform will require that the Secretary and the Director have all the authorities necessary to hire, fire, shape, and train a workforce appropriate to address current and future requirements. To allow for this flexibility, senior ONS staff positions should be filled by Senior Executive Service or Excepted Service personnel.

Action Items

7.1 The Secretary and Director should establish strong career and leadership development programs, require rotational assignments, and place greater emphasis on continuing education and professional certifications.

The Secretary and Director need to reform the personnel management system, including pay, compensation, and evaluation processes to build skills aligned with the Department's nuclear security missions and reformed governance model. Senior managers should be required to acquire experience in both the field and headquarters. This includes programs to systematize rotational assignments and competitive opportunities for training, education, and broadening experience, to build technical and leadership expertise.

The Director should lead an annual succession planning activity to identify candidates to fill key positions in the future and to prepare them for the responsibilities thereby entailed.

7.2 The Secretary and Director should reshape staffs as needed to implement governance reforms.

The Director should be granted the authorities necessary to reconfigure the ONS's workforce as necessary, including broader utilization of Excepted Service positions (for all but administrative staff) and targeted tools such as early retirement, buy-outs, and other workforce-shaping authorities. Several skills require growth in both capabilities and staff numbers. Staff in other functional areas will need to be reduced, particularly those associated with transactional oversight and contract compliance.

7.3 The Secretary and Director should conduct a zero-based personnel review to right-size government staffs consistent with recommended reforms and changing workload since the end of the Cold War; this review should include the consolidation of headquarters activities across DOE&NS's Forrestal headquarters, the Germantown campus, and the Albuquerque complex.

In implementing the proposed reforms, the Secretary, together with the Director, should carefully review DOE headquarters and field personnel needs. The purpose is to align and adjust personnel requirements and capabilities in accordance with changing needs. This includes evaluating not only the appropriate numbers of staff for program execution and mission support, but also optimal management-to-staff ratios and the value of Germantown and Albuquerque as satellite headquarters. Considerable cost savings should be realizable from this review and resultant restructuring.

Recommendation

8. The Secretary should establish trusted Cost Analysis and Resource Management staffs, tools, and data; the Director should be responsible for this process in ONS.

The Director needs to reinforce recent efforts to build a capability for independent cost estimating and resource analysis within ONS to address persistent problems. The panel recommends a number of actions to strengthen the personnel, data, and tools for independent cost estimating and conducting an Analyses of Alternatives. Significant additional investment will be needed to establish capabilities that are trusted by key customers and national leadership. The Director needs to recruit additional resources for a strong, independent team for resource management. This team should be empowered to build the competencies and mechanisms needed to conduct independent cost estimates, Analyses of Alternatives, and thorough peer reviews. In parallel, the Director should encourage the M&Os to develop similar capabilities.

Action Items

8.1 The Secretary and Director should strengthen the Department's efforts to develop independent cost and resource analysis capabilities.

The Secretary should strengthen and elevate the Department's headquarters oversight office devoted to program/project analysis and advice for the Secretary (currently the Office of Acquisition and Project Management (OAPM) in the Department's Office of Management). This would include:

- Enhance the staff competencies to conduct independent cost and schedule estimates and program evaluation, in addition to capital project evaluation
- Strengthen the Department's current Project Management System (Directive 413) to specifically include more rigorous independent cost analysis and oversight of Analyses of Alternatives to provide effective advice for the Secretary and Director

- Extend the office's scope to include evaluation of and reporting on major programs, such as LEPs, in addition to major capital construction projects

Once the Department establishes this office, the Secretary should receive its formal advice during milestone decision making, with the mandate to document acceptance or rejection of its advice, similar to the legislation that stipulates such a requirement on DOD with regard to the CAPE organization.

To support long-term improvements in cost and resource analysis, the Secretary and Director should establish an activity-based cost accounting system that would enable managers to determine true costs of underlying enterprise capabilities and the incremental costs of specified programs. This would better align resources with mission priorities, provide a basis for estimating the cost of future projects, and provide a more sound basis for communication with customers.

8.2 The Secretary and Director should employ a rigorous Analyses of Alternatives process during program formulation as the basis for assessing and validating program requirements.

The Department could significantly (and relatively quickly) enhance program decision making by conducting a competition of ideas to explore and question alternative programmatic approaches, using a rigorous and contemporary Analysis of Alternatives early in the decision process. Periodic, independent peer reviews would help to ensure programs remain on track. This is already being done in other parts of DOE.

8.3 The Secretary and Director should take advantage of established DOD resource analysis capabilities in establishing DOE's cost analysis and resource management capabilities.

The Secretary should develop a Memorandum of Understanding (MOU) with DOD to train DOE personnel in cost estimating capabilities. The MOU could also encompass sending program management interns to the Defense Acquisition University to acquire formal, professional program manager training and certification.

One potential model for building the needed capabilities is DOD's CAPE, which is independent of the acquisition chain (for all intents and purposes, the Director of CAPE reports to the Deputy Secretary of Defense), carries out independent cost estimates (ICE) and reviews investment alternatives. It maintains a store of cost data and estimating relationships from previous major acquisition programs to inform *should cost* analyses for current and proposed programs.

Recommendation

9. The Director should establish a simple, clear line-management operating structure that both synchronizes activities across programs, mission-support functions, and operating sites and provides leadership focus for key programs.

The key synchronizing functions that had been performed by the Albuquerque Operations Office are needed today. An effective mechanism would solidify the decision authority of the Director and coordinate the efforts of all the key officials accountable for executing the program. The participants include the Director, Deputy Directors, program managers, M&O leadership, and field office managers.

An effective mechanism will permit the participants to share information regularly across sites, programs, and functions. It will provide a clearinghouse for raising issues in the execution of programs and for considering strategies for resolving them. Over time, the discipline of exercising leadership and management roles through this mechanism will reinforce the needed management culture by improving communications, understanding, and working relationships.

Action Items

9.1 The Director should create operational mechanisms to perform the key synchronization functions that used to be performed by the Albuquerque Operations Office.

The needed mechanisms would regularly engage the key line-management decision makers and mission-support officials to share information, raise issues, and seek solutions. The key participants would include the Director, Deputy Directors, program managers, the M&O leadership, and the Federal field office managers. A relatively small number of well-informed, qualified leaders and managers are needed to align decision making for missions and mission-support functions.

The panel's benchmarking suggests effective models for such mechanisms: successful organizations commonly convene the key operational stakeholders regularly in brief gatherings or teleconferences to ensure the free flow of information, coordinate activities, identify and resolve issues at the lowest possible level and at the earliest possible time, and rapidly elevate issues to higher authorities when necessary to resolve them. Such mechanisms serve to clarify who can approve and who can say no when decisions need to be made, and facilitate direct interactions among decision makers, with a minimum of bureaucracy. Such organizations insist on simplicity and discipline in their decision-making mechanisms. They document decisions and follow up on those decisions. They empower people to take decisions as far down the management chain as is reasonable, and they have procedures for promptly elevating issues up the chain when necessary. They measure timeliness of decisions, and they study and improve the decision-making process itself.

9.2 Deputy Directors should be designated to lead in the integrated planning and execution of programs in their mission areas of responsibility.

The Deputy Directors would support the Director in integrating the execution of programs by developing integrated operating plans that align programs, resources, infrastructure capabilities, and the workforce. The line management responsibilities assigned to Deputy Directors are designed to shift the management culture from a compliance based one to an operational, mission-performance oriented one.

9.3 The Deputy Director responsible for Life Extension Programs, working with DOD, should create a long-term operating plan to support the nation's warhead modernization strategy; this plan should be designed to create a relatively stable, long-term workload.

A stable baseline of design, engineering, and production is needed to make effective use of the available capabilities in the weapons complex, provide the basis for sizing and modernizing the weapons complex, and identify potentially conflicting demands on available capabilities. An operational plan would provide the basis for creating an executable *Stockpile Stewardship and Management Plan*, as well as for keeping this plan aligned with DOD plans for modernizing delivery systems. This recommendation does not assume precise knowledge of the requirements for future programs. Enough is known about the near- and mid-term needs of the nation to outline an approximate plan and to design the production system to accommodate some uncertainty.

A rough plan would be extremely helpful for integrating activities across the weapons complex and for efficiently employing available capacity. A continuous, predictable cycle of development and production of LEPs is critical to fulfilling production demands, sustaining critical skills, maintaining safe operations, and doing so for reasonable costs. The attendant shift in operational focus toward the execution of a long-term program of work will provide an important driver for changing DOE's governance culture.

As noted in the panel's benchmarking work, such a long-term production strategy has precedent in the strategic systems arena. For example, the Navy plans for the production of large solid rocket motors at the minimal rates needed to assure quality and process control for the Trident II Life Extension Program, and in doing so, sustains the requisite industrial base.

Recommendation

10. The Director should establish program managers who are provided necessary authorities and resources, and who are held accountable for major mission deliverables.

An essential step toward creating a culture focused on mission performance and accountability is to establish program managers (PMs) for major programs and construction projects, who have sufficient authority, resources, and accountability to meet mission deliverable objectives. Delegating control to these PMs for relevant funding would serve to transform program managers from weak coordinators—who must negotiate for support from the campaigns and mission-support staffs—to resource-owning managers. These officials would serve as the focal point for planning and executing their programs, and become the "go-to" individuals for solving problems and resolving issues. Program managers should also have approval authority for all personnel assigned to their projects and be responsible for personnel evaluations. To exercise their authorities effectively, these PMs must have proven technical, managerial, and leadership skills.

As described in Recommendation 9, each program manager would report to the Deputy Director responsible for his or her mission area. This management structure is designed to provide the program manager with effective authority to focus on executing a particular program, while the Deputy Director focuses on the synchronization of activities, weapons complex capacity, and resources across programs and mission areas.

Action Items

10.1 The Director, in coordination with the responsible Deputy Director, should designate program managers for each Life Extension Program and major construction project.

The panel's proposed approach builds on and extends the very positive initiatives recently undertaken by NNSA to strengthen program management. In DOE/NNSA's recent actions, the B61 LEP program manager has been provided control over a significant share of the resources necessary to execute the program and has been granted a 5 percent management reserve by Congress.[52]

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[52] The program manager reports that many necessary management authorities have been assigned to his program office:

- The program manager controls the B61 LEP funding ($530 million), which now constitutes about 85–90 percent of the unique funds required to execute the program.
- The remaining 10–15 percent of funding—"other peoples' money" in campaigns, stockpile support, etc.—is identified, support agreements are in place, and are subject to the Deputy Administrator's quarterly program reviews.
- Congress provides funds for the B61 program in only two congressional line items.
- The B61 program has a management reserve at each site and within each PM's management budget. The management reserve (beginning in FY14) of about $35 million gives the PM improved latitude to address problems.

10.2 Program managers should be held accountable to employ effective management practices.

The B61 program has established a very detailed plan as well as a prototype earned value management system for monitoring program progress. The government program manager reports that he has a regular meeting cycle with the responsible M&Os, involved DOE offices, and customers in DOD. The PM believes that everyone understands the plan; and they are executing according to the plan. Both the program office and key M&Os agree that communication is very good.

10.3 The Director should delegate to the program managers control of any funds identified as uniquely required to execute their programs.

Funding that is currently allocated for other activities (Stockpile Systems, Stockpile Services, Campaigns, Mission Support) that are uniquely required for executing programmatic work should be consolidated under the control of the Deputy Directors (and PMs).

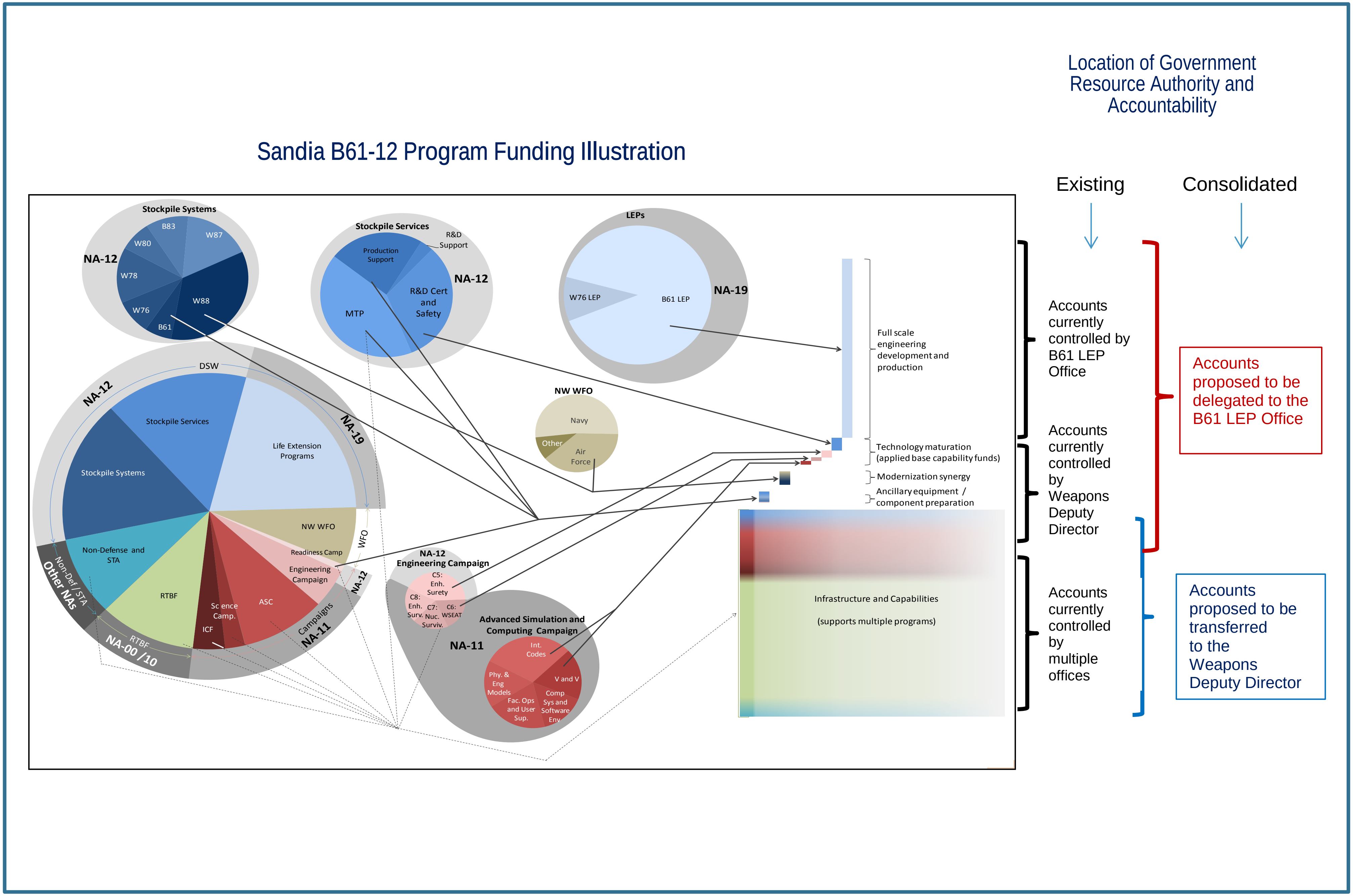
A related issue, discussed in Recommendation 11, is the need to simplify funding categories and to consolidate control over resources within the chain of line management. A significant increase in line managers' authorities can be accomplished if the Director were to transfer the control of resources in existing budget accounts from officials responsible for mission-support functional areas to the Deputy Directors responsible for mission deliverables and, by delegation, to individual program managers who would also be held responsible for such factors as ES&H compliance on their programs.

An illustration of the benefits of such budget transfers and consolidation is provided in Figure 6. In FY13, B61 LEP work at Sandia was funded by more than twenty NNSA funding sources. The figure shows that control of this funding is spread over numerous organizations, including the B61 program office, numerous offices within the Defense Programs organization, and the offices responsible for infrastructure funding. Managing funding at the current level of detail with this large number of resource owners creates major coordination demands: every budget category has headquarters proponents who must be consulted and persuaded on every decision related to their resources.

- The program office has been able to fund infrastructure upgrades at the sites, where needed, to execute the program. Examples include investments at MESA and a new high explosives press at Pantex.
- The PM tracks regulatory requirements and approvals necessary for executing the B61 program. In particular, the steps necessary to secure approvals at Pantex are included in the overall plan.

The illustration shows how the consolidation of resource control authority with a small number of well-informed, qualified managers could reduce complexity in executing programs. First, the transfer of relevant infrastructure funding to the Deputy Director responsible for the LEPs would simplify the headquarters interfaces necessary for managing those funds. Second, the delegation of resource control to the PM for all funds that are uniquely linked to B61 program execution would provide the program manager with the day-to-day control of needed resources (subject to ongoing oversight and review by the Deputy Director).

A careful review of the budget will be needed to identify the appropriate allocation of funds between program managers and mission-support staffs. As a general rule, *fixed costs* necessary for funding infrastructure and maintaining common capabilities should remain with mission-support functions. *Incremental costs* uniquely required to execute individual programs should be controlled by the PMs accountable for meeting customer needs.



Source: Sandia Briefing to the National Security Enterprise Panel.

Figure 6. Current and Proposed Resource Control for the B61 LEP (Sandia Example)

10.4 The Director should delegate control over personnel assigned to their programs to the program managers.

In addition to having increased control over funding, PMs should have approval authority over personnel assigned to the project, to include personnel evaluation authority.

Recommendation

11. The Congress, Secretary, and Director should adopt a simplified budget and accounting structure (by reducing budget control lines) that aligns resources to achieve efficient mission execution while providing sufficient visibility to enable effective management oversight.

A redesign of the budget and accounting structures to better align resources with program deliverables would both improve the budget as a management tool and enhance customers' visibility of program execution. With improved alignment it should also be possible to simplify the budget structure—reducing both the number of budget lines and the number of people controlling them—thereby providing the flexibility needed to execute programs effectively.

Action Items

11.1 Congress should reduce the number of Congressional budget control lines to the number of major programs plus major mission-support functions.

Congress should impose fewer funding lines on the enterprise to reduce fragmentation of the budget and increase the ability to manage programs across the enterprise. The designation of line items for major programs and major mission-support functions serve to provide sufficient transparency into the employment of funds while preserving a significant degree of flexibility to manage funds within budget categories. This approach would reduce the number of Congressional budget control lines to roughly thirty versus the current eighty-two. [53]

11.2 The Director should reduce ONS's internal budget control lines to the minimum number needed to assign funding for major programs and mission-support activities across the sites.

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[53] This number is a rough estimate, based on the following factors: Across the five Deputy Directors responsible for missions, there are presently about twenty major programs. These include the Life Extension Programs, Stockpile Surveillance and Maintenance, Campaigns, Nonproliferation programs, Counter-proliferation programs, and Counter-terrorism programs. If the Director were to retain the current categories of infrastructure funding, this would require an additional ten budget categories.

The Director should consolidate the hundreds of internally defined budget lines that have been created by NNSA that constrain program management flexibility, and align the appropriate lines of funding under relevant Deputy Directors and program managers. This approach would reduce the number of ONS budget control lines to approximately 240. [54]

11.3 Infrastructure funding that is uniquely required for the execution of Life Extension Programs should be integrated into the portfolio of the Deputy Director for Defense Programs.

It is vital for this Deputy Director to have full control of funding for both program elements and program-specific infrastructure to address cross-seam issues.

Recommendation

12. The Director should develop a strategy and plan to reshape the weapons complex to meet future needs.

The enterprise must sustain and modernize nuclear weapons and their delivery platforms, aligning its capabilities to deliver a modernized stockpile and a recapitalized infrastructure to meet twenty-first century national security needs. To accommodate this work within reasonable budget levels, existing infrastructure must be upgraded and right sized. As a steady-state, long-term work plan is developed, decisions will need to be made on what infrastructure and personnel will be needed. (The requirement to right-size ONS staff is addressed in Recommendation 7.)

Action Items

12.1 The Director should ensure that the strategy and plan identify and address the deferred maintenance backlog.

In the last two decades, large portions of NNSA's production infrastructure aged while safety rules and other precautions expanded rapidly, leaving NNSA with a significantly reduced ability to design, develop, and produce life-extended warheads. Delayed infrastructure maintenance must be appropriately budgeted to address LEP and other requirements.

12.2 The Director should ensure that the strategy and plan match (and, in many cases, reduce) the infrastructure needed to meet requirements.

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[54] Thirty Congressional budget lines allocated across eight sites yields 240 internal budget control lines.

The panel recognizes that NNSA has developed plans to shrink the weapons complex footprint. This is an issue that will require strong Congressional support.

12.3 The Director should ensure that the strategy and plan identify investments in the needed skills in the workforce.

There needs to be an analysis of the level and skill mix of the workforce necessary to meet future requirements, and an assessment of the steps required to recruit and retain them.

12.4 The Director should ensure that the strategy and plan specify investments in capabilities, including the sites' use of internally directed research and development. The panel recommends Laboratory Directed Research and Development (LDRD) funding of no less than 6 percent, which is needed to sustain leadership in nuclear science, engineering, and manufacturing.

Even as the Director brings greater focus to the execution of customer deliverables, it is essential to sustain the campaigns and independent research that build future capabilities. In this regard, it will be important for Congress to reassess ceilings placed on LDRD funding, which makes an important contribution in sustaining scientific capability, supporting innovative R&D, and attracting and retaining young scientific/technical talent. In light of its importance, the panel recommends the laboratories be authorized to fund LDRD at no less than current levels (no lower than 6 percent), pending further review. Similar support should be given to the plants and NNSS for their internally directed research and development. At the same time, it should be assured that all LDRD is relevant to carrying out the mission of the nuclear enterprise and/or maintaining the capability to do so.

Recommendation

13. The Secretary and Director should continue ongoing efforts to improve construction project management capabilities (at all levels) by introducing disciplined management practices in order to recapitalize infrastructure on time and on budget.

Facility recapitalization projects have been a continuing source of program schedule delays and cost overruns that, as noted, have significantly undermined NNSA's credibility. Major reforms are needed to demonstrate a commitment to sound management practices and improved performance, building on the current OAPM initiative. These include steps to strengthen organizational focus and to adopt proven management practices. The panel notes that the current Secretary has undertaken important preliminary steps in this area, but affirms that persistent commitment and additional and continuing focus on these problems is needed.

Action Items

13.1 The Director should strengthen infrastructure project management skills, tools, and the collection and analysis of data.

The Director should recruit a strong management team supported by experienced experts in facility planning, design, engineering, and construction. This team should be commissioned to create a trusted capability for executing future facility projects.

13.2 The Director should build on recent efforts to adopt best practices for managing infrastructure projects, especially the use of external peer review.

The Director should commission the management team to undertake an initiative to identify, adapt, and expand the use of best practices from inside other parts of the Department, such as the Office of Science's structured approach for facilities construction peer reviews (the "Lehman Review model") and from other government agencies as well as the private sector.

13.3 The Secretary and Director should hold managers accountable for adopting the effective practices detailed in the Department's directive on project management (Order 413), consistent with the principles provided in OMB Circular A-11 in infrastructure projects.

While adherence to DOE Orders is mandatory, in practice, Order 413 has been viewed more as guidance that is not always followed. Stricter enforcement is necessary. The Secretary and Director should ensure effective practices are employed everywhere.

4. Maximize the Contributions of the Management and Operating (M&O) Organizations to the Safe, Secure Execution of the Mission

Don't tell people how to do things; tell them what to do and let them surprise you with their ingenuity.

–George S. Patton

CHALLENGES

The government needs access to and a healthy working relationship with first-class scientific, engineering, manufacturing and management expertise that in some cases is not resident within the government. In the nuclear weapons complex, this is done using a Management and Operating (M&O) contract.[55] This may be supplemented, when appropriate, by the Federally Funded Research and Development Center (FFRDC) model, as discussed in this chapter. There is concern across the NNSA complex that these needed relationships have eroded over the years, and have become more of an arm's length, even adversarial contracting relationship, rather than the needed collaborative one.

In effective organizations, the Federal sponsor decides *what* is needed and the M&O organization decides *how* to meet that need. Put in the simplest terms, the Federal sponsor should identify the objective to be accomplished; identify the best performer; provide adequate resources; monitor results; and hold the performer accountable. Under this construct, a competent M&O organization is relied upon to provide expertise, corporate culture, and leadership sufficient to execute the work while meeting the government's operating standards.

Changes in mission priorities, performance expectations, and cultures have worked to erode the relationship between the Federal sponsor and the M&Os established during the Cold War. Beginning in the early 1990s, mission priorities underwent major transformation, while in

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[55] Federal Acquisition Regulation (17.601) defines a management and operating contract to mean "an agreement under which the Government contracts for the operation, maintenance, or support, on its behalf, of a Government-owned or -controlled research, development, special production, or testing establishment wholly or principally devoted to one or more major programs of the contracting Federal agency." An M&O contract is appropriate where "The work is closely related to the agency's mission and is of a long-term or continuing nature."

parallel the nation's demands in the areas of environmental management, workplace health and safety, and security grew significantly.[56] Two actions that profoundly affected the nuclear enterprise were the decisions in 1991–92 to cancel or postpone several nuclear weapons programs and to suspend underground nuclear testing. These actions ceased the well-established weapons complex product delivery cycle of design-test-build that had organized work throughout the Cold War. In the early 1990s, the DOE identified Science Based Stockpile Stewardship as the strategy for sustaining the safety, security, and reliability of nuclear warheads, while simultaneously sustaining weapons research and development through investments in key stewardship capabilities, including advanced computing, fusion research, materials properties research, and non-nuclear component testing. But the nuclear weapons production complex was allowed to deteriorate to the point where today's NNSA is carrying out warhead life extension work at several facilities that were commissioned in the 1950s and 1960s.

Three decisions made when establishing NNSA also reinforced the shift in relationships. First, as noted earlier, the Albuquerque Operations Office was disestablished in 2002 and no headquarters activity was established that provided comparable expertise or continued operational focus. Second, the new management structure placed greater emphasis on contract management: In the NNSA transition plan, it was proposed that each field office manager would become a contracting officer and serve as the major point of contact with the site operators.[57] Third, as described in Chapter 3, the budget structure was also significantly modified and expanded during the creation of NNSA with the effect of transferring a significant share of resource control to the mission-support staffs within NNSA.

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56 In response to growing public concern over environmental hazards and nuclear safety (Three Mile Island occurred in March 1979; Chernobyl occurred in April 1986), significant actions were taken to tighten the regulation of weapons complex facilities and operations. Congress established the Defense Nuclear Facilities Safety Board in 1988. The board was created to provide an independent observer and advisor on nuclear facilities safety. Admiral James Watkins became the Secretary of Energy in March 1989. In June of that year, Watkins announced the Ten-Point Plan to strengthen environmental protection and waste management activities at the U. S. Department of Energy's production, research, and testing facilities. Included in the plan was the creation of "Tiger Teams" to identify possible environmental problems and violations across the DOE complex. Watkins also modified contracts to provide stronger incentives to address ES&H matters. On 9 November 1989, Watkins established the Office of Environmental Restoration and Waste Management. The joint FBI-EPA raid on the Rocky Flats plutonium facility in June of that year was perhaps the most publicly visible demonstration of the shift in focus.

57 NNSA, *Report to Congress on the Organization and Operations of the National Nuclear Security Administration*, February 2002. The report, never fully implemented, declared the intention of establishing a single line of tasking authority, but does so through the contract management function, rather than through line managers for executing programs. Tasks are to be assigned as follows: "Federal program direction to the laboratories, production plants, and the test site will be delivered only by a warranted contracting officer (CO) or by a designated contracting officer's representative (COR)." The report goes on to say, "NNSA has decided to flow the Administrator's authority and responsibility directly through a contracting officer—who is also an NNSA Site Office manager—to the laboratories, production plants, and test site contractors. In this way, NNSA's basic reporting model is that the laboratory directors and facility managers report directly through to the Administrator through a contracting officer. (pp. 1, 20)

The tension in defining the roles of the M&Os and the Federal mission-support officials has created significant friction in the government-M&O relationships, especially at the laboratories. This friction in the field has been aggravated by the lack of clear roles and responsibilities within government headquarters. It also has been aggravated by the transition of the laboratories toward a more diversified customer base, as well as by the transition to for-profit parent organizations for the M&Os at the laboratories. These changes have led to a heightened, if incorrect, perception on the part of many Federal personnel that the M&Os are now driven foremost by their incentives for growth and profit and only secondarily by their traditional commitment to national service. In addition, the transition to award fees to encourage competition has created the belief among Federal personnel that greater oversight and transparency is required to monitor M&O performance.

In short, the combined effect of the changes in mission, increased regulatory oversight, reduced budget flexibility, and ascendancy of contracting officers in the management structure overturned accepted relationships within the nuclear weapons program. DOE/NNSA has increasingly moved toward detailed direction and regulation of the M&Os, resulting in the current troubled relationship. Concurrently, focus has shifted from mission accomplishment to one of compliance. In the view of one long-tenured laboratory leader: “Historically the job was to accomplish the mission safely and securely. Beginning with Secretary Watkins’ Tiger Teams, the job began to change to ‘Make sure nothing bad ever happens,’ with too little regard to the ability to accomplish NNSA’s missions.”[58]

A 2012 National Research Council study directed by Congress concluded there is little trust in the relationship between the laboratories and NNSA. NNSA has lost confidence in the ability of the laboratories to “maintain operation goals such as safety, security, environmental responsibility and fiscal integrity.”[59] The panel has learned of some efforts to repair this relationship. There is evidence, for example, of recent positive interactions between the field offices and the sites, and more routine channels of communication have been opened between headquarters and the field offices. Nevertheless, the panel affirms these positive changes must be institutionalized and still much more needs to be done.

Five fundamental problems will need to be addressed to create the needed government-M&O organizations’ working relationships necessary to restore the effective and efficient operation of the enterprise.

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58 Testimony to the panel (nonattribution).

59 National Research Council, *Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories*, 5.

Breakdown of the Federally Funded Research and Development Center Model

The FFRDC model for the three NNSA labs has been seriously impaired. Historically, the Federally Funded Research and Development Centers—the laboratories—have played a key strategic role as *trusted advisors* in informing the government regarding effective execution of the mission. The historic, statutorily-defined relationship between the FFRDC and its sponsor includes[60]

- Comprehensive knowledge of sponsor needs: mission, culture, expertise, and institutional memory regarding issues of enduring concern to the sponsor
- Adaptability: ability to respond to emerging needs of their sponsors and anticipate future critical issues
- Objectivity: ability to produce thorough, independent analyses to address complex technical and analytical problems
- Freedom from conflicts of interest and dedication to the public interest: independence from commercial, shareholder, political, or other associations
- Long-term continuity: uninterrupted, consistent support based on a continuing relationship
- Broad access to sensitive government and commercial proprietary information: absence of institutional interests that could lead to misuse of information or cause contractor reluctance to provide such information
- Quick response capability: ability to offer short-term assistance to help sponsors meet urgent and high-priority requirements

Ideally, the benefit of such a relationship is that an FFRDC can function as an independent, long-term, trusted advisor and honest broker. The FFRDC is answerable only to the Federal customer and has no vested interest in particular technologies or solutions. To achieve this ideal, the FFRDC must trust that the sponsor values its role. The government sponsor must trust that the FFRDC is acting as a disinterested, supportive party. These behaviors make it possible to build mutual trust.

In some quarters of the government, the transition to for-profit M&Os, combined with laboratory competition to increase their work for other agencies, has called into question the assumptions regarding the M&O's objectivity and the primacy of the public interest in their

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60 Definition taken from "Federally Funded Research and Development Centers (FFRDC)," on the Defense Acquisition University website, https:dap.dau.mil/acquipedia, accessed 29 July 2014.

operations.[61] Consequently, the trusted FFRDC special relationship has increasingly been replaced by one whereby the laboratories are perceived as profit-motivated contractors to be held at arm's-length, rather than as *trusted agents*. The Laboratory Directors have expressed their concern that the enterprise lacks an effective forum for strategic dialogue between NNSA leadership and their labs.[62] As one symptom of the breakdown in dialogue, one executive reported that his team learned about the site's FY14 budget through the trade press, rather than from NNSA headquarters. Current leadership appears committed to addressing this shortfall, and has initiated strategic forums and more frequent dialogue with the Laboratory Directors, but far more must be done to restore the essence of the FFRDC relationship, and more broadly to reinstill trust in government-M&O relationships.

Unclear Responsibilities for Managing Operations at the Operating Sites

The panel finds that the respective roles and responsibilities of the Federal sponsors and M&Os are not consistently and clearly stated or understood. Rather, they are unique to each site and evidently have evolved over time from the cumulative interactions of government and M&O personnel. Indeed, the panel has been told many times that the relationships between the M&Os and government personnel can vary from site to site and from issue to issue, depending largely on the personalities involved.

Ambiguity is pronounced when it comes to the fundamental question, "Who is the risk acceptance authority (i.e., who is accountable)?" In the case of the Kansas City Plant, for example, the field office and plant manager stated unequivocally that they co-owned the risk. At the Savannah River Site, the M&O has taken ownership of the risk and conducts routine internal management reviews to find the *right* balance in the operation of its activities. Generally, multiple individuals in the government and the M&O will lay claim to owning the risk, but the sense of responsibility and explanations differ from site to site.

While everyone the panel met with accepts a shared responsibility, this leaves no one person directly responsible. Today's system provides no clear answer to the question of who at each site is responsible for balancing across different risks for mission delivery, and the system provides no defined mechanism for clarifying operational interpretations of policy and resolving day-to-day questions or disagreements.

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61 Of note, the Federal Acquisition Regulation (FAR) does not exclude for-profit industry from FFRDC participation, as long as industry complies with the FAR.

62 The laboratory leadership views were expressed in the "Tri-Lab Letter," which provides their characterization of the degraded relationship and recommended changes. See Penrose C Albright, Charles F. McMillan, and Paul J. Hommert, "The Model for the National Nuclear Security Administration and its Laboratories: Recommendations for Moving Forward" (17 April 2012).

From a practical standpoint, the true measure of responsibility is to be held accountable—whether for success or for failure. Within NNSA, the ambiguities in the understanding of the responsibilities for risk are amplified by the unbalanced system of accountability when things go wrong. In the case of the July 2012 Y-12 security incident, in which an octogenarian nun and two aging activists penetrated four security barriers, the differences among the repercussions for the nun, the security contractor, the M&O and the government personnel were stark. The nun was imprisoned. Among the involved contractors, nine top officials were fired. The security contract managed by the government was terminated and security responsibility was transferred to the M&O. In contrast, there were two NNSA Federal employees in the Y-12 field office that were formally punished. One was suspended without pay for ten days and one was moved out of security and is no longer a member of the Senior Executive Service. Within NNSA headquarters, three Senior Executive Service staff were relieved and reassigned outside of NNSA. No DOE employees outside of NNSA were disciplined.[63]

Insufficient Influence of the M&O Parent Organizations' Cultures

The premise of the operating model outlined at the beginning of this chapter is that the government would engage excellent parent organizations to instill strong cultures, operating practices, and systems in the weapons complex operating facilities. Overall, the record has been mixed. There have been important successes and recent progress. The obvious example is at the Kansas City Plant, where the parent Honeywell Corporation has thoroughly driven its highly regarded business systems and culture into that plant's operations. The panel also learned of other somewhat narrower examples of successes, for example the adaptation by Sandia of its parent, Lockheed Martin's earned value management system for the B61 LEP.

But success has by no means been as broad as it could or should be, and there are barriers to progress both within the government and within the M&O parent organizations. The M&O parents argue that sometimes the government does not sufficiently credit their initiatives. For example, when an M&O has adopted parent corporation practices, such as Lean Six Sigma management improvement processes, or invested to obtain industrial certification, NNSA has not relieved them of related transactional oversight. From the government perspective, the M&O parents sometimes under-contribute. The examples cited from this perspective include

- Failures to install promised top talent on the M&O management teams following competitive contract awards, or to keep top managers in place for more than a couple of years
- Failures to install "best-of-breed" corporate management systems at the operating sites

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63 The panel found it extremely challenging to obtain even such broad information with regard to the discipline administered to Federal employees.

- An unwillingness to collaborate among M&O organizations to identify best practices and seek common solutions and efficiencies across the weapons complex

As noted earlier, there is a distinct relationship between the Federal sponsor and M&O employees located at each site that has evolved over time. The same can be said for the relationship between the M&O's headquarters and the site: Some M&Os have single industrial parents and others have multi-member joint ventures. Each model can work and each brings advantages to the site. The weapons complex could benefit from greater collaboration to identify best practice solutions and to implement cost-saving common support functions. The M&O contractors can and should be major contributors to the Department's improvement initiatives.

Costly and Ineffective Transactional Oversight

NNSA's transactional oversight has proven to be expensive and counterproductive.[64] From the perspective of the field looking up at headquarters, the emergence of powerful but unaligned mission-support staffs within NNSA has created confusing, layered oversight. The operating entities of the enterprise face a multitude of oversight agencies, exacerbated in part by the flawed DOE/NNSA governance structure discussed earlier. The result is uncoordinated efforts to address the mission's safety, security, and environmental stewardship without sufficient regard to effectiveness, cost, schedule, risk, or mission impact.

Excessive and uncoordinated inspections, audits, and formal data calls fuel inefficiencies and generate little value added; in fact, they may detract from the desired safety, security, or environmental outcome. Under the current system, elements in the field are subject to review of their programs by NNSA (headquarters and field office staffs); DOE's Health, Safety and Security (HSS) office; the DOE Office of the Inspector General (OIG); GAO; OIGs other than DOE's OIG; the DNFSB; and OSHA and other industrial standards organizations (e.g., National Quality Assurance). Sandia, for example, reported that seventy-eight external audits or inspections were started in FY2013, more than one per week.[65] The workload is such that one full-time employee is required simply to schedule associated activities. Across the weapons

64 As described by one former Laboratory Director, "Transactional oversight entails setting precise steps to be followed and examining implementation of each step with more than 100 Federal employees at each site and hundreds of external audits annually. By its very nature, this process is extremely conservative, risk-averse, and avoids appropriate cost-benefit considerations." George H. Miller, Director Emeritus, Lawrence Livermore National Laboratory, "Opening Remarks and Summary," Hearing of the Armed Services Committee Strategic Forces Subcommittee, U.S. House of Representatives (16 February 2012), 2, accessed 3 April 2014, http://armedservices.house.gov/index.cfm/files/serve?File_id=619ff080-e877-43f6-918f-66be678ef721.

65 Sandia tracks inspections and audits based on new starts. Each noted event may trigger multiple days of engagement and support. Sites track various metrics, including audits and inspection closed out, or the total open audits and inspections.

complex, such audits, reviews and assessments consume enormous time and energy to prepare for, conduct, and follow up on actions.

When asked why a person holding line responsibility cannot say no to these external reviews, the reply was often “There is no gatekeeper of these reviews.” There are also multiple and duplicative inspections and formal data calls. This multiplicity of inspectors and overseers is not rationalized or synchronized. There is insufficient integration of findings to determine the overall impact on mission or risk acceptance. Further, there is only modest evidence that these reviews have actually improved performance or resulted in any other type of constructive change.

Witnesses note that the focus on compliance checklists can actually divert attention from the substance of safe and secure mission performance. In the case of the Y-12 security incident mentioned earlier, the security contractor had been consistently highly rated by DOE prior to the incident. The contractor met the compliance criteria, but long-standing complacency regarding false and nuisance security alarms along the perimeter fencing contributed to an unacceptable security force response. Two assessments done at the request of Secretary of Energy Steven Chu subsequent to the incident underscore these points:

- “…the evaluations of the security at Y-12 had received consistently high marks in the period before the incident. The overall situation reveals significant failings in oversight by DOE.”[66]
- “In general, inspections and testing have focused on verifying that contract terms are satisfied or that the Design Basis Threat…has been countered. Immense volumes of documentation containing innumerable check-lists have been produced—little of which addresses what the Department of Defense would consider Operational Testing… Standards are often procedural rather than performance-oriented, and stress testing has been lacking. What is needed is not more inspections but better inspections.”[67]

This latter point could be applied more generally to oversight, not just to inspections. What is needed is not more oversight but better oversight. [68]

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66 Richard A. Meserve, letter to Secretary Steven Chu, 6 December 2012, available at http://www.pogo.org/blog/2013/01/20130117-now-is-the-time-for-nuclear-security-changes.html, accessed 7 July 2014.

67 Norman R. Augustine, letter to Secretary Steven Chu, 6 December 2012, available at http://www.pogo.org/blog/2013/01/20130117-now-is-the-time-for-nuclear-security-changes.html, accessed 7 July 2014.

68 Two past studies address in considerable detail the issue of transactional oversight. See National Academy of Public Administration, *Positioning DOE’s Labs for the Future*, 47–49; and National Research Council, *Managing for High-Quality Science and Engineering*, 19–21.

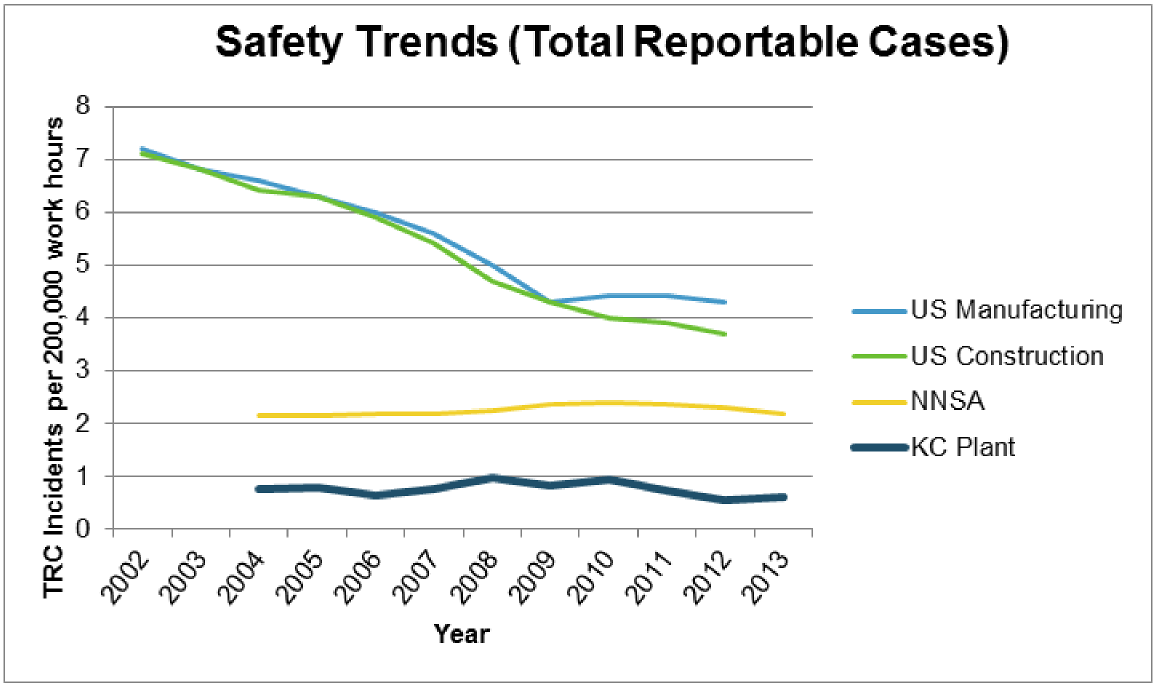
In the case of the Uranium Processing Facility (also at Y-12), none of the many external reviews uncovered a major design flaw (the building height is too low to hold the equipment it must accommodate) until late in the design process. This is now being addressed—at significant cost. Hence, multiple layers of process cannot by themselves ensure zero risk or high confidence in mission performance. These processes can, in fact, generate late changes in requirements that are costly and excessive. Competent, dedicated human judgment is also required. In another case, the panel was told that LLNL, in spite of repeated appeals, was required to purchase large safes to store small arms (.22 caliber) ammunition, but these were then illogically required to be located within a vaulted space where some fifty pounds of high explosives were routinely handled and openly stored. Meanwhile, the same ammunition could be openly purchased in nearby commercial stores.

The panel found there is no consistent reporting on the kinds and frequency of transactional oversight imposed on the weapons complex. Data provided to the panel from the field show that the scope and criteria for required approvals vary significantly across sites. Approval requirements address such areas as Interagency Work (discussed in Chapter 5), travel, conference attendance approvals, and subcontract approvals. The thresholds for reporting vary across sites as well.

Evidence of the high costs and ineffectiveness of transactional, compliance-focused oversight is provided by the gains achieved from the successful reform of regulation at the Kansas City Plant. Beginning in 2005, DOE exempted the Kansas City Plant (non-nuclear operations) from DOE/NNSA orders in areas where there were relevant commercial or industrial standards. The reforms moved the Kansas City Plant under industrial best practice standards (e.g., ISO standards) with validation from external expert bodies. Kansas City Plant officials estimate that this initiative reduced the DOE/NNSA-specific regulatory requirements on the facility by about 55 percent. These changes, coupled with internal business process improvements, have generated steady increases in workplace performance along with reduced mission-support costs.

The plant reports that its safety record, which was already quite good, has remained excellent under the reformed regulatory regime, and is about six times better than U.S. industry averages. A common metric used for reporting safety data is the Total Reportable Case Rate (TRC) per 200,000 working hours, a standard established by OSHA. Figure 7 depicts the TRC rates for the Kansas City Plant from FY04–13, and compares them with the overall NNSA TRC rate, as well as the U.S. rates for the manufacturing and construction sectors. The figure shows that the NNSA safety record is quite good relative to overall industry rates, and that Kansas City accident rates are still less than half those for the overall weapons complex.

A 2008 independent audit following the reforms estimated that the personnel savings for the Kansas City Plant overall was about 12 percent.[69] In parallel, NNSA's field office was able to reduce its staff by 20 percent, from fifty to forty staff. In the case of Kansas City, a better process has yielded continued excellence in safety performance with much lower costs. This is possible because, while the industrial (ISO) certification process is extremely rigorous, the annual recertification process is much less labor intensive. Assuming performance remains excellent, the recertification is straight-forward and avoids costly transactional oversight.



Source: Office of Analysis, Office of Health, Safety and Security, U.S. Department of Energy, "Department of Energy Safety Performance Information and Metrics Focused on Worker Safety and Health," 22 January 2014, briefing as provided to the panel. U.S. manufacturing and construction data are from the Bureau of Labor Statistics.

Figure 7. Kansas City Plant, NNSA, and National Safety Trends

An internal NNSA Enterprise Re-Engineering Team concluded that the "Kansas City model" of relying on applicable industrial standards should be much more widely applied to replace transactional oversight for routine administrative functions, or for industrial-type operations activities that do not pose unique nuclear or health hazards. In 2009, the then Administrator, Thomas D'Agostino, proposed an initial extension of the approach for Sandia and

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69 J.W. Bibler and Associates, "Kansas City Site Office Oversight Plan: Assessment of Implementation Cost Savings" (January 2008). The plant management reported to the panel that its internal process improvements actually began in the 1990s, and over the period 1995–2012 it has reduced the headcount of ES&H specialists by 81 percent.

NNSS, with the intent of deploying this approach across the weapons complex.[70] Over the ensuing years, the proposals to adopt the Kansas City model have been evaluated by senior leadership at DOE headquarters but not accepted. This approach appears to be a significant governance reform opportunity that deserves careful, renewed attention.

Another measure of the costs of transactional oversight is the size of the staffs who reside in the field offices, where much of this oversight occurs. In terms of NNSA's field offices, when benchmarked against the other parts of DOE, such as the Office of Science and Naval Reactors, the difference in the size of the field offices is striking, as depicted in Table 4.[71] Comparisons with other nuclear oversight activities, such as the Nuclear Regulatory Commission, demonstrate that they too maintain much smaller site offices than does NNSA.[72] There are plans to reduce the size of NNSA's field offices, and each has been asked to furnish projected staffing levels for FY16, but even with reductions, there will remain a considerable gap between NNSA averages and those of the other DOE programs. Obviously, differences in the field office's assignments of oversight and mission-support functions between NNSA and the Office of Science accounts for a significant portion of this difference in staffing levels; nevertheless, the opportunities for reducing transactional oversight through the wider application of industrial standards should not be overlooked. M&Os have observed that they must maintain at least one or two employees to respond to requests from each Federal oversight person at the field offices. As field office personnel are reduced, it should be expected that there will be corresponding reductions in the M&O staff.

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70 In a memo dated 22 December 2009, Administrator Thomas D'Agostino kicked off the "NNSA Enterprise Reengineering Reform Initiative." In the memo, he stated his intent as follows: "Within the past three years, NNSA underwent a successful change in how we conduct business at the Kansas City Plant (KCP). This change is known as the KCP Oversight Model for Non-Nuclear Operations. Given the success of this KCP model, I believe NNSA is ready to cascade the principles of the KCP non-nuclear operations model to other NNSA contractors in a systematic approach that leverages the lessons learned from KCP and other efforts to implement the KCP model at the Sandia Site Office (SSO)/Sandia National Laboratory (SNL) first followed by implementation at Nevada Site Office (NSO)/NSTec and then site/contractor by contractor across the NSE. … Over the next few years, transitioning all of NNSA's contractors to the KCP model for non-nuclear operations is one of my highest priorities."

71 Naval Reactors reports their site offices average roughly seventy staff, yielding a ratio of government staffs to M&O personnel of about .36 per 100. In terms of technical capacity, "NNSA employs a total of 89 PhDs (among its 2,500 personnel), whereas in the Office of Science, nearly all scientific program managers are PhD scientists with extensive research experience." Source: Letter to the panel from a former DOE Office of Science Official.

72 The NRC reports that it maintains very small site offices with two or three individuals at each site. This is not a direct comparison, because the majority of NRC field personnel are in regional offices.

Table 4. Field Office Personnel Comparisons

Field Office Personnel	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	FO per 100 M&O (2013)
Kansas City Field Office	50	46	42	42	35	39	43	40	37	35	**1.2**
Livermore Field Office	94	89	96	95	95	96	97	94	85	83	**1.4**
Los Alamos Field Office	109	108	105	108	106	105	107	103	91	86	**0.8**
Nevada Field Office	100	98	95	96	92	96	98	96	87	83	**3.0**
Sandia Field Office	87	86	83	85	83	83	99	82	80	81	**0.7**
Savannah River Field Office	21	23	33	34	36	30	31	33	28	28	**0.6**
Pantex Field Office	86	85	82	75	77	81	78				
Y-12 Field Office	80	82	84	83	79	78	81				
NNSA Production Office*								149	129	127	**1.5**
Avg. NNSA Field Office**									67		**1.1**
Avg. Office of Science Field Office									19		**0.1**
Naval Nuclear Propulsion Program											**.4**

* In 2012, the Pantex and Y-12 field offices were merged, to create the NNSA Production Office

**Average is based on eight field offices, since Pantex and Y-12 are two sites

Sources: For NNSA field office data: DOE, information provided to the panel, 25 March 2014. For Office of Science data: Steve Binkley, "A DOE View on NNSA Labs Governance," briefing slides, 12 March 2014. For M&O data, information provided to the panel, June 2014.

Contract Requirements and Performance Metrics that Divert Attention and Resources from Mission Execution

Misguided contract requirements reinforce the focus on inefficient transactional oversight. By specifying detailed compliance requirements, DOE/NNSA is, in effect, imposing government processes—generally not widely praised for their efficiency—on the M&Os, rather than taking advantage of the strengths that the M&Os bring to the table from the competitive marketplace. In short, this is the very opposite of what should happen.

Award fees, when combined with mission-support-oriented compliance criteria, reinforce DOE/NNSA's emphasis both at headquarters and in the field on transactional oversight. Indeed, close observers have told the panel that the available fee incentives have been divided among the mission-support communities, who view the fees as an important source of leverage for enforcing compliance. At the same time, the fees incentivize middle managers in the M&O organizations to organize efforts designed to maximize their fee award.

Under the current contracts, the percentage of total fee that is at risk (the incentive fee) ranges from 10 percent for Sandia to 70 percent for LANL and LLNL.[73] In 2012, one laboratory reported on twelve sets of performance-based objectives, including over seventy-four individual milestones and deliverables, each with specific performance measures and associated fee. One laboratory official reported that the laboratory's performance report filled a binder that was several inches thick, requiring a huge effort to produce. Moreover, the fees were predominantly centered on mission-support compliance criteria rather than on mission accomplishment itself. One site official noted that, at one point, fully 80 percent of the award fee was tied to mission-support activities, not to mission execution.

The recent transition to Strategic Performance Evaluation Plans (PEP) provides a step away from detailed transactional oversight, focusing more broadly on five evaluation areas with much more emphasis on mission accomplishment and leadership. But, this approach still retains the essence of the fee-driven, compliance culture.

Several experts have recommended shifting the incentive structure away from award fees and instead to focus on the extension of the M&O operator's period of performance as the incentive for satisfactory mission performance. Similarly, a decision not to extend the contract, or even to terminate the contract early, provides a powerful lever to punish poor performance. It has been observed that at the Kansas City Plant's reform efforts were driven importantly by the fear that the long-term future of the contract was at risk, and continuation required major cost savings.

RECOMMENDATIONS

An effective, trusting, and collaborative government relationship with M&Os is vital for accomplishing the nuclear security mission. DOE&NS must establish a relationship that attracts world-class parents for the M&O organizations, and takes advantage of their ability to recruit and retain talent, instill a strong management culture, and contribute proven business systems, processes, and practices. The significant erosion of this relationship and an inability of the M&Os to adequately apply their knowledge and best practices due to onerous oversight and increasingly tactical contractual constraints has resulted in at least an arm's length—and at worst, an adversarial—relationship.

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[73] The Sandia contract was renegotiated in the summer of 2014 and the award fee component was reduced from 35 percent to 10 percent. The data on fees and performance metrics were obtained during panel fact-finding visits and follow-up email correspondence.

It is clear that the recent acting NNSA Administrator recognized existing problems and set in motion some changes to help resolve them. In the field, the panel saw evidence of improved communication and collaboration between the M&Os and NNSA's field offices, especially at the plants. However, these positive changes do not appear to extend to relationships with NNSA headquarters, either on the part of the M&Os or the field offices.

While the focus on tactical compliance as opposed to strategic outcomes has been driven partially by the incentive fees embedded in the existing contract approach, the panel remains skeptical regarding recent calls for a return to the *public service* contracting model. It also finds it inappropriately pejorative. Although the details of this model have yet to be unveiled, the panel firmly believes that turning back the clock to the modern equivalent of the $1 per year public service arrangement of the Manhattan Project is neither practicable nor advisable.

The panel recommends a major transformation in incentives and relationships. The panel's recommendations are intended to restore the trust and mutual respect intended in the government-contractor (GOCO) management and FFRDC advisory model and the Department's ability to rely on the sites' leadership and expertise for strategic, technical, and programmatic advice, while minimizing ineffective and wasteful transactional oversight activities across the complex.

Recommendation

14. The Director should reform M&O contracts, replacing the award fee structure with fixed fees for longer (multi-year) award terms and linking performance incentives to the contractual period of performance.

The panel found that an unintended consequence of the award fee structure is that it contributes significantly to detailed, transactional oversight. It has contributed to the growth of a government bureaucracy responsible to track fee. This, in turn, has induced the M&O organizations to grow a corresponding bureaucracy to provide the assessments that justify their award fees. The panel recommends the following actions to end this dysfunctional practice.

Action Items

14.1 The Director should adopt market-based fixed fees for new M&O contracts commensurate with M&O-borne risks, M&O investments in the enterprise, and the scale of the undertaking.

The Director should reform the fee structure and contract performance assessments for the M&Os for future contracts. Award fees should be eliminated and replaced with fixed fees. To the extent that small incentive fees are retained, they should be appropriately focused on rewarding best practices. Fees should be market based, commensurate with

- the risk exposure of parent organizations (tangible and reputational)

- the value of the parent's investments in the nuclear enterprise (leadership and corporate talent, industrial best practices, safety/security culture, management systems, etc.)
- the size and complexity of the undertaking to be managed

14.2 Where practicable, the Director should convert existing contracts to similar fixed fee arrangements.

Using the criteria described in Action Item 14.1, the size of the fixed fees could be negotiated based on a thorough market analysis.

14.3 The Director should base decisions to extend an M&O contract's period of performance primarily on contributions to mission performance; unsatisfactory performance should lead to early termination.

The primary basis for the decision on contract extension should be mission performance, except in the case of extraordinary failures in supporting areas. Extension of the contract period of performance should be the foundational element of evaluation and, in turn, successful performance. Award terms should be for multiple years to encourage continuity and high performance. Such an award term should be added on to the end of the contract. This is often referred to as the *evergreen approach*.[74]

14.4 The Director should seek greater standardization of contract provisions across similar entities.

For example, the M&O should be responsible for security at the site (to avoid bureaucratic seams, such as those that arose at Y-12 during the 2012 incident). Standardization could also create greater equality in fixed fee, to avoid existing disparities such as seem to exist between the LANL/LLNL and Sandia contracts.

Recommendation

15. The Secretary and Director should reinforce the M&O parent organizations' obligations to contribute to enterprise management improvement initiatives

The panel finds a wide range of M&O contributions at the sites. What is clear from the most successful examples is that a strong infusion of a successful parent organization's corporate

[74] According to Investopedia, the definition of "evergreen" is "A contract provision that automatically renews the length of the agreement after a predetermined period, unless notice for termination is given. Evergreens are often used for long term agreements…" http://www.investopedia.com/terms/e/evergreen.asp, accessed 30 September 2014.

culture, business systems, and talent are essential for effective operations at the site. This requires a personal commitment by the firm's top executives.

Action Items

15.1 The Director should create collaborative mechanisms to strengthen the joint contributions of the M&O organizations in improving the effectiveness and efficiency of enterprise operations.

The Director and M&O leadership (to include the Laboratory Directors, plant managers, and other appropriate senior leaders) should work together to improve visibility and integration of overall enterprise technical work programs including infrastructure sustainment and Interagency Work (IW). Along with better visibility, there should be a concerted effort to effectively prioritize the work, improve cost accounting and transparency. This effort should be undertaken with the objectives of more informed resource management across the enterprise and more opportunities to improve overall efficiency and effectiveness.

15.2 The Director should task M&O organizations to identify and assess management improvement opportunities, both for mission execution and for mission-support functions.

The M&O organizations should be tasked to contribute their corporate knowledge and experience to identify ways to improve the management of the nuclear enterprise. As an element of the Director's continuous learning and improvement system, the M&Os should be routinely tasked to identify and assess possible management improvement initiatives.

Recommendation

16. The Secretary and Director should eliminate wasteful and ineffective transactional oversight.

The panel finds that regulation of the DOE nuclear security enterprise has over time become increasingly beleaguered with competing authorities, conflicting guidance, and costly but often ineffective oversight. It is imperative that existing practices be overhauled. This requires at least two actions by the Secretary and Director.

Action Items

16.1 The Secretary and Director should direct a reduction in the number of audits, inspections, and formal data calls, and better synchronize those that remain.

The Secretary and Director should conduct a zero-based review of all audits, inspections, and studies. The Director should be empowered to approve or disapprove any internal DOE&NS/ONS audits to eliminate non-value-added activities. The Director should establish procedures to coordinate and synchronize all internal and external (e.g., GAO) audits, inspections, and formal data calls imposed on headquarters and field activities to the extent possible to minimize disruptions to operations. The focus of internal reviews should shift toward mission success as opposed to compliance.

16.2 The Secretary and Director should eliminate transactional oversight in areas where there are better mechanisms for certifying contractor performance, to include reform of the field office's staffing levels and performance criteria.

The infusion of a proven safety and security culture from a world-class parent organization, the adoption of modern industry standards, and the reliance of external experts for accreditation or certification can yield very positive results. The Secretary should adopt the best practices of the Kansas City Plant wherever possible. First, insist on strong corporate cultures of the parent M&Os as the basis for achieving safe, secure operations. Second, employ industry standards for non-nuclear operations, with exceptions applied only under extraordinary circumstances (such as processing beryllium). Third, transition to an alternative oversight model based on performance-based standards, rigorous accreditation/certification, and observed performance. Examples from the panel's benchmarking efforts include: Naval Reactors, Strategic Systems Programs, and the Office of Science.

Recommendation

17. The Secretary, Director, and the National Laboratory Directors should adopt management practices that serve to rebuild the strategic Government-FFRDC relationship.

A fundamental concern across the complex, but particularly on the part of the laboratories, is the lack of mechanisms for strategic dialogue and impact to planning. Integrated decision making and planning are critical to successful performance of the endeavor and will serve to restore the trust and transparency necessary to rebuild the FFRDC special relationship.

Action Items

17.1 The Secretary and Director should continue to reinvigorate the strategic dialog with the Laboratory Directors.

Integrated planning and decision-making forums will help ensure coherence across the Department and provide an opportunity to communicate expectations. These forums will facilitate the government being able to convey what needs to be done, and the laboratories being able to convey how it can best be accomplished. The panel notes that an improved dialog has evolved in the last year and makes this recommendation to ensure the dialog continues and deepens.

17.2 Leaders in both the government and M&Os should prescribe and enforce behaviors that rebuild credibility and trust.

Communication policies: There should be consistent messaging among government and M&O officials on factual matters and program priorities. There needs to be "one message, many voices."

Commitment: The Secretary and Director should support the continued evolution of the laboratories *national security* roles in serving nuclear security customers across the government, while emphasizing that all customers must be served. It is essential that DOD customers trust that the laboratories' attention to other customers' needs does not distract from nuclear deterrence needs.

Credibility: Both government and laboratory personnel must focus on delivering on commitments made within agreed-upon timeframes and agreed-upon costs. They must also be committed to communicating honestly and openly with each other, without fear of retribution if they, on occasion, must deliver bad news.

Investment in the relationship: The M&Os should focus on providing world-class business systems and practices for advancing mission execution and mission-support responsibilities.

17.3 The appropriate government officials (e.g., Deputy Directors, program managers) should meet at least monthly with the M&O leadership, and preferably have daily informal interactions.

Monthly meetings would offer a regular opportunity for a two-way discussion of project status, needs, and required changes.

5. Strengthen Customer Collaboration to Build Trust and a Shared View of Mission Success

Our distrust is very expensive.

–Ralph Waldo Emerson

CHALLENGES

The panel examined the relationships between NNSA and nuclear weapons customers in DOD, as well as other customers in DOD, Department of State, Department of Homeland Security, and the Intelligence Community. The most serious collaboration issues are with the DOD nuclear weapons customers, who believe that the current processes for DOD-DOE consultation and collaboration are not serving their needs. DOE/NNSA's history of over-promising and under-delivering has seriously undermined the trust of the DOD's weapons customers. These DOD customers lack confidence in NNSA's ability to execute warhead life extension programs (LEPs) and major nuclear facility modernization projects. This is both a cultural and communications divide. A fundamental void is the lack of an affordable, executable, joint DOD-DOE vision, plan or program for the future of nuclear deterrence capabilities, which are described in more detail in this chapter. On the whole, other customers who currently are working with NNSA laboratories and plants indicate that they are satisfied. Even here, however, detailed oversight of transactions impedes collaborative relationships; a more strategic collaborative approach could strengthen capabilities and improve the services provided.

Collaboration between NNSA and the nuclear weapons customers in DOD occurs primarily through the Joint DOD-DOE/NNSA Nuclear Weapons Council, its subordinate Standing and Safety Committee (SSC) and staff *action officer* working groups, as well as through the Project Officer Groups responsible for each type of nuclear weapon in the inventory.[75] The NWC has a

[75] The USD(AT&L) is the chairman of the Nuclear Weapons Council. The other four members are: Vice Chairman, Joint Chiefs of Staff; Undersecretary of Defense (Policy); Commander, USSTRATCOM; and Under Secretary for Nuclear Security of the Department of Energy (Administrator, NNSA). The Services and other staffs are invited to participate as observers. The Council's role and responsibilities are found in 10 U.S.C. §179. Sub-paragraph (d) stipulates the following responsibilities of the NWC:

(1) Preparing the annual Nuclear Weapons Stockpile Memorandum.
(2) Developing nuclear weapons stockpiles options and the costs of such options and alternatives.

central role to play in creating an executable plan for the future stockpile agreed on by the two Departments. This responsibility will require an orderly process for the NWC's working groups to serve its principals and provide greater transparency between the two Departments.

Productive working relationships with the customers of nuclear security missions are essential for the health of the enterprise. Three substantial weaknesses in joint NSE-customer collaborative mechanisms undermine the necessary working relationships.

Lack of Effective Joint DOD-DOE Planning and Budget Coordination

The DOE/NNSA-DOD relationship has been significantly stressed over the past several years, due largely to failed attempts to converge on a viable plan for modernizing nuclear weapons and nuclear facilities. Within the past two years, at the behest of the Chairman of the Nuclear Weapons Council and under the leadership of U.S. Strategic Command, the DOD has produced the *baseline plan*: a concept outlining DOD's warhead and delivery platform needs over the next three decades, the NNSA infrastructure required to support DOD's needs, and a "3+2 Concept" for the long-term stockpile.[76] The NWC has vetted and endorsed the conceptual underpinnings of this approach, but agreement on the details remains elusive within DOD as well as between NNSA and DOD.

The recent decision by the Deputy Defense Secretary's Management Action Group (the DMAG 1) is currently viewed as a near-term path forward, and it represents a step toward an agreed approach.[77] However, there remain fundamental differences in views on the appropriate composition of the weapon life extension programs and the timing of deliverables.

Many DOD witnesses have expressed frustration with the lack of progress in developing a mutually agreed-upon plan, and have suggested to the panel that the NWC mechanism should be strengthened to drive the needed convergence between DOD and DOE/NNSA on mission priorities and resource plans. Other witnesses have countered that these mechanisms work well for their intended purposes. Still others propose an industrial-type contract between DOD and

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(3) Coordinating and approving programming and budget matters pertaining to nuclear weapons programs between the Department of Defense and the Department of Energy.
(4) Identifying various options for cost-effective schedules for nuclear weapons production.
(5) Considering safety, security, and control issues for existing weapons and for proposed new weapon program starts.

76 The "3+2 Concept" is a vision for reducing warhead types over the long term via consolidation and retirements thereby making the management of the stockpile more efficient. The concept, if and when it is fully realized, will narrow the number of warhead types to "3" for ballistic missile delivery systems and "2" for aircraft and cruise missile delivery systems.

77 DMAG 1 represents the most recent DOD programmatic decision taken during the last cycle of budget development and program review. It represents a commitment to fund completion of the W76 LEP deliveries, the W88 Alt, and the B61 LEP, albeit with delays from the original requirement. DMAG 1 delayed the scheduled delivery of the long range standoff missile and W78/88-1.

DOE. As discussed in Chapter 1, the panel is recommending joint reviews of warhead and delivery system programs by OMB and the NSC, in part to drive the needed collaboration between the nuclear enterprise and its weapon customers.

Regardless of the role assigned to the NWC, there are significant process issues that need to be addressed to improve its effectiveness. The processes supporting the NWC have been unable to achieve the collaboration required to build consensus or to systematically frame issues at the working levels across the Department... This is despite many attempts at establishing better communication, more disciplined staff processes, and closer follow up.

Lack of DOD-DOE Information Sharing and Trust

NNSA's unreliable planning and cost estimating, as discussed earlier, combined with DOD's perception of a lack of transparency into DOE/NNSA programs, has engendered significant distrust of the DOE process within the DOD. Beginning in 2010, DOD has worked with DOE/NNSA initially under a Memorandum of Agreement for a one-time *transfer* of a portion of proposed budget authority for nuclear weapons activities from DOD's proposed budget to NNSA's proposed budget for sustaining deterrence capabilities—including LEPs, stockpile surveillance, CMRR, and UPF.

NNSA and DOD staffs spent much of 2012 working to achieve a common resource plan for the national enterprise that would be geared to meeting DOD's needs. This effort led to a tentative agreement in early 2013 on an NNSA program and budget that would be in line with the "3+2 Concept," and DOD agreed to contribute additional proposed budget authority to execute the program in FY14. In total, DOD has reallocated nearly $12 billion over multiple years in proposed budget authority to DOE. However, because these funds are in *proposed* budget authority, most, but not all, of the funds were actually received by DOE.

During this period, a series of NNSA budget shortfalls were reported. These resulted largely from significant cost growth in the DOE programs. Other contributing factors included reductions in the overall NNSA budget—due to Continuing Resolutions, congressional marks, the Budget Control Act, and the effects of sequestration.

DOD leaders have been frustrated by these continuing shortfalls, delays in agreed-upon programs, and DOE/NNSA requests for additional funding. DOD officials also have been frustrated by the limited budget and cost information provided by DOE/NNSA, and they have pressed for information on budgeting and program management processes in order to track the execution of the funds that DOD gave up. A satisfactory degree of visibility has not been achieved. The differing perceptions on these *transfers* have exacerbated tensions and further undermined trust in the DOE-DOD relationship.

Also contributing to the challenges of DOD-DOE collaboration is the difference between the Departments in preparing longer term budget estimates. While DOD uses a well-developed planning, programming and budgeting system (PPBS) to create its FYDP, DOE's approach to creating its FYNSP has historically lacked the same level of transparency and rigor in its cost analysis and estimating. Recent efforts, such as the 2015 *Stockpile Stewardship and Management Plan* (SSMP), are a step in the right direction, but additional rigor is still needed.

Weak Processes for Interagency Coordination and Tasking

Beyond DOD, the enterprise has many other customers from across the government, such as the Intelligence Community, Department of State, and the Department of Homeland Security, all of whom make use of the science and technology (S&T) capabilities of NNSA's national security laboratories, NNSS and, to some degree, the production plants (as well as the DOE Office of Science laboratories). Such customers provide the funds needed to accomplish a mutually agreed program of work on an agreed schedule. This program was known as Work for Others, but has more recently been referred to as Interagency Work (IW).[78]

In the main, the IW customers report they are satisfied with the quality of science and engineering, and the final product they receive from DOE/NNSA. This favorable assessment is consistent with the growth in IW, which now accounts for between one-tenth and one-third of the nuclear weapons laboratories' total funding. The continued growth of this work lends credence to the observation that the three NNSA laboratories are transitioning from strictly nuclear weapons labs to national nuclear security labs, as was noted in the *Strategic Posture Commission Report*.[79] The amount of IW performed at each site during FY13 is captured in Table 5, in terms of its dollar value, its percentage relative to the site's overall budget, and the number and size of projects the funding represents.

Interagency Work has become an important contributor to the science and technology base that supports the weapons program. Conversely, this work would not be possible without the long-standing and substantial investments of the nuclear weapons program. By addressing the requirements of many customers, the IW program can help DOE/NNSA balance the needs of near-term program execution and long-term national security requirements. The IW efforts have yielded breakthrough developments in combatting improvised explosive devices, detection technologies for weapons of mass destruction, and advanced conventional munitions. IW has also been identified as nurturing and honing capabilities in areas such as weapons design, materials science and radiation hardening technologies to enhance survivability. These programs are also important for hiring and developing needed talent.[80] Finally, because IW customers

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78 As of September 2014, a new term for IW is being adopted: Strategic Partnership Projects. For the purposes of this report, drafted while IW was still the term in use, all references are to IW.

79 Strategic Posture Commission, *America's Strategic Posture*, 52, 53–55.

80 On the overall importance of IW, see DSB, *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills* (Washington, DC: DOD, September 2008), 47–49; and Elizabeth Turpen, *Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century* (Washington, DC: Stimson

often have a choice among potential providers, the ability of the NNSA complex to attract this work is one way to judge the quality of the workforce. On the other hand, controls must be in place to assure that work unrelated to NNSA's unique skills do not become a distraction from the basic mission or an excuse for hiring or retaining otherwise unneeded personnel.

Table 5. Interagency Work (IW) by Site (FY13)

	Total IW Funding ($M)	IW Funding as % of Total Funding	Total Projects	Projects by Funding Level (Percentage)			
				≤$100K	$100–500K	$501K–$1M	≥$1M
LANL	225	11	607	44	37	10	9
LLNL	272	18	836	61	24	8	8
Sandia	879	35	1862	41	31	11	17
KCP	187	20	279	28	35	13	23
NNSS	97	19	137	28	44	15	12
Pantex	5	< 1	29	76	21	0	3
SRS**	22	2	60	43	23	7	27
Y-12	28	< 1	31	26	32	13	29
NNSA Totals	$1,715		3,810	45%	31%	10%	14%

Note: These figures do not include site work for other parts of DOE.

** At SRS, NNSA work is performed by two major contractors, the M&O and a construction contractor. Data provided is as follows: M&O/Construction/Total. The M&O information includes NNSA and Environmental Management.

Source: Data provided to the panel by each site upon its request, June 2014.

While the panel did not focus deeply on DOE/NNSA's relationships with its interagency customers, experts did identify several issues for the panel's consideration. One is the tactical approach taken by many customers: much of this work for external sponsors is accomplished using annual task orders with no long-term commitment. Interagency tasks are typically quite small and each laboratory manages hundreds of such tasks. For example, LLNL reported it manages about 800 interagency tasks, many providing a few tens of thousands of dollars in support, as noted above in Table 5. As this issue has frequently been summarized, the IW customers "buy by the glass" but do not invest in "maintaining the vineyard." There is also a range of areas where working relationships could be simplified and improved:

Center, 2009), 27–31, 33. On the specific point of its ability to attract and retain talent, see Albright, McMillen, and Hommert, "The Model for the National Nuclear Security Administration and its Laboratories: Recommendations for Moving Forward,"1.

- Approval processes are needlessly cumbersome, as Figure 8 illustrates. Tasks are reviewed and approved individually, even though these tasks are typically quite small and each laboratory manages hundreds of them (as shown in Table 5). Even small, routine contracts require multiple levels of approval sometimes taking weeks.

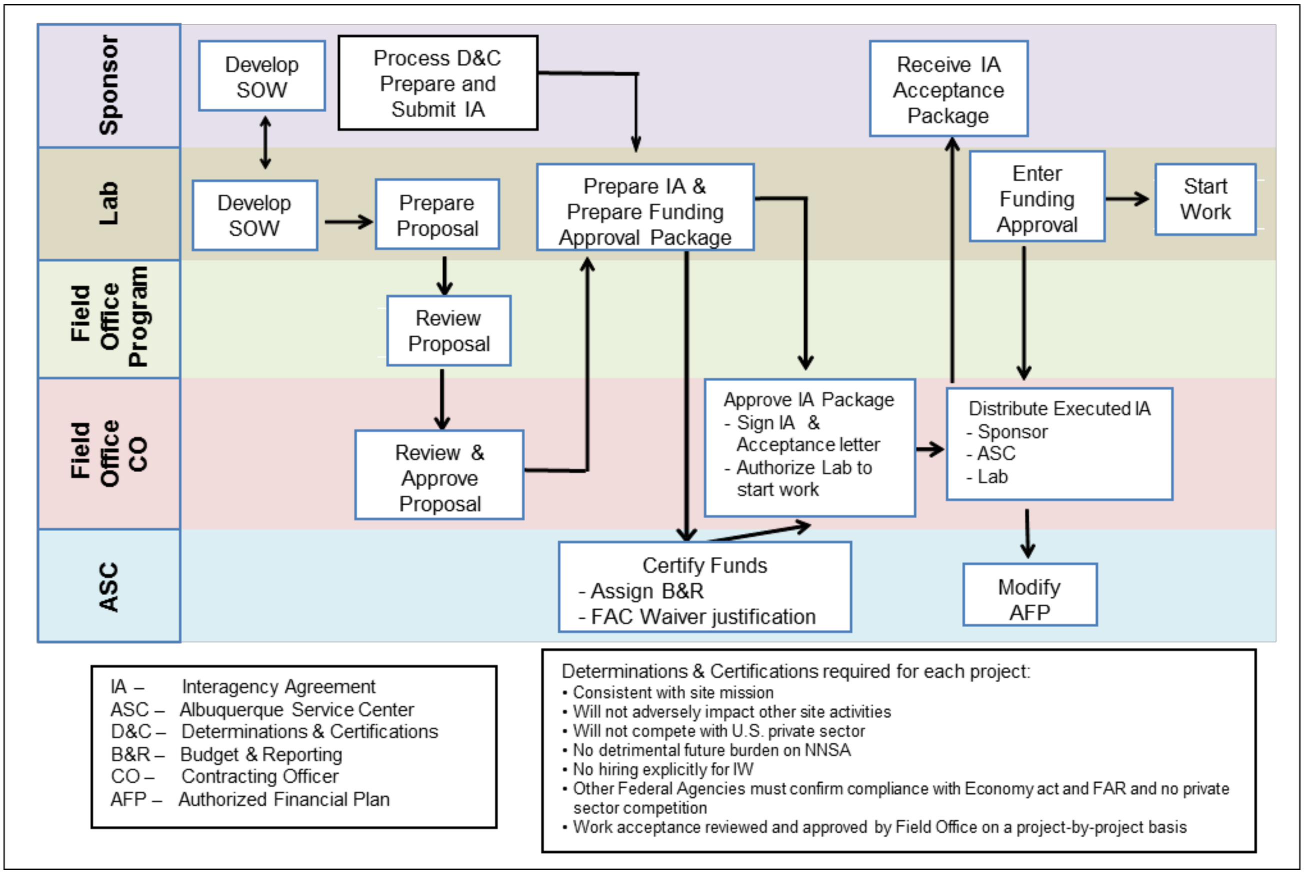

Figure 8. The Interagency Work (IW) Approval Process

- Delays are not uncommon in the movement of funds from sponsors to the labs. In some cases, technical efforts may be put on hold pending arrival of funds.
- Year-to-year uncertainty in funding makes it difficult to forecast demand and manage professional staffs.
- Recapitalization of scientific and physical capital is not addressed. While external funding covers the overhead costs immediately associated with the work being accomplished, it does not cover the cost of refurbishing and replacing the unique laboratory capital equipment or capabilities used in some tasks.

Some customers have found ways to resolve some of these challenges by employing interagency agreements with DOE/NNSA in which the external funding organization makes a standing commitment to funding support at a specified level of effort.[81] While necessarily subject to the availability of annual appropriations, this eliminates much of the uncertainty, enabling the NNSA laboratories to better align and manage professional staffs and plan and conduct technical work. Capital investments to develop needed capabilities for interagency customers are a more difficult challenge, but they too have been overcome in a limited number of cases. NNSA has approached this challenge on a facility-by-facility basis.

The 2010 establishment of the Mission Executive Council (MEC), via a four-party Governance Charter signed by the Secretaries of Energy, Defense, Homeland Security, and the Director of National Intelligence, is intended to facilitate interagency collaboration on long-term planning and investment in the enterprise's skill sets.[82] The MEC provides a forum for coordinating shared, long-term planning for the critical, and often unique, capabilities resident in the DOE national laboratories (not just NNSA laboratories) that are of cross-cutting strategic national security interest. The MEC, however, has had limited success to date in identifying common technology areas, addressing long-term investment needs, and providing a strategic focus.

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[81] The panel was told, generically, of Intelligence Community examples. In addition, Homeland Security Act of 2002, §309, authorizes DHS use of DOE national laboratories and sites via joint sponsorship, direct contract, or "work for others." Labs and sites perform such work on an equal basis to other missions at the laboratory and not just on a noninterference basis. DHS does not pay costs of DOE or its contractors in excess of the amount that the DOE pays. DHS' position is that it strongly prefers using authorities given it in law to allow it to work across the DOE complex in response to proposals.

[82] The "Governance Charter for an Interagency Council on the Strategic Capability of DOE National Laboratories as National Security Assets," U.S.C §188 (2012), has the following objectives:

- Provide a forum for the Parties' leadership to identify and plan strategic ST&E collaboration of common interest in the area of national security;
- Examine critical strategic mission needs requiring the ST&E capabilities unique to the National Laboratories;
- Develop a mecnahism for two or more of the Parties to undertake long-term strategic planning of common interest to develop and sustain strategic capabilities of inter-agency interest at the National Laboratories; and
- Create an interagency framework for two or more Parties to consider making collaborative national security investment decisions.

The Governance Charter further states that "The Council will serve as an inter-agency forum for discussion and coordination on developing priorities among the Parties regarding long-term strategic ST&E capabilities at the National Laboratories."

RECOMMENDATIONS

The panel finds that NNSA's many customers and sponsors have uneven levels of satisfaction and varied perceptions of collaboration and transparency. Some of DOE/NNSA's customers are satisfied, but its nuclear warhead customers in DOD are dissatisfied with the lack of transparency and the continued growth in costs and slips in the schedules for major programs and infrastructure projects. Secretarial attention is needed to reconcile the current disparity between the statutory roles and responsibilities of the Nuclear Weapons Council and the results of the Council's work. The panel provides a number of recommendations to strengthen collaboration in order to improve communication and drive toward a common view of mission success.

Recommendation

18. The Secretary should collaborate with the Secretary of Defense to better align the planning, resourcing, and execution of sustainment and modernization programs for nuclear weapons and their supporting infrastructure with DOD's delivery platforms.

In order for the enterprise to fulfill its nuclear deterrence mission, the relationship between DOE&NS and DOD must be collaborative. Secretarial attention is needed to strengthen commitment and collaboration across Departments, including an effort to strengthen the statutorily-established Nuclear Weapons Council.

Action Items

18.1 The Department Secretaries should direct activities that foster collaboration and communications among the principals and staffs supporting the Nuclear Weapons Council (NWC).

The Secretary, in collaboration with the Secretary of Defense, should jointly review performance of the Nuclear Weapons Council and its Standing and Safety Committee and working groups in light of the stipulations establishing the Council's role and responsibilities found in 10 U.S.C. §179 (1994). This review should include steps to increase information sharing, communication, and transparency at all levels of the two Departments' interactions.

18.2 The Department Secretaries, supported by the chairman and members of the NWC, should reinvigorate its working-level elements.

The Council needs to reinvigorate its working-level groups (i.e., the Standing and Safety Committee and action officer groups), which offer proven staff and analytical processes, and embrace the inputs they provide. Their more effective use can strengthen working-level coordination and enhance preparations for informed decision-making during Council sessions.

18.3 The Department Secretaries should establish transparent information sharing mechanisms and increase direct staff collaboration on a daily basis to address persistent communications and trust issues.

Principal members of the Nuclear Weapons Council, the Project Officer Groups, and responsible staff elements should have full access to all program information, including cost data, necessary to carry out their responsibilities. Access to and transparency of program data, irrespective of source, for any nuclear weapon system program impacting both Departments—warhead LEPs and delivery systems—is inherent in the effective synchronization of the enterprise.

In addition to the formal interactions occurring through the NWC and its subordinate entities, other mechanisms for more routine coordination should be identified that would enhance mutual understanding and transparency in the nuclear weapons program. For example, there should be continued joint work on cost estimating, budgeting, and program management. This should take the form of regular collaboration between ONS staff and appropriate DOD counterparts in OSD, the Joint Staff, the Military Services, and the Combatant Commands.

18.4 The Department Secretaries should confer on each Department's proposed co-chair to the Standing and Safety Committee (SSC), which reports to the NWC.

Specific focus should be placed on the expertise, experience, and team building skills of the two principals responsible for co-chairing the Standing and Safety Committee. These two officials provide a key bridge for communication and collaboration across the Departments, and an effective working relationship is critical to the success of the enterprise. (They are the Assistant Secretary of Defense for Nuclear, Chemical and Biological Defense Programs [ASD(NCB)] in DOD and the Director of Defense Programs in DOE.) If the Secretaries were to confer on their respective nominees for these positions, this would help ensure compatible individuals with the right mix of talents are appointed. While the appointee of each Department is entirely the province of the Secretary of that Department, informal coordination is important, both as a professional courtesy and as a means of forestalling future, avoidable, problems.

18.5 The Department Secretaries should involve the NWC in drafting and reviewing the annual assessment to the NSC of progress on meeting Presidential guidance.

The Secretary, in collaboration with the Secretary of Defense, should jointly direct the Nuclear Weapons Council to conduct an annual review of progress toward achieving Presidential guidance and report results of this review to the Secretaries (as described in Action Item 1.1 in Chapter 1, calling for robust annual Presidential guidance including the NWC's preparation of an expanded NWSM). To this end, the two Departments should coordinate budget development for the relevant portions of the warhead and strategic systems budgets; the NWC should assess this synchronization effort. This would help fulfill the Council's chartered role to "coordinate and approve programming and budget matters" between the two Departments.

This Council role would support the implementation of Action Item 1.2 in Chapter 1 calling for OMB to expand and extend its "joint budget reviews" to include the nuclear weapons and strategic forces of the two Departments, as well as Action Item 1.3 in Chapter 1 calling for an NSC joint program review.

18.6 The Director should strengthen the roles, responsibilities, and accountability of the senior military officer assigned to ONS in order to improve DOE&NS-DOD collaboration.

The Secretary and the Director should increase the leadership responsibilities and coordination roles of the DOD General Officer/Flag Officer assigned to the ONS. This would help to improve communications across Departments and maximize use of the officer's skills and expertise.

Recommendation

19. The Secretary and Director should align and streamline processes for collaboration with Interagency customers.

The important role played by Interagency Work can be improved by better mission alignment and by eliminating cumbersome business processes to meet the needs of these customers. The Mission Executive Council's goals are appropriate but not yet adequately fulfilled.

Action Items

19.1 The Secretary, working through the Mission Executive Council, should improve coordination for planning and executing Interagency Work.

The Secretary should provide a structure for IW to align it strategically with the Department's missions. This reform should seek to simplify access to nuclear security complex capabilities, speed approval processes, and establish approaches for strategic, multi-year investments in the complex's capabilities by IW customers. It should also ensure that such work is, in fact, relevant to the nuclear enterprise's overall mission.

The Intelligence Community provides a model for consistent, responsive contracting with the DOE enterprise. Such a process could be tailored and replicated for other customers.

19.2 The Mission Executive Council should annually conduct a review of the execution of Interagency Work across the nuclear security enterprise to identify improvement opportunities in working relationships, collaborative mechanisms, and management practices.

The Mission Executive Council should convene one MEC forum annually dedicated to overseeing fulfillment of IW customer needs and the status of strategic investments by MEC members in the enterprise, in keeping with the objectives of the MEC Governance Charter.

6. Conclusion

Perfection is not attainable, but if we chase perfection
we can catch excellence.

–Vince Lombardi

REFORM IS NEEDED ACROSS THE NUCLEAR ENTERPRISE

The recent history of the enterprise recounted here provides ample evidence that wide-reaching reform is necessary. The panel finds that while NNSA has done some things well and the current leadership has begun steps to address some of the problems, major additional actions are needed to put the enterprise on a sound footing. The scope of the challenge is reflected in the five enterprise-wide maladies identified in the introduction. The recommendations, detailed in the preceding chapters, provide detailed actions targeted at each of these areas:

- Strengthen national leadership focus, direction, and follow-through
- Solidify Cabinet Secretary ownership of the mission
- Adopt proven management practices to build a culture of performance, accountability, and credibility
- Maximize the contributions of the M&O organizations to the safe, secure execution of the mission
- Strengthen customer collaboration to build trust and a shared view of mission success

IMPLEMENTATION OF THE PANEL'S RECOMMENDATIONS

The panel fully recognizes the enormous challenges in implementing its recommendations. Multiple panels and commissions over the past two decades—among them commissions led by the President's Foreign Intelligence Advisory Board, the National Academy of Sciences, the Defense Science Board, John Foster (multiple times), General Larry Welch (multiple times), Admiral Hank Chiles (multiple times), the Stimson Center, and most recently the work of the Bipartisan Congressional Commission on the U.S. Strategic Posture and the National Research Council—have developed coherent, consistent recommendations to address many, if not most, of the problems the panel has identified. But these recommendations either have not been implemented or their implementation has failed. Indeed, there are no assurances that this panel's work will not result in a comparable outcome.

At the root, these failures can be attributed to insufficient attention to the enterprise, and demand for change from national leadership. The panel, therefore, attaches great importance to sustained White House attention and congressional cohesion in ensuring successful implementation of these reforms.

The panel believes its recommendations must be viewed in their entirety and implemented as an integrated package to ensure lasting reform. Successful implementation requires: (1) creation of champions within organizations who are empowered, and held accountable, to effect real change, and (2) institutionalized and structured means to monitor progress on implementation on at least an annual basis.

Along these lines, the panel's recommendations charge three sets of leaders to take action. First, the panel asks that the President and his national security advisors increase their efforts to direct and align nuclear security plans, programs, and budgets across the Energy and Defense Departments. Second, the panel asks that the Congress strengthens and unifies its focus, and most significantly, that it amends the NNSA Act to clarify Department leadership roles and refocus the Department on nuclear security missions. Finally, the panel recommends that the Department leadership, both the Secretary and the Director, ONS, undertake numerous reforms to more closely align authority and responsibility with mission goals, increase accountability, streamline management, transform the culture of the Department, strengthen the M&Os' contribution to the mission, and restore trust and credibility with customers. Ideally, each of these activities would have a champion authorized to monitor implementation on a regular basis and charged with driving change through the system.

Most of the work on implementation will be carried out within the Department of Energy and Nuclear Security. A small team of senior experts, reporting directly to the current Administrator, NNSA, should be empowered and held accountable within six months to develop an implementation plan including, as necessary, options for decision. The group would be asked to assess the degree to which the plan is aligned with the panel's intended approach. Once agreement among senior leaders was achieved, implementation of the plan should proceed. To assist it in achieving an independent assessment, the Secretary should commission a team of independent experts to review and advise on progress.

If implementation is reasonably prompt, measurable progress on many recommendations could be observed very quickly. Ongoing reviews should focus on certain concrete indicators of change including the following:

- Presidential guidance is in place addressing an executable, funded long-term plan for modernizing the nuclear deterrent capabilities, aligned with DOE&NS and DOD and updated annually, for platform modernization, warhead life extension and infrastructure recapitalization; DOE&NS and DOD programs are in place to execute this plan

- Highly qualified experts from the National Security Council staff are routinely engaged in policy development and nuclear enterprise oversight and strategic direction
- Congress supports the panel's approach by amending the NNSA Act to clarify the roles of the Secretary, and provide the Director, ONS with the authority needed to succeed
- Congressional committees and associated staffs are well versed and routinely engaged in matters pertaining to the nuclear security enterprise and they are working in a collaborative manner that ensures consistent, efficient, and effective authorization, appropriation, and oversight
- A strong DOE&NS and ONS leadership team is in place; Congress agrees that political appointments for the Secretary and Director be confirmed by both the Senate Energy and Natural Resources and Armed Services Committees
- The DOE&NS has clearly delineated and documented the authorities of the Director, ONS and his or her relationship with other senior DOE&NS officials including managers responsible for mission-support functions
- A *risk management* culture has replaced the existing *risk aversion* culture; technical competence is restored within the workforce to address safety issues raised by the DNFSB
- Internal management reforms have substantially reduced excessively burdensome budgeting detail and transactional oversight, and have led to substantial staff realignments and a performance-based approach; a staff right-sizing plan is in place and is being executed
- Warhead Life Extension Program and Infrastructure Modernization Program Managers are established in ONS with control over program resources and are accountable for delivering on agreed schedules
- Cost-estimating and resource management staffs are in place, and work is underway to develop management tools and data
- The Director, ONS has developed an executable plan to build needed new facilities, reduce maintenance backlogs, and eliminate outmoded facilities
- Mechanisms for strategic dialogue have been instituted and the government-M&O/FFRDC relationships have been restored
- Laboratory Directors, plant managers, and M&O leadership have developed and are executing plans that provide for clear identification of required technical work and infrastructure sustainment, accurate and transparent cost accounting, and initiatives to continuously improve value performance
- Contracts with the M&Os have been revised to provide incentives focused on mission success, replacing award fees with fixed fees and the potential for contract extensions

- ONS customers express satisfaction with collaboration, information sharing, and business practices, as well as performance in delivering on their needs

The panel believes that its recommendations, if fully and effectively implemented, provide the best chance to achieve a nuclear security enterprise that is much more efficient and capable and, thus, much better prepared to deliver its products within assigned budgets and schedules. If, based on assessments by independent overseers, attention to implementation is lacking and significant progress is not made within the next two years, then the panel believes that the only remaining course of action—and a clearly inferior one—is to remove ONS from what is now the Department of Energy and establish it as an autonomous, independent organization.

Appendices

Appendix A
Charter of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

SEC. 3166 of NDAA 2014. CONGRESSIONAL ADVISORY PANEL ON THE GOVERNANCE OF THE NUCLEAR SECURITY ENTERPRISE.

(a) ESTABLISHMENT.—There is established a congressional advisory panel to be known as the ‘‘Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise’’ (in this section referred to as the ‘‘advisory panel’’). The purpose of the advisory panel is to examine options and make recommendations for revising the governance structure, mission, and management of the nuclear security enterprise.

(b) COMPOSITION AND MEETINGS.—

(1) MEMBERSHIP.—The advisory panel shall be composed of12 members appointed as follows:

(A) Two by the chairman of the Committee on Armed Services of the House of Representatives.

(B) Two by the ranking minority member of the Committee on Armed Services of the House of Representatives.

(C) Two by the chairman of the Committee on Armed

Services of the Senate.

(D) Two by the ranking minority member of the Committee

on Armed Services of the Senate.

(E) One by the Speaker of the House of Representatives.

(F) One by the minority leader of the House of Representatives.

(G) One by the majority leader of the Senate.

(H) One by the minority leader of the Senate.

(2) CO-CHAIRMEN.—Two members of the advisory panel shall serve as co-chairmen

(A) The chairman of the Committee on Armed Services of the House of Representatives and the ranking minority member of the Committee on Armed Services of the Senate, in consultation with the Speaker of the House of Representatives and the minority leader of the Senate, shall jointly designate one member of the advisory panel to serve as co-chairman of the advisory panel.

(B) The chairman of the Committee on Armed Services of the Senate and the ranking minority member of the Committee on Armed Services of the House of Representatives, in consultation with the majority leader of the Senate and the minority leader of the House of Representatives, shall jointly designate one member of the advisory panel to serve as co-chairman of the advisory panel.

(3) SECURITY CLEARANCE REQUIRED.—Each individual appointed as a member of the

advisory panel shall possess (or have recently possessed before the date of such appointment) the appropriate security clearance necessary to carry out the duties of the advisory panel.

(4) PERIOD OF APPOINTMENT; VACANCIES.—Each member of the advisory panel shall be appointed for the life of the advisory panel. Any vacancy in the advisory panel shall be filled in the same manner as the original appointment.

(5) MEETINGS.—The advisory panel shall commence its first meeting by not later than ~~March 1, 2013~~,[83] so long as at least two members have been appointed under paragraph (1) by such date.

(c) COOPERATION FROM GOVERNMENT.—

(1) COOPERATION.—The advisory panel shall receive the full and timely cooperation of the Secretary of Defense, the Secretary of Energy, and any other Federal official in providing the advisory panel with analyses, briefings, and other information, including access to classified information, necessary for the advisory panel to carry out its duties under this section. With respect to access to classified information, the Director of National Intelligence may determine which information is necessary under this paragraph.

(2) LIAISON.—the following heads of Federal agencies shall each designate at least one officer or employee of the respective agency to serve as a liaison officer between the agency and the advisory panel

(A) The Secretary of State.

(B) The Secretary of Defense.

(C) The Secretary of Energy.

(D) The Secretary of Homeland Security.

(E) The Director of National Intelligence.

(d) REPORTS REQUIRED.—

(1) INTERIM REPORT.~~—Not later than 180 days after the date of the enactment of this Act,~~ Not later than March 2014 (understanding with HASC/SASC staff from 1st Panel meeting), the advisory panel shall submit to the President, the Secretary of Defense, the Secretary of Energy, the Committees on Armed Services and Energy and Natural Resources of the Senate, and the Committees on Armed Services and Energy and Commerce of the House of Representatives an interim report on the initial findings, conclusions, and recommendations of the advisory panel. To the extent practicable, the interim report shall address the matters described in paragraph (2) and focus on the immediate, near-term actions the advisory panel recommends be taken.

(2) REPORT.—Not later than ~~February 1~~ March 1, 2014 (changed in House report,

and Natural Resources of the Senate, and the Committees on Armed Services and Energy and Commerce of the House of Representatives a report on the findings, conclusions, and recommendations of the advisory panel. The report shall

[83] Note: strikethroughs and changes to dates reflect changes made in House Report, NDAA 2014

include the following:

(A) An assessment of each option considered by the advisory panel for revising the governance structure, mission, and management of the nuclear security enterprise, including the advantages, disadvantages, costs, risks, and benefits of each such option.

(B) The recommendation of the advisory panel with respect to the most appropriate governance structure, mission, and management of the nuclear security enterprise.

(C) Recommendations of the advisory panel with respect to—

(i) the appropriate missions of the nuclear security enterprise, including how complementary missions should be managed while ensuring focus on core missions;

(ii) the organization and structure of the nuclear security enterprise and the Federal agency responsible for such enterprise;

(iii) the roles, responsibilities, and authorities of Federal agencies, Federal officials, the national security

laboratories and nuclear weapons production facilities, and the directors of such laboratories and facilities, including mechanisms for holding such officials and directors accountable;

(iv) the allocation of roles and responsibilities with respect to the mission, operations, safety, and security of the nuclear security enterprise;

(v) the relationships among the Federal agency responsible for the nuclear security enterprise and the National Security Council, the Nuclear Weapons Council, the Department of Energy, the Department of Defense, and other Federal agencies;

(vi) the interagency planning, programming, and budgeting process for the nuclear security enterprise;

(vii) the appropriate means for managing and overseeing the nuclear security enterprise, including the role of federally funded research and development centers, the role and impact of various contracting and fee structures, the appropriate role of contract competition and nonprofit and for-profit contractors, and the use of performance-based and transactional oversight;

(viii) the appropriate means for ensuring the health of the intellectual capital of the nuclear security enterprise, including recruitment and retention of personnel and enhancement of a robust professional culture of excellence;(ix) the appropriate means for ensuring the health and sustainment of the critical capabilities and physical infrastructure of the nuclear security enterprise; (x) infrastructure, rules, regulations, best practices, standards, and appropriate oversight mechanisms to ensure robust protection of the health and safety of workers and the public while also providing such workers the ability to effectively and efficiently carry out their mission;(xi) the appropriate congressional committee structure for oversight of the nuclear security enterprise; (xii) the length of the terms and suggested qualifications for senior officials of the Federal agency responsible for the nuclear security enterprise;

(xiii) contracting, budget planning, program management, and regulatory

mission effectiveness or requirements and ensuring robust protection of the health and safety of workers and the public; and

(xiv) Statutory, regulatory, and policy changes necessary for implementing the recommendations of the advisory panel.

(D) An assessment of if and how the recommendations of the advisory panel will lead to greater mission focus and more effective and efficient program management for the nuclear security enterprise.

(E) Any other information or recommendations relating to the future of the nuclear security enterprise that the advisory panel considers appropriate.

(e) FUNDING.—Of the amounts authorized to be appropriated by this Act or

not more than $3,000,000 shall be made available to the advisory panel to carry out this section.

(f) TERMINATION.—The advisory panel shall terminate not later than ~~June 1, 2014~~ September 31, 2014.

Appendix B
Panel Members

Dr. Michael R. Anastasio

Michael Anastasio is Director Emeritus, Los Alamos National Laboratory (LANL) and Lawrence Livermore National Laboratory (LLNL)

Currently, Dr. Anastasio is laboratory associate at LANL. He serves on the Department of Defense (DOD) Defense Science Board, the Department of State (DOS) International Security and Arms Control Board, the Draper Laboratory Corporation, and is a Special Advisor to the Commander, U.S. Strategic Command (STRATCOM). He is a member of the Boards of Governors of Los Alamos National Security LLC and Lawrence Livermore National Security LLC, and a member of the National Academy of Sciences Committee on Peer Review and Design Competition at the NNSA Laboratories.

Dr. Anastasio received his BA, with Honors, from The Johns Hopkins University and PhD in Theoretical Nuclear Physics from Stony Brook University. He performed research in physics in Saclay, France and Julich, West Germany and was a Visiting Assistant Professor at Brooklyn College.

In 1980, Dr. Anastasio joined LLNL as a physicist dealing with the science of nuclear design, and rose to lead the nuclear weapons program, and then in 2002, to Laboratory Director. In 2006, he became Director of LANL.

Mr. Norman R. Augustine

Norman Augustine, a graduate of Princeton University and retired chairman and Chief Executive Officer (CEO) of Lockheed Martin, has held positions in government, industry, academia, and the nonprofit sector. He has served as Under Secretary and acting Secretary of the Army, chairman and CEO of Martin Marietta, and Lecturer with the Rank of Professor at Princeton University. He has been chairman of the National Academy of Engineering and was a sixteen year member of the President’s Council of Advisors on Science and Technology.

Mr. Augustine chaired the Congressionally-mandated National Academies’ committee that produced the Gathering Storm report on education and competitiveness. He is a Regent of the University System of Maryland, a former trustee of the Massachusetts Institute of Technology (MIT) and Princeton, a trustee emeritus of Johns Hopkins, has been awarded the National Medal of Technology by the President of the United States, and holds thirty-three honorary degrees. He has been chairman of the Defense Science Board, a member of the Department of Energy

Advisory Board, chairman of the Lawrence Berkley National Laboratory Advisory Board, and a member of the Y-12 Incident Investigation Group. He has authored or co-authored four books. He is a member of the National Academy of Sciences, the National Academy of Engineering, the American Philosophical Society, and the American Academy of Arts and Sciences.

Admiral Kirkland H. Donald, U. S. Navy (Retired)

Kirkland Donald joined Systems Planning and Analysis, Inc. (SPA) as the Executive Vice President and a member of the Board of Directors in June 2013. In July 2013, he assumed the role of Chief Operating Officer and became President and CEO in January 2014.

In November 2012, Admiral Donald completed a distinguished thirty-seven year Navy career with his final assignment as Director, Naval Nuclear Propulsion Program and Deputy Administrator, Naval Reactors for the National Nuclear Security Administration. While in the Navy, Admiral Donald served on four submarines, including the *USS Batfish*, *USS Mariano G. Vallejo*, *USS Seahorse*, and as Commanding Officer of the *USS Key West.* He served as Commander, Naval Submarine Forces; Commander, Allied Submarine Command, Atlantic; and Commander, Task Forces 84 and 144 in Norfolk, VA. His other command assignments included Submarine Development Squadron Twelve, Submarine Group Eight and, Submarines Allied Naval Forces South, in Naples, Italy. His shore assignments included the Pacific Fleet Nuclear Propulsion Examining Board and the staff of the Director, Naval Nuclear Propulsion Program. He also held assignments at the Bureau of Naval Personnel, on the Joint Staff, and as Deputy Chief of Staff for C4I, Resources, Requirements and Assessments, U.S. Pacific Fleet.

Admiral Donald is currently a member of the Board of Directors for Entergy Corporation and the Executive Advisory Board for Moelis Capital Partners.

Admiral Donald is a 1975 graduate of the United States Naval Academy, where he earned a Bachelor’s Degree in Ocean Engineering. He also holds a Master’s Degree in Business Administration from the University of Phoenix and is a graduate of Harvard University’s John F. Kennedy School of Government Senior Executive Fellows Program and Stanford University’s Directors’ Consortium in 2014.

Mr. T. J. Glauthier

T. J. Glauthier served as Deputy Secretary and Chief Operating Officer of the Department of Energy from 1999 to 2001. Prior to that, he held another Presidential appointment, as Associate

Director for Natural Resources, Energy and Science in the Office of Management and Budget for five years. He also served on President Obama's transition team in 2008.

Currently, Mr. Glauthier is co-chairing the Congressionally-mandated Commission to Review the Effectiveness of the National Energy Laboratories, which deals with all seventeen of the DOE national laboratories. He also serves on corporate boards of directors for EnerNOC and VIA Motors, and is an advisor to several energy companies and to the energy practice of Booz Allen Hamilton. In addition, he sits on advisory boards at Stanford, the Lawrence Berkeley National Laboratory, and the National Academy of Sciences.

Mr. Glauthier served as CEO of the Electricity Innovation Institute, an affiliate of the Electric Power Research Institute (EPRI), and spent twenty years in management consulting. He is a graduate of Claremont McKenna College and the Harvard Business School.

Mr. David L. Hobson

Congressman David Hobson (Ret., R-OH) is an experienced former legislator, having served eighteen years in the U.S. House of Representatives representing Ohio's 7th District. While in Congress, Mr. Hobson served as the Chairman and Ranking Member of the House Appropriations Energy and Water Development Subcommittee; Chairman of the Military Construction Appropriations Subcommittee; Senior Member of the Defense Appropriations Subcommittee; and Member of the VA/HUD and Independent Agencies Subcommittee. In addition, he was appointed as the Speaker's delegate to the Budget Committee where he was instrumental in achieving the balanced budget for fiscal years 1998–2001.

In Congress, Mr. Hobson worked to improve and privatize military housing and to invest in defense research and development, including NASA aeronautics and research programs. He is widely credited with improving management practices at the Army Corps of Engineers and for supporting numerous Department of Energy projects. Prior to serving in Congress, Mr. Hobson spent eight years as a Senator in the Ohio Senate, where he served in numerous leadership roles, including President *Pro Tempore*, Majority Whip, Chairman of the Health, Human Services and Aging Committee, and Chairman of the Reference and Oversight Committee.

After retiring from the U.S. House of Representatives, Mr. Hobson joined Vorys, Sater, Seymour and Pease LLP and he co-founded and is chairman of CBD Advisors. He provides strategic counsel, consulting, and lobbying services to businesses and other clients.

Dr. Gregory B. Jaczko

Gregory Jaczko served as Chairman and Commissioner of the U.S. Nuclear Regulatory Commission from January 21, 2005 until July 9, 2012. Prior to assuming the post of Commissioner, Dr. Jaczko served as appropriations director for U.S. Sen. Harry Reid and also served as the Senator's science policy adviser. He began his Washington, DC, career as a congressional science fellow in the office of U.S. Rep. Edward Markey. In addition, he has been an adjunct professor at Georgetown University teaching science and policy. Born in Pennsylvania and raised in upstate New York, Dr. Jaczko earned a bachelor's degree in physics and philosophy from Cornell University, and a doctorate in physics from the University of Wisconsin-Madison.

Admiral Richard W. Mies, U. S. Navy (Retired)

Richard Mies is the CEO of The Mies Group, Ltd. and provides strategic planning and risk assessment advice and assistance to clients on international security, energy, defense, and maritime issues.

A distinguished graduate of the Naval Academy, Admiral Mies completed a thirty-five year career as a nuclear submariner in the U.S. Navy and commanded U.S. Strategic Command (USSTRATCOM) for four years prior to retirement in 2002.

Admiral Mies served as a Senior Vice President of Science Applications International Corporation (SAIC) and as the President and Chief Executive Officer of Hicks and Associates, Inc., a subsidiary of SAIC from 2002 to 2007. He also served as the Chairman of the Department of Defense Threat Reduction Advisory Committee from 2004 to 2010 and as the Chairman of the Board of the Navy Mutual Aid Association from 2003 to 2011. He presently serves as the Chairman of the Strategic Advisory Group of U.S. Strategic Command and Chairman of the Naval Submarine League. He is a member of the Committee on International Security and Arms Control of the National Academy of Sciences, a member of the Boards of Governors of Los Alamos National Laboratory and Lawrence Livermore National Laboratory, and a member of the Board of Directors of Babcock and Wilcox, Exelon, and the U.S. Naval Academy Foundation. He also serves on numerous advisory boards.

Admiral Mies completed post-graduate education at Oxford University, the Fletcher School of Law and Diplomacy, and Harvard University. He holds a master’s degree in government administration and international relations.

Mr. Franklin C. Miller

Frank Miller is a Principal at the Scowcroft Group in Washington, DC. A member of the Defense Policy Board and the Strategic Command Advisory Group, he served for thirty-one years in the U.S. government, the bulk of these years in senior positions in the Office of the Secretary of Defense. He spent 2001 to 2005 detailed to the White House, where he was a Special Assistant to President George W. Bush and the Senior Director for Defense Policy and Arms Control on the NSC staff.

He is the Chairman of the Board of Directors of the Charles S. Draper Laboratory and also serves on the Board of Directors of Airbus Group Inc. A member of the Council on Foreign Relations, Mr. Miller is also a Director of the Atlantic Council of the United States and a non-resident Senior Adviser at the Center for Strategic and International Studies (CSIS).

Mr. Miller has been deeply involved in nuclear weapons policy throughout his career. In addition to numerous high-level awards from the Departments of State, Defense, Navy, and Energy, he has been awarded an honorary knighthood by Queen Elizabeth II, the French Legion of Honor, and the Norwegian Royal Order of Merit.

He received his undergraduate degree from Williams College and an MPA from Princeton University's Woodrow Wilson School. He served as a naval officer afloat from 1972 to 1975 and was a reserve officer from 1975 to 1980.

Dr. William Schneider, Jr.

William Schneider Jr. is an Economist and Defense Analyst. Dr. Schneider is the President of International Planning Services, Inc., and a Senior Fellow of the Hudson Institute.

Early in his career, Dr. Schneider served as a Staff Associate of the Subcommittee on Defense and Foreign Operations of the U.S. House Appropriations Committee. Prior to joining the U.S. House staff in 1977, he was a U.S. Senate staff member and a professional staff member of the Hudson Institute. He was designated the Associate Director for National Security and International Affairs at the Office of Management and Budget in the first Reagan Administration, and then became the Under Secretary of State for Security Assistance, Science and Technology (1982–1986).

Dr. Schneider has also served as a consultant to the Departments of State, Defense, and Energy. He has served on numerous Presidential Commissions and government advisory bodies dealing with counterterrorism, intelligence, defense, and economic policy. He was Chairman of the President's General Advisory Committee on Arms Control and Disarmament (1987–1993); a Member of the Japan-U.S. Friendship Commission (operated under the auspices of the United States Information Agency (USIA)), the Commission to Assess the Ballistic Missile Threat to the

United States, and the Commission on the Future of the United States Aerospace Industry. Dr. Schneider is a member of the Defense Science Board, and served as its Chairman from 2001 to 2009. In addition to his government service, Dr. Schneider has served on the boards and advisory councils for numerous civic, commercial, and financial organizations. He has contributed to studies on strategic forces, Soviet affairs, theater nuclear force operations, and arms control. He is the author of several works on defense and foreign policy, U.S. strategic forces, theater nuclear forces, and unconventional warfare. Dr. Schneider received his PhD from New York University in 1968.

Mr. John M. Spratt, Jr.

John Spratt represented the 5th District of South Carolina for twenty-eight years in the U. S. House of Representatives, serving as Ranking Democrat and Chairman of the Budget Committee during the years the Balanced Budget Agreement of 1997 was adopted and implemented. He rose in seniority to become the second ranking member of the Armed Services Committee, and he originated the idea of a Department of Energy Panel, and chaired the panel. He also proposed a special commission to assess the safety and security of the U.S. nuclear arsenal, and arranged the appointment of Sidney Drell, John Foster, and Charles Townes to what became the Drell Commission. Mr. Spratt also served in Congress as a member of the House Oversight Committee, and as chair of several of its subcommittees. He currently co-chairs the United States-Canada Permanent Board on Defense and Homeland Security, and he served recently as court-appointed mediator of an agreement for expansion of the Savannah Port.

Mr. Spratt graduated from Davidson College in 1964; attended Oxford University as a Marshall Scholar, graduating with a master's degree in economics in 1966; and attended Yale Law School, graduating with a LLB in 1969. He served on active duty as a Captain in the Army in the Operations Analysis Group on the staff of the Assistant Secretary of Defense (Comptroller) from 1969 to 71.

Ms. Ellen O. Tauscher

Ellen Tauscher is a former Democratic Member of the U. S. House of Representatives for California's 10th Congressional District (Walnut Creek, CA) from 1996 until 2009. She was confirmed as Under Secretary of State for Arms Control and International Security Affairs on June 25, 2009, she served in this role until February 6, 2012. Ms. Tauscher served as Special Envoy for Strategic Stability and Missile Defense at the State Department from February 7, 2012 until August 31, 2012.

While in the Congress, Ms. Tauscher served on the House Armed Services Committee and became the Chairman of the Strategic Forces subcommittee in 2006.

As Under Secretary of State, Ms. Tauscher was responsible for successfully concluding negotiations of the New START Treaty with the Russian Federation, for representing the United States at the Non-Proliferation Treaty Review Conference at the United Nations in May 2010, which produced the first consensus agreement in ten years, and for negotiating to secure the sites and bilateral agreements to deploy the European Phased Adaptive Approach missile defense system to be deployed with NATO allies in Poland, Romania and Turkey well within the deployment deadline.

Ms. Tauscher currently is the Vice Chair of the Atlantic Council's Brent Scowcroft Center on International Security, a member of the Atlantic Council's Board of Directors and Executive Committee, and a member of the Board of Governors of Lawrence Livermore National Security Corporation LLC, and the Board of Governors of Los Alamos National Security Corporation LLC. Ms. Tauscher also serves on the boards of several public service and health care organizations. In September 2012, she joined Baker Donelson Bearman, Caldwell & Berkowitz, PC as the firm's Strategic Advisor for national security, defense, transportation, export control, and energy policy. Ms. Tauscher graduated in 1974 from Seton Hall University, where she obtained a Bachelor of Science degree. Her early career was on Wall Street, where at age 25, she became one of the first women to become a Member of the New York Stock Exchange.

Dr. Heather A. Wilson

Heather Wilson is President of the South Dakota School of Mines & Technology in Rapid City, SD. The South Dakota School of Mines & Technology prepares leaders in science and engineering at the bachelor's, master's, and doctoral level.

From 1998 through 2009 Dr. Wilson was a member of Congress from New Mexico. She was a senior member of the Energy & Commerce Committee and served on the House Armed Services Committee. Ms. Wilson was the Chair and Ranking Member of the Subcommittee on Technical and Tactical Intelligence.

Dr. Wilson is a graduate of the U.S. Air Force Academy and a Rhodes Scholar with Master and Doctoral degrees from Oxford University. As an Air Force officer, she served in Europe during the Cold War engaged in both the deployment of cruise missiles and arms control. She worked on the National Security Council Staff from 1989 to 1991.

Dr. Wilson has served as an advisor to Los Alamos, Sandia, the Nevada test site, and Oak Ridge as well as a number of intelligence agencies. She is a board member of Peabody Energy (NYSE: BTU) as well as several non-profit organizations.

Appendix C
Proposed Statutory Changes

The Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise submits the following proposed statutory changes to 42 U.S.C. 84 (1977) and to the legislation establishing the National Nuclear Security Agency (NNSA) (Title XXXII of the National Defense Authorization Act for Fiscal Year 2000). Note: Significant modifications and additions are highlighted in bold, red, italics. All other proposed changes are highlighted in red only.

42 U.S. Code Chapter 84 – Department of Energy ***and Nuclear Security***

§ 7131: Establishment

There is established at the seat of government an executive department to be known as the Department of Energy ***and Nuclear Security***. There shall be at the head of the Department a Secretary of Energy ***and Nuclear Security*** (hereinafter in this chapter referred to as the "Secretary"), who shall be appointed by the President by and with the advice and consent of the Senate. The Department shall be administered, in accordance with the provisions of this chapter, under the supervision and direction of the Secretary

The Secretary's Specified Authorities and Responsibilities for the Department's Nuclear Security Mission

In addition to the general duties performed by the Secretary of Energy and Nuclear Security, the position will entail several specific authorities and responsibilities associated with the Department's nuclear security mission:

- ***The Secretary is the lead authority responsible and accountable to the President and Congress for the Department's nuclear security mission, and a chief advisor to the President on nuclear security matters***
- ***The Secretary's Senate confirmation shall entail a joint process involving hearings with both the Senate Armed Services Committee and the Senate Energy and Natural Resources Committee***
- ***The Secretary sets Departmental policy and priorities for executing the mission, conveys full authority to the Director, Office of Nuclear Security for executing the mission, ensures Departmental staffs and resources are provided to serve the nuclear security missions effectively, and conducts appropriate oversight to ensure that the mission is executed effectively and in conformance with the Secretary's policies***
- ***The Secretary will provide annual reviews with Presidential staff and oversight committees of Congress on the status of the nuclear enterprise, its missions, and its support provided to other Agencies of the government***

The Secretary shall be appointed from among persons who have a demonstrated background, qualifications, and interest in the Department's nuclear security mission.

§ 7132. Principal officers

(a) Deputy Secretary

There shall be in the Department a Deputy Secretary, who shall be appointed by the President, by and with the advice and consent of the Senate, and who shall be compensated at the rate provided for level II of the Executive Schedule under section 5313 of title5. The Deputy Secretary shall act for and exercise the functions of the Secretary during the absence or disability of the Secretary or in the event the office of Secretary becomes vacant. The Secretary shall designate the order in which the Under Secretary and other officials shall act for and perform the functions of the Secretary during the absence or disability of both the Secretary and Deputy Secretary or in the event of vacancies in both of those offices

Specified Provisions with Respect to the Department's Nuclear Security Mission

- ***The Deputy Secretary shall perform such duties as assigned by the Secretary and act on the delegated authority of the Secretary.***
- ***The Deputy Secretary's Senate confirmation shall entail a joint process involving hearings with both the Senate Armed Services Committee and the Senate Energy and Natural Resources Committee.***

The Deputy Secretary shall be appointed from among persons who have a demonstrated background, qualifications, and interest in the Department's nuclear security mission.

(b) ~~Under Secretary~~ ***Director, Office of Nuclear Security***

(1) There shall be in the Department a~~n Under Secretary for~~ Director, Office of Nuclear Security, who shall be appointed by the President, by and with the advice and consent of the Senate. ***Senate confirmation shall entail a joint process involving hearings with both the Senate Armed Services Committee and the Senate Energy and Natural Resources Committee.***

(2) The ~~Under Secretary~~ Director shall be compensated at the rate provided for at level II~~I~~ of the Executive Schedule under section 5314 of title 5.

(3) Length of Term – The term of office as Director, Office of Nuclear Security shall be (at least) six years.

(4) The ~~Under Secretary~~ Director, shall be appointed from among persons who—

(A) have extensive background in national security, organizational management, and appropriate technical fields; and

(B) are well qualified to manage the nuclear weapons, nonproliferation, and materials disposition programs of the Office of Nuclear Security in a manner that advances and protects the national security of the United States.

(5)~~The Under Secretary for Nuclear Security shall serve as the Administrator for Nuclear Security under section 2402 of title 50.~~ ***In carrying out the functions of the ~~Administrator~~ Office of Nuclear Security and section 2402 of title 50 the ~~Under Secretary~~ Director shall be assigned line-management authority and accountability for executing ONS missions, subject to the authority, direction, and control of the Secretary.*** ~~Such authority, direction, and control may be delegated only to the Deputy Secretary of Energy, without redelegation~~.

(6) Specified authorities and responsibilities of the Director, ONS. In addition to the general authorities specified in paragraph (5), the Director shall

- ***be provided direct access to the President on issues relating to the missions of ONS;***
- ***have direct access to the Secretary on all ONS matters;***
- ***be assigned risk acceptance responsibility and authority on ONS matters, taking full responsibility and accountability within the Department for executing the Secretary's policies;***
- ***be responsible to recommend to the Secretary responses to the findings and recommendations of advisory/oversight groups on all ONS matters;***
- ***have full authority to shape and manage the ONS staff, including the selection of any mission-support staff assigned to support and advise ONS and the authority to review the performance of assigned individuals.***

§ 7144. Establishment of policy for the ~~NNSA~~ ***Office of Nuclear Security***

(a) Responsibility for establishing policy

The Secretary shall be responsible for establishing policy for the ~~NNSA~~ ***Office of Nuclear Security.***

- ***The Director shall advise the Secretary on all Departmental policies as they affect the nuclear security mission.***
- ***The Director shall be responsible for formulating and assessing options on all Departmental policies regarding ONS, compiling the assessments performed by functional experts, and presenting these to the Secretary for decisions.***

(b***) Program execution and review*** ~~(b) Review of programs and activities~~

- ***The Secretary shall devise such Departmental decision processes for executing the nuclear security missions as necessary to implement the Director's authorities, to define relationships among the Department's principal officers and other senior staff, to ensure competing views are provided to the Secretary in decision-making forums, and to ensure the timely resolution of conflicts among the principal officers and senior staff.***

- ***The Director shall be responsible for formulating and assessing options on all Departmental mission execution matters regarding ONS, compiling the assessments performed by functional experts, and presenting these to the Secretary for decisions.***

~~The Secretary may direct officials of the Department who are not within the National Nuclear Security Administration to review the programs and activities of the Administration and to make recommendations to the Secretary regarding administration of those programs and activities, including consistency with other similar programs and activities of the Department.~~

c) Staff

The Secretary ***and Director*** shall have adequate staff to support the Secretary's responsibilities under this section, ***while avoiding duplication of roles and functions.***

- ***The Secretary will maintain such staffs as necessary to formulate Departmental policy for ONS and provide independent oversight of execution.***
- ***The Director will maintain such staffs within ONS as necessary to exercise line-management authority for executing the Secretary's policies.***

THE NUCLEAR ENTERPRISE REFORM ACT

~~[As Amended Through P.L. 112-239, Enacted January 2, 2013]~~

~~Title XXXII of the National Defense Authorization Act for Fiscal Year 2000 (Public~~

~~Law 106-65, approved Oct. 5, 1999), as amended~~

TITLE XXXII—~~NATIONAL NUCLEAR SECURITY~~
~~ADMINISTRATION~~ *OFFICE NUCLEAR SECURITY*

Sec. 3235. [50 U.S.C. 2425] Government access to information on
~~Administration~~ Office of Nuclear Security
computers.
Sec. 3236. [50 U.S.C. 2426] Congressional oversight of special access programs.

Subtitle C—Matters Relating to Personnel

Sec. 3241. [50 U.S.C. 2441] Authority to establish certain contracting, program
management, scientific, engineering, and technical positions.
Sec. 3241A. [50 U.S.C. 2441a] Authorized personnel levels of the Office of the ~~Administrator~~Director, ~~Secretary for~~ Office of Nuclear Security. 3242. Repealed.]
Sec. 3243. Severance pay.
Sec. 3244. Continued coverage of health care benefits.

Subtitle D—Budget and Financial Management

Sec. 3251. [50 U.S.C. 2451] Separate treatment in budget.
Sec. 3252. [50 U.S.C. 2452] Planning, programming, and budgeting process.
Sec. 3253. [50 U.S.C. 2453] Future-years nuclear security program.
Sec. 3254. [50 U.S.C. 2454] Semiannual financial reports on defense nuclear nonproliferation
programs.
Sec. 3255. [50 U.S.C. 2455] Comptroller General assessment of adequacy of budget
requests with respect to the modernization and refurbishment of the
nuclear weapons stockpile.

Subtitle E—Miscellaneous Provisions

Sec. 3261. [50 U.S.C. 2461] Environmental protection, safety, and health requirements.
Sec. 3262. [50 U.S.C. 2462] Compliance with Federal Acquisition Regulation.
Sec. 3263. [50 U.S.C. 2463] Sharing of technology with Department of Defense.

laboratories by
entities outside the ~~Administration~~ Office of Nuclear Security.

Subtitle F—Definitions

Sec. 3281. [50 U.S.C. 2471] Definitions.

Subtitle G—Amendatory Provisions, Transition Provisions, and Effective Dates

Sec. 3291. [50 U.S.C. 2481] Functions transferred.
[Sec. 3292. Repealed.]
Sec. 3293. Pay levels.
Sec. 3294. Conforming amendments.
[Sec. 3295. Repealed.]
Sec. 3296. [50 U.S.C. 2484] Applicability of preexisting laws and regulations.
[Sec. 3297. Repealed.]

Sec. 3298. [50 U.S.C. 2401 note] Classification in United States Code.
Sec. 3299. [50 U.S.C. 2401 note] Effective dates.

SEC. 3201. 50 U.S.C. 2401 note SHORT TITLE.
~~the ‘‘National Nuclear Security Administration~~ ”The Nuclear Enterprise Reform Act”.

SEC. 3202~~. UNDER~~DIRECTOR, ~~SECRETARY FOR~~ OFFICE OF NUCLEAR SECURITY OF DEPARTMENT
OF ENERGY and NUCLEAR SECURITY.
[Omitted-Amendment *See revised 42 U.S.C. § 7132 above**]**

SEC. 3203. ~~ESTABLISHMENT OF POLICY FOR~~ SECRETARY’S ROLES AND RESPONSIBILITIES FOR ~~NATIONAL NUCLEAR SECURITY~~
~~ADMINISTRATION~~ NUCLEAR SECURITY MATTERS.
[Omitted-Amendment *See revised 42 U.S.C. § 7144 above**]**

SEC. 3204. ORGANIZATION OF DEPARTMENT OF ENERGY AND NUCLEAR SECURITY COUNTERINTELLIGENCE
AND INTELLIGENCE PROGRAMS AND ACTIVITIES.
[Omitted-Amendment**]**

Subtitle A—Establishment and Organization
SEC. 3211. 50 U.S.C. 2401 ESTABLISHMENT AND MISSION.
(a) ESTABLISHMENT.—There is established within the Department
of Energy and Nuclear Security an ~~separately organized agency~~ office to be known as the
~~National Nuclear Security Administration~~ Office of Nuclear Security (in this title referred to
as the ‘‘~~Administration~~ “ONS’’).
(b) MISSION.—The mission of the ~~Administration~~ Office of Nuclear Security shall be the
following:
(1) To enhance United States national security through the
military application of nuclear energy.
(2) To maintain and enhance the safety, security, reliability, and
effectiveness of the United States nuclear weapons stockpile
~~including the ability to~~ through design, production~~e~~, and testing, in order to
meet national security requirements.
(3) To provide the United States Navy with safe, militarily
effective nuclear propulsion plants and to ensure the safe and

(4) To promote international nuclear safety and nonproliferation.
(5) To reduce global danger from weapons of mass destruction.
(6) To support United States leadership in science and

(c) OPERATIONS AND ACTIVITIES TO BE CARRIED OUT CONSISTENT
WITH CERTAIN PRINCIPLES.—In carrying out the mission of

the ~~Administration~~ Office of Nuclear Security, the Director ~~for~~ shall ensure

and activities of the ~~Administration~~ Office of Nuclear Security are consistent with the
principles of protecting the environment and safeguarding the safety
and health of the public and of the workforce of the ONS.

- ***Where appropriate, the Director will rely on national and international consensus standards for achieving these objectives, with the understanding that that goal is to improve performance while reducing inefficient transaction-centered regulation. The orders and directives should account for unique nuclear and high-hazard conditions that may require special considerations (such as in the use of beryllium); and they should establish performance-based, risk-informed guidelines.***
- ***Within one year, the Director shall provide the cognizant Committees a report on its plan to transition from compliance-based transactional regulation and oversight of the weapons complex to the adoption of industrial standards with expert validation of performance-based approaches and results.***

SEC. 3212. 50 U.S.C. 2402 ~~ADMINISTRATOR DEPUTY SECRETARY~~ DIRECTOR, OFFICE OF ~~FOR~~ NUCLEAR SECURITY.

(a) IN GENERAL.—(1) There is at the head of the ONS a

as the '~~'Administrator~~' "Director'').

~~(2) Pursuant to subsection (c) of section 202 of the Department of Energy Organization Act (42 U.S.C. 7132), the Under Secretary for Nuclear Security of the Department of Energy serves as the Administrator.~~

(b) FUNCTIONS.—***The Director has line-management authority over, and is ultimately responsible for, all programs and activities of the ONS in executing the Secretary's policies.*** (Except for the functions of the Deputy Director, ~~Administrator for~~ Naval ~~Reactors~~ Nuclear Propulsion Program specified in the Executive order referred to in section) ***Exercise of the Director's authority shall be informed by mission-support staffs, but shall not be subject to the advance concurrence or approval of any mission-support staff function or individual within the Department of Energy and National Security other than the Secretary.***

3216(b)) In executing line-management authority for executing the ONS mission, the Director will also be responsible for the successful performance of necessary mission-support functions. The ONS functional responsibilities of the Director include:

(1) Strategic management.

(2) Policy ~~development~~ implementation and guidance.

(3) Budget formulation, guidance, and execution, and other financial matters.

(4) Resource requirements determination ***(including cost estimation and analyses of alternatives)*** and allocation.

(5) Program management and direction.

(6) Safeguards and security***, to include personnel security matters for all ONS personnel.***

(7) Emergency management.

(8) Integrated safety management.

(9) Environment, safety, and health operations.
(10) Administration of contracts, including the management and operations of the nuclear weapons production facilities and the national security laboratories.
(11) Intelligence.
(12) Counterintelligence.
(13) Personnel, including the selection, appointment, distribution, supervision, establishing of compensation, and separation of personnel in accordance with subtitle C of this title.
(14) Procurement of services of experts and consultants in

~~(15) Legal matters.~~
~~(16) Legislative affairs.~~
~~(17) Public affairs.~~
(15) Eliminating inventories of surplus fissile materials usable for nuclear weapons.
(16) Liaison with other elements of the Department of Energy and Nuclear Security and with other Federal agencies, State, tribal, and local governments, and the public.

(c) Matrix Staff Support for ONS

(1) In executing the line management responsibilities and mission-support functions outlined above, and in order to avoid duplication of Departmental staffs, the Director, Office of Nuclear Security will rely to the extent practicable on matrix staff support from those mission-support organizations within the Department responsible for these functions.

(2) Departmental mission-support personnel shall be assigned to support and advise the Director in the execution of ONS missions.

- ***The Director will propose an ONS staffing plan to the Secretary that enables the effective and efficient execution of the ONS mission.***
- ***The Director will have the authority to select or remove individuals assigned to support and advise ONS.***
- ***When on assignment to ONS, individuals will report to the Director.***
- ***When on assignment to ONS, the job performance of individuals will be reviewed by the Director.***

(3) The Departmental executives with the lead responsibility for these mission-support functions will be accountable to the Secretary and Director for the successful execution of their functions in support of the ONS mission. The Director will annually provide the Secretary with an assessment of the performance of each executive responsible for such mission-support functions.

(d) PROCUREMENT AUTHORITY.—The ~~Administrator~~Director is the senior procurement executive for the ~~Administration~~ ONS for the purposes of section 16(3) of the Office of Federal Procurement Policy Act (41 U.S.C. 414(3)).

(d) POLICY IMPLEMENTATION AUTHORITY.—The ~~Administrator~~ Director ~~may~~ shall ~~establish Administration~~
~~specific policies~~ implement Department of Energy and Nuclear Security requirements and practices under the direction of the Secretary.

- ***The Director's execution authority shall not be subject to the advance concurrence or approval of any staff function or individual within the Department of Energy and Nuclear Security other than the Secretary.***
- ***The Director will inform the Secretary on significant new precedents or policy implementation decisions.***
- ***Disagreements on the interpretation and implementation of policy between the Director and the other Departmental principal officers and the Secretary's senior staff shall be resolved by the Secretary through a timely process led by the Secretary; the Director will be responsible to summarize the issues and alternatives for the Secretary's decision.***

(e) MEMBERSHIP ON JOINT NUCLEAR WEAPONS COUNCIL.—The ~~Administrator~~ Director serves as a member of the Joint Nuclear Weapons Council under section 179 of title 10, United States Code.
(f) REORGANIZATION AUTHORITY.—Except as provided by subsections (b) and (c) of section 3291:
(1) The ~~Administrator~~Director may establish, abolish, alter, consolidate, or discontinue any organizational unit or component of the ~~Administration~~ONS, or transfer any function of the ~~Administration~~ ONS.
(2) Such authority does not apply to the abolition of organizational

component.

SENIOR Office of Nuclear Security STAFF

- ***The positions of the Deputy Directors who are presidentially appointed, and Senate confirmed within the NNSA structure, will we converted in the ONS organization to positions filled directly by the Director, ONS. These include the positions of Principal Deputy Director, the Deputy for Defense Programs, and the Deputy for Defense Nuclear Nonproliferation.***

- ***The Deputies will perform duties as assigned by the Director. They will be accorded such rank and delegated authority as is necessary to perform their assignments and to interact effectively as peers with senior officials elsewhere in Department and in other government agencies.***

~~**SEC. 3213. 50 U.S.C. 2403 PRINCIPAL DEPUTY ADMINISTRATOR FOR NUCLEAR SECURITY.**~~
~~(a) IN GENERAL.—(1) There is in the Administration a Principal Deputy Administrator, who is appointed by the President, by and with the advice and consent of the Senate.~~
~~(2) The Principal Deputy Administrator shall be appointed from among persons who have extensive background in organizational management and are well qualified to manage the nuclear~~

~~weapons, nonproliferation, and materials disposition programs of the Administration in a manner that advances and protects the national security of the United States.~~

~~(b) DUTIES.—Subject to the authority, direction, and control of the Administrator, the Principal Deputy Administrator shall perform such duties and exercise such powers as the Administrator may prescribe, including the coordination of activities among the elements of the Administration. The Principal Deputy Administrator shall act for, and exercise the powers of, the Administrator when the Administrator is disabled or the position of Administrator is vacant.~~

~~SEC. 3214. 50 U.S.C. 2404 DEPUTY ADMINISTRATOR FOR DEFENSE PROGRAMS.~~

~~(a) IN GENERAL.—There is in the Administration a Deputy Administrator for Defense Programs, who is appointed by the President, by and with the advice and consent of the Senate.~~

~~(b) DUTIES.—Subject to the authority, direction, and control of the Administrator, the Deputy Administrator for Defense Programs shall perform such duties and exercise such powers as the Administrator may prescribe, including the following:~~

~~(1) Maintaining and enhancing the safety, reliability, and performance of the United States nuclear weapons stockpile, including the ability to design, produce, and test, in order to meet national security requirements.~~

~~(2) Directing, managing, and overseeing the nuclear weapons production facilities and the national security laboratories.~~

~~(3) Directing, managing, and overseeing assets to respond to incidents involving nuclear weapons and materials.~~

~~SEC. 3215. 50 U.S.C. 2405 DEPUTY ADMINISTRATOR FOR DEFENSE NUCLEAR NONPROLIFERATION.~~

~~(a) IN GENERAL.—There is in the Administration a Deputy Administrator for Defense Nuclear Nonproliferation, who is appointed by the President, by and with the advice and consent of the Senate.~~

~~(b) DUTIES.—Subject to the authority, direction, and control of the Administrator, the Deputy Administrator for Defense Nuclear Nonproliferation shall perform such duties and exercise such powers as the Administrator may prescribe, including the following:~~

~~(1) Preventing the spread of materials, technology, and expertise relating to weapons of mass destruction.~~

~~(2) Detecting the proliferation of weapons of mass destruction worldwide.~~

~~(3) Eliminating inventories of surplus fissile materials usable for nuclear weapons.~~

~~(4) Providing for international nuclear safety.~~

SEC. 3216. 50 U.S.C. 2406 ~~DEPUTY~~ DIRECTOR , ~~ADMINISTRATOR FOR~~ NAVAL NUCLEAR

PROPULSION PROGRAM~~REACTORS~~.
(a) IN GENERAL.—(1) There is in the ~~Administration~~ ONS a ~~Deputy Administrator~~ Director, ~~for~~ Naval Nuclear Propulsion Program. ~~The director of the Naval Nuclear Propulsion Program provided for under the Naval Nuclear Propulsion Executive Order shall serve as the Deputy Administrator for Naval Reactors.~~
(2) Within the Department of Energy and Nuclear Security, the ~~Deputy~~ Director, Naval Nuclear Propulsion Program~~Administrator~~ shall report to the Secretary of Energy and Nuclear Security through the ~~Administrator~~ Director, Office of Nuclear Security and shall have direct access to the Secretary and other senior officials in the Department.
(b) DUTIES.—The ~~Deputy~~ Director, Naval Nuclear Propulsion Program~~Administrator~~ shall be assigned the responsibilities, authorities, and accountability for all functions of the Office of Naval Reactors under the Naval Nuclear Propulsion Program Executive Order.
(c) EFFECT ON EXECUTIVE ORDER.—Except as otherwise specified in this section and notwithstanding any other provision of this title, the provisions of the Naval Nuclear Propulsion Program Executive Order remain in full force and effect until changed by law.
(d) NAVAL NUCLEAR PROPULSION Program EXECUTIVE ORDER.—As used

Executive Order No. 12344, dated February 1, 1982 (42 U.S.C.

of Defense Authorization Act, 1985 (Public Law 98–525; 42 U.S.C. 7158 note)). ~~2~~

~~**SEC. 3217. 50 U.S.C. 2407 GENERAL COUNSEL.**~~
~~There is a General Counsel of the Administration. The General Counsel is the chief legal officer of the Administration~~

SEC. 3218. 50 U.S.C. 2408 STAFF.
(a) IN GENERAL.—The ~~Administrator~~ Director shall maintain within the ~~Administration~~ ONS sufficient staff to assist the ~~Administrator~~ Director in carrying out the duties and responsibilities of the ~~Administrator~~ Director.
(b) RESPONSIBILITIES.—The staff of the ~~Administration~~ ONS shall perform, in accordance with applicable law, such of the functions of the ~~Administrator~~ Director as the ~~Administrator~~ Director shall prescribe. ~~The Administrator shall assign to the staff responsibility for the following functions:~~
~~(1) Personnel.~~
~~(2) Legislative affairs.~~
~~(3) Public affairs.~~
~~(4) Liaison with the Department of Energy’s Office of Intelligence and Counterintelligence.~~

~~(5) Liaison with other elements of the Department of Energy and with other Federal agencies, State, tribal, and local governments, and the public.~~

SEC. 3219. 50 U.S.C. 2409 SCOPE OF AUTHORITY OF SECRETARY OF ENERGY AND NUCLEAR SECURITY TO MODIFY ORGANIZATION OF ~~ADMINISTRATION~~ONS.

Notwithstanding the authority granted by section 643 of the

other provision of law, the Secretary of Energy and Nuclear Security may not establish, abolish, alter, consolidate, or discontinue any organizational unit or component, or transfer any function, of the ~~Administration~~ ONS, except as authorized by subsection (b) or (c) of section 3291.

SEC. 3220. 50 U.S.C. 2410 STATUS OF ~~ADMINISTRATION~~ ONS AND CONTRACTOR PERSONNEL WITHIN DEPARTMENT OF ENERGY AND NUCLEAR SECURITY.

(a) STATUS OF ADMINISTRATION ONS PERSONNEL.—Each officer or employee of the ~~Administration~~ ONS—

(1) shall be responsible to and subject only to the authority, direction, and control of—

(A) the Secretary acting through the ~~Administrator~~ Director and consistent with section 202(c)(3) of the Department of Energy Organization Act;

(B) the ~~Administrator~~ Director; or

(C) the ~~Administrator's~~ Director's designee within the ~~Administration~~ ONS; and

(2) shall not be responsible to, or subject to the authority, direction, or control of, any other officer, employee, or agent of the Department of Energy and Nuclear Security.

(3) No ONS staff function shall be subject to the concurrence, review or approval of a duplicate function within the Department of Energy and Nuclear Security.

(c) STATUS OF CONTRACTOR PERSONNEL.—Each officer or employee of a contractor of the ~~Administration~~ ONS shall not be responsible to, or subject to the authority, direction, or control of, any officer, employee, or agent of the Department of Energy and Nuclear Security who is not an employee of the ~~Administration~~ ONS, except for the Secretary of Energy and Nuclear Security consistent with section 202(c)(3) of the Department of Energy Organization Act.

(1) No employee or agent of the Department of Energy and Nuclear Security who is not an employee of the ONS shall levy requirements or task contractor personnel executing the mission of the ONS.

(c) CONSTRUCTION OF SECTION.—Subsections (a) and (b) may

communication of technical findings derived from, and in accord with, duly authorized activities between (1) the head, or any contractor

employee, of a national security laboratory or of a nuclear
weapons production facility, and (2) the Department of Energy and Nuclear Security, the
President, or Congress.
(d) PROHIBITION ON DUAL OFFICE HOLDING.—Except in accordance with sections 3212(a)(2) and 3216(a)(1):
(1) An individual may not concurrently hold or carry out the responsibilities of—
(A) a position within the ~~Administration~~ ONS; and
(B) a position within the Department of Energy and Nuclear Security not within the ~~Administration~~ ONS.
(2) No funds appropriated or otherwise made available for any fiscal year may be used to pay, to an individual who concurrently holds or carries out the responsibilities of a position specified in paragraph (1)(A) and a position specified in paragraph (1)(B), the basic pay, salary, or other compensation relating to any such position.
(e) STATUS OF INTELLIGENCE AND COUNTERINTELLIGENCE PERSONNEL.—
Notwithstanding the restrictions of subsections (a) and (b), each officer or employee of the ~~Administration~~ ONS, or of a contractor of the ~~Administration~~ ONS, who is carrying out activities related to intelligence or counterintelligence shall, in carrying out those activities, be subject to the authority, direction, and control of the Secretary of Energy and Nuclear Security or the Secretary's delegate.

Subtitle B—Matters Relating to Security

SEC. 3231. 50 U.S.C. 2421 PROTECTION OF NATIONAL SECURITY INFORMATION.

(a) POLICIES AND PROCEDURES REQUIRED.—The ~~Administrator~~ Director shall establish procedures to ensure the maximum protection of classified information in the possession of the ~~Administration~~ ONS.
(b) PROMPT REPORTING.—The ~~Administrator~~ Director shall establish procedures to ensure prompt reporting to the ~~Administrator~~ Director of any significant problem, abuse, violation of law or Executive order, or deficiency relating to the management of classified information by personnel of the ~~Administration~~ ONS.

SEC. 3232. 50 U.S.C. 2422 OFFICE OF DEFENSE NUCLEAR SECURITY.

(a) ESTABLISHMENT.—There is within the Administration an

the Director, ONS..
(b) CHIEF OF DEFENSE NUCLEAR SECURITY.—(1) The head of the Office of Defense Nuclear Security is the Chief of Defense Nuclear Security, who shall report to the ~~Administrator~~ Director and shall implement the security policies directed by the Secretary and ~~Administrator~~ Director.
(2) The Chief shall have direct access to the Secretary and all

concerning security matters.

(3) The Chief shall be responsible for the development and implementation of security programs for the ~~Administration~~ Director, including the protection, control and accounting of materials, and for the physical and cyber security for all facilities of the ~~Administration~~ ONS.

SEC. 3233. 50 U.S.C. 2423 COUNTERINTELLIGENCE PROGRAMS.

(a) NATIONAL SECURITY LABORATORIES AND NUCLEAR WEAPONS PRODUCTION FACILITIES.—The Secretary of Energy and Nuclear Security shall, at each national security laboratory and nuclear weapons production facility, establish and maintain a counterintelligence program adequate to protect national security information at that laboratory or production facility.

(b) OTHER FACILITIES.—The Secretary of Energy and Nuclear Security shall, at each ~~Administration~~ ONS facility not described in subsection (a) at which Restricted Data is located, assign an employee of the Office of Counterintelligence of the Department of Energy and Nuclear Security who shall be responsible for and assess counterintelligence matters at that facility.

SEC. 3234. 50 U.S.C. 2424 PROCEDURES RELATING TO ACCESS BY INDIVIDUALS TO CLASSIFIED AREAS AND INFORMATION OF ADMINISTRATION.

The ~~Administrator~~ Director shall establish appropriate procedures to ensure that any individual is not permitted unescorted access to

~~Administration~~ ONS

until that individual has been verified to hold the appropriate security clearances.

SEC. 3235. 50 U.S.C. 2425 GOVERNMENT ACCESS TO INFORMATION ON ADMINISTRATION ONS COMPUTERS.

(a) PROCEDURES REQUIRED.—The ~~Administrator~~ Director shall establish procedures to govern access to information on ~~Administration~~ ONS computers. Those procedures shall, at a minimum, provide that any individual who has access to information on an ~~Administration~~ ONS computer shall be required as a condition of such access to provide to the ~~Administrator~~ Director written consent which permits access by an authorized investigative agency to any ~~Administration~~ ONS computer used in the performance of the duties of such employee during the period of that individual's access to information on an ~~Administration~~ ONS computer and for a period of three years thereafter.

(b) EXPECTATION OF PRIVACY IN ~~ADMINISTRATION~~ ONS COMPUTERS.—Notwithstanding any other provision of law (including any provision of law enacted by the Electronic Communications Privacy Act of 1986), no user of an ~~Administration~~ ONS computer shall have any expectation of privacy in the use of that computer.

(c) DEFINITION.—For purposes of this section, the term ''authorized investigative agency'' means an agency authorized by law or regulation to conduct a counterintelligence investigation or investigations of persons who are proposed for access to classified information to ascertain whether such persons satisfy the criteria for obtaining and retaining access to such information.

SEC. 3236. 50 U.S.C. 2426 CONGRESSIONAL OVERSIGHT OF SPECIAL ACCESS PROGRAMS.

(a) ANNUAL REPORT ON SPECIAL ACCESS PROGRAMS.—(1) Not later than February 1 of each year, the ~~Administrator~~ Director shall submit to the congressional defense committees a report on special access programs of the ~~Administration~~ ONS.

(2) Each such report shall set forth—

(A) the total amount requested for such programs in the President's budget for the next fiscal year submitted under section 1105 of title 31, United States Code; and

(B) for each such program in that budget, the following:

(i) A brief description of the program.

(ii) A brief discussion of the major milestones established for the program.

(iii) The actual cost of the program for each fiscal year during which the program has been conducted before the fiscal year during which that budget is submitted.

(iv) The estimated total cost of the program and the estimated cost of the program for (I) the current fiscal year, (II) the fiscal year for which the budget is submitted, and (III) each of the four succeeding fiscal years during which the program is expected to be conducted.

(b) ANNUAL REPORT ON NEW SPECIAL ACCESS PROGRAMS.—(1) Not later than February 1 of each year, the ~~Administrator~~ Director shall submit to the congressional defense committees a report that, with respect to each new special access program, provides—

(A) notice of the designation of the program as a special access program; and

(B) justification for such designation.

(2) A report under paragraph (1) with respect to a program shall include—

(A) the current estimate of the total program cost for the program; and

(B) an identification of existing programs or technologies that are similar to the technology, or that have a mission similar to the mission, of the program that is the subject of the notice.

(3) In this subsection, the term ''new special access program''

(c) REPORTS ON CHANGES IN CLASSIFICATION OF SPECIAL ACCESS PROGRAMS.—(1) Whenever a change in the classification of a special access program of the ~~Administration~~ ONS is planned to be made

or whenever classified information concerning a special access program
of the ~~Administration~~ ONS is to be declassified and made public,
the ~~Administrator~~ Director shall submit to the congressional defense committees
a report containing a description of the proposed change,
the reasons for the proposed change, and notice of any public announcement planned to be made with respect to the proposed
change.
(2) Except as provided in paragraph (3), any report referred to
in paragraph (1) shall be submitted not less than 14 days before
the date on which the proposed change or public announcement is
to occur.
(3) If the ~~Administrator~~ Director determines that because of exceptional
circumstances the requirement of paragraph (2) cannot be met with
respect to a proposed change or public announcement concerning a
special access program of the ~~Administration~~ ONS, the ~~Administrator~~ Director
may submit the report required by paragraph (1) regarding the
proposed change or public announcement at any time before the
proposed change or public announcement is made and shall include
in the report an explanation of the exceptional circumstances.
(d) NOTICE OF CHANGE IN SAP DESIGNATION CRITERIA.—Whenever
there is a modification or termination of the policy and criteria
used for designating a program of the ~~Administration~~ ONS as a special
access program, the ~~Administrator~~ Director shall promptly notify the congressional
defense committees of such modification or termination.
Any such notification shall contain the reasons for the modification
or termination and, in the case of a modification, the provisions of
the policy as modified.
(e) WAIVER AUTHORITY.—(1) The ~~Administrator~~ Director may waive any
requirement under subsection (a), (b), or (c) that certain information
be included in a report under that subsection if the ~~Administrator~~ Director
determines that inclusion of that information in the report
would adversely affect the national security. The ~~Administrator~~ Director
may waive the report-and-wait requirement in subsection (f) if the
~~Administrator~~ Director determines that compliance with such requirement
would adversely affect the national security. Any waiver under this
paragraph shall be made on a case-by-case basis.
(2) If the Administrator Director exercises the authority provided under
paragraph (1), the ~~Administrator~~ Director shall provide the information described
in that subsection with respect to the special access program
concerned, and the justification for the waiver, jointly to the
chairman and ranking minority member of each of the congressional

(f) REPORT AND WAIT FOR INITIATING NEW PROGRAMS.—A special

(1) the congressional defense committees are notified of the
program; and

(2) a period of 30 days elapses after such notification is received.

Subtitle C—Matters Relating to Personnel

SEC. 3241. 50 U.S.C. 2441 AUTHORITY TO ESTABLISH CERTAIN CONTRACTING, PROGRAM MANAGEMENT, SCIENTIFIC, ENGINEERING, AND TECHNICAL POSITIONS.

The ~~Administrator~~ Director may, for the purposes of carrying out the responsibilities of the ~~Administrator~~ Director under this title, establish contracting, program management, scientific, engineering, and technical positions in the ~~Administration~~ ONS, appoint and dismiss individuals in such positions, and fix the compensation of such individuals. Subject to the limitations in the preceding sentence, the authority of the ~~Administrator~~ Director to make appointments and fix compensation with respect to positions in the ~~Administration~~ ONS under this section shall be equivalent to, and subject to the limitations of, the authority under section 161 d. of the Atomic Energy Act of 1954 (42 U.S.C. 2201(d)) to make appointments and fix compensation with respect to officers and employees described in such sec-

section are used, the ~~Administrator~~ Director, to the extent practicable, shall appoint an individual to such an excepted position to replace the vacancy of a nonexcepted position.

SEC. 3241A. 50 U.S.C. 2441a AUTHORIZED PERSONNEL OF THE OFFICE OF THE ~~ADMINISTRATOR~~ DIRECTOR.

(a) FULL-TIME EQUIVALENT PERSONNEL LEVELS.—

(1) Within one year of the enactment of this legislation, the Director will review government personnel requirements, and provide the cognizant Congressional Committees with a report on efficiency measures needed to staff ONS. This report will include approximate numbers and skill mix of the workforce.

(b) COUNTING RULE.—(1) A determination of the number of employees in the Office of the ~~Administrator~~ Director under subsection (a) shall be expressed on a full-time equivalent basis.

(2) Except as provided by paragraph (3), in determining the total number of employees in the Office of the ~~Administrator~~ Director under subsection (a), the ~~Administrator~~ Director shall count each employee of the Office without regard to whether the employee is located at the headquarters of the ~~Administration~~ ONS, a site office of the ~~Administration~~ ONS, a service or support center of the ~~Administration~~ ONS, or any other location.

(3) The following employees may not be counted for purposes

~~Administrator~~ Director under subsection (a):

(A) Employees of the Office of Naval Reactors.

(B) Employees of the Office of Secure Transportation.
(C) Members of the Armed Forces detailed to the ~~Administration~~ ONS.
(D) Personnel supporting the Office of the ~~Administrator~~ Director pursuant to the mobility program under subchapter VI of chapter 33 of title 5, United States Code (commonly referred to as the ''Intergovernmental Personnel Act Mobility Program'').
(c) VOLUNTARY EARLY RETIREMENT.—In accordance with section 3523 of title 5, United States Code, the ~~Administrator~~ Director may offer voluntary separation or retirement incentives to achieve an effective and efficient ONS organization.
(d) USE OF IPA.—The ~~Administrator~~ Director shall ensure that the expertise of the national security laboratories and the nuclear weapons production facilities is made available to the ~~Administration~~ ONS, the Department of Energy and Nuclear Security, the Department of Defense, other Federal agencies, and Congress through the temporary assignment of

Intergovernmental Personnel Act Mobility Program and other similar programs.
[Section 3242 repealed by section 3132(c)(1)(A) of division C of Public Law 112–239.]

SEC. 3243. SEVERANCE PAY.
[Omitted-Amendment**]**

SEC. 3244. CONTINUED COVERAGE OF HEALTH CARE BENEFITS.
[Omitted-Amendment**]**

Subtitle D—Budget and Financial Management

SEC. 3251. 50 U.S.C. 2451 SEPARATE TREATMENT IN BUDGET.
(a) PRESIDENT'S BUDGET.—In each budget submitted by the

States Code, amounts requested for the ~~Administration~~ ONS shall be set forth separately within the other amounts requested for the Department of Energy and Nuclear Security.
(b) BUDGET JUSTIFICATION MATERIALS.—(1) In the budget justification materials submitted to Congress in support of each such budget, the amounts requested for the ~~Administration~~ ONS shall be specified in individual, dedicated program elements.
(2) In the budget justification materials submitted to Congress in support of each such budget, the ~~Administrator~~ Director shall include an assessment of how the budget maintains the core nuclear weapons skills of the ~~Administration~~ ONS, including nuclear weapons design, engineering, production, testing, and prediction of stockpile aging.

SEC. 3252. 50 U.S.C. 2452 PLANNING, PROGRAMMING, AND BUDGETING PROCESS.

(a) PROCEDURES REQUIRED.—The ~~Administrator~~ Director shall establish

and financial activities of the ~~Administration~~ ONS comport with sound financial and fiscal management principles. Those procedures shall, at a minimum, provide for the planning, programming, and budgeting of activities of the ~~Administration~~ ONS

(b) ANNUAL PLAN FOR OBLIGATION OF FUNDS.—(1) Each year, the ~~Administrator~~ Director shall prepare a plan for the obligation of the amounts that, in the President's budget submitted to Congress that year under section 1105(a) of title 31, United States Code, are proposed to be appropriated for the ~~Administration~~ ONS for the fiscal year

year'') and the two succeeding fiscal years.

(2) For each program element and construction line item of the ~~Administration~~ ONS, the plan shall provide the goal of the ~~Administration~~ ONS for the obligation of those amounts for that element or item for each fiscal year of the plan, expressed as a percentage of the total amount proposed to be appropriated in that budget for that element or item.

(c) SUBMISSION OF PLAN AND REPORT.—The ~~Administrator~~ Director shall submit to Congress each year, at or about the time that the President's budget is submitted to Congress under section 1105(a) of title 31, United States Code, each of the following:

(1) The plan required by subsection (b) prepared with respect

(2) A report on the plans prepared with respect to the preceding years' budgets, which shall include, for each goal provided in those plans—

(A) the assessment of the ~~Administrator~~ Director as to whether or not that goal was met; and

(B) if that assessment is that the goal was not met—

(i) the reasons why that goal was not met; and

(ii) the plan of the ~~Administrator~~ Director for meeting or, if necessary, adjusting that goal.

SEC. 3253. 50 U.S.C. 2453 FUTURE-YEARS NUCLEAR SECURITY PROGRAM.

(a) SUBMISSION TO CONGRESS.—The ~~Administrator~~ Director shall submit to Congress each year, at or about the time that the President's budget is submitted to Congress that year under section 1105(a) of title 31, United States Code, a future-years nuclear security program (including associated annexes) reflecting the estimated expenditures and proposed appropriations included in that budget. Any such future-years nuclear security program shall cover the fiscal year with respect to which the budget is submitted and at least

(b) ELEMENTS.—Each future-years nuclear security program shall contain the following:

(1) A detailed description of the program elements (and the

each such program element) during the applicable five-fiscal
year period for at least each of the following:
(A) For defense programs—
(i) directed stockpile work;
(ii) campaigns;
(iii) readiness in technical base and facilities; and
(iv) secure transportation asset.
(B) For defense nuclear nonproliferation—
(i) nonproliferation and verification, research, and

(ii) arms control; and
(iii) fissile materials disposition.
(C) For naval reactors, naval reactors operations and

(2) A statement of proposed budget authority, estimated
expenditures, and proposed appropriations necessary to support
each program element specified pursuant to paragraph
(1).
(3) A detailed description of how the funds identified for
each program element specified pursuant to paragraph (1) in
the budget for the ~~Administration~~ ONS for each fiscal year during
that five-fiscal year period will help ensure that the nuclear
weapons stockpile is safe and reliable, as determined in accordance
with the criteria established under section 4202(a) of the
Atomic Energy Defense Act (50 U.S.C. 2522(a)).
(4) A description of the anticipated workload requirements
for each ~~Administration~~ ONS site during that five-fiscal year period.
(5) A statement of proposed budget authority, estimated
expenditures, and proposed appropriations necessary to support
the programs required to implement the plan to transform
the nuclear security enterprise under section 4214 of the Atomic
Energy Defense Act, together with a detailed description of
how the funds identified for each program element specified
pursuant to paragraph (1) in the budget for the ~~Administration~~ ONS
for each fiscal year during that five-fiscal-year period will help
ensure that those programs are implemented. The statement
shall assume year-to-year funding profiles that account for increases
only for projected inflation.
(6) A plan, developed in consultation with the ~~Director of~~
~~the Office of~~ Associate Under Secretary for Environment, Health, Safety, and Security of the Department of
Energy and Nuclear Security, for the research and development, deployment, and
lifecycle sustainment of the technologies employed within the

threats during the applicable five-fiscal year period, together

with—
(A) for each site in the nuclear security enterprise, a description of the technologies deployed to address the physical and cyber security threats posed to that site;
(B) for each site and for the nuclear security enterprise, the methods used by the ~~National Nuclear Security Administration~~ ONS to establish priorities among investments in physical and cyber security technologies; and
(C) a detailed description of how the funds identified for each program element specified pursuant to paragraph (1) in the budget for the ~~Administration~~ ONS for each fiscal year during that five-fiscal year period will help carry out that plan.
(c) CONSISTENCY IN BUDGETING.—(1) The ~~Administrator~~ Director shall ensure that amounts described in subparagraph (A) of paragraph (2) for any fiscal year are consistent with amounts described in subparagraph (B) of paragraph (2) for that fiscal year.
(2) Amounts referred to in paragraph (1) are the following:
(A) The amounts specified in program and budget information submitted to Congress by the ~~Administrator~~ Director in support of expenditure estimates and proposed appropriations in the budget submitted to Congress by the President under section 1105(a) of title 31, United States Code, for any fiscal year, as shown in the future-years nuclear security program submitted pursuant to subsection (a).
(B) The total amounts of estimated expenditures and proposed appropriations necessary to support the programs, projects, and activities of the ~~Administration~~ ONS included pursuant to paragraph (5) of section 1105(a) of such title in the budget submitted to Congress under that section for any fiscal year.
(d) TREATMENT OF MANAGEMENT CONTINGENCIES.—Nothing in this section shall be construed to prohibit the inclusion in the future-years nuclear security program of amounts for management contingencies, subject to the requirements of subsection (c).

SEC. 3254. 50 U.S.C. 2454 SEMIANNUAL FINANCIAL REPORTS ON DEFENSE NUCLEAR NONPROLIFERATION PROGRAMS.
(a) SEMIANNUAL REPORTS REQUIRED.—The ~~Administrator~~ Director shall submit to the Committees on Armed Services of the Senate and the House of Representatives a semiannual report on the amounts available for the defense nuclear nonproliferation programs of the ~~Administration~~ ONS. Each such report shall cover a half of a fiscal year (in this section referred to as a ‘‘fiscal half’’) and shall be submitted not later than 30 days after the end of that fiscal half.

(b) CONTENTS.—Each report for a fiscal half shall, for each

are available for the fiscal year that includes that fiscal half, set

forth the following:
(1) The aggregate amount available for such program as of the beginning of such fiscal half and, within such amount, the uncommitted balances, the unobligated balances, and the unexpended balances.
(2) The aggregate amount newly made available for such program during such fiscal half and, within such amount, the amount made available by appropriations, by transfers, by reprogrammings, and by other means.
(3) The aggregate amount available for such program as of the end of such fiscal half and, within such amount, the uncommitted balances, the unobligated balances, and the unexpended balances.

SEC. 3255. 50 U.S.C. 2455 COMPTROLLER GENERAL ASSESSMENT OF ADEQUACY OF BUDGET REQUESTS WITH RESPECT TO THE MODERNIZATION AND REFURBISHMENT OF THE NUCLEAR WEAPONS STOCKPILE.
(a) GAO STUDY AND REPORTS.—(1) For the nuclear security budget materials submitted in each fiscal year by the ~~Administrator~~ Director, the Comptroller General of the United States shall conduct a study on whether both the budget for the fiscal year following the fiscal year in which such budget materials are submitted and the future-years nuclear security program submitted to Congress in relation to such budget under section 3253 provide for funding of the nuclear security enterprise at a level that is sufficient for the modernization and refurbishment of the nuclear security enterprise.
(2) Not later than 90 days after the date on which the ~~Administrator~~ Director submits the nuclear security budget materials, the Comptroller General shall submit to the congressional defense committees a report on the study under paragraph (1), including—
(A) the findings of such study; and
(B) whether the nuclear security budget materials support the requirements for infrastructure recapitalization of the facilities of the nuclear security enterprise.
(b) DEFINITIONS.—In this section:
(1) The term ‘‘budget’’ means the budget for a fiscal year

(2) The term ‘‘nuclear security budget materials’’ means the materials submitted to Congress by the ~~Administrator~~ Director in support of the budget for a fiscal year.

Subtitle E—Miscellaneous Provisions
SEC. 3261. 50 U.S.C. 2461 ENVIRONMENTAL PROTECTION, SAFETY, AND HEALTH REQUIREMENTS.
(a) COMPLIANCE REQUIRED.—The ~~Administrator~~ Director shall ensure

that the ~~Administration~~ ONS complies with all applicable environmental, safety, and health statutes and substantive requirements. ~~. and substantive requirements.~~

~~(b) PROCEDURES REQUIRED.—The Administrator shall develop procedures for meeting such requirements.~~

(~~c~~b) RULE OF CONSTRUCTION.—Nothing in this title shall diminish the authority of the Secretary of Energy and Nuclear Security to ascertain and ensure that such compliance occurs.

SEC. 3262. 50 U.S.C. 2462 COMPLIANCE WITH FEDERAL ACQUISITION REGULATION.

The ~~Administrator~~ Director shall establish procedures to ensure that the mission and programs of the ~~Administration~~ ONS are executed in full compliance with all applicable provisions of the Federal Acquisition Regulation issued pursuant to the Office of Federal Procurement

SEC. 3263. 50 U.S.C. 2463 SHARING OF TECHNOLOGY WITH DEPARTMENT OF DEFENSE.

The ~~Administrator~~ Director shall, in cooperation with the Secretary of Defense, establish procedures and programs to provide for the sharing of technology, technical capability, and expertise between the ~~Administration~~ ONS and the Department of Defense to further national security objectives.

SEC. 3264. 50 U.S.C. 2464 USE OF CAPABILITIES OF NATIONAL SECURITY LABORATORIES BY ENTITIES OUTSIDE THE ~~ADMINISTRATION~~ONS.

The Secretary, in consultation with the ~~Administrator~~ Director, shall establish appropriate procedures to provide for the use, in a manner consistent with the national security mission of the ~~Administration~~ ONS under section 3211(b), of the capabilities of the national security laboratories by elements of the Department of Energy and Nuclear Security not within the ~~Administration~~ ONS, other Federal agencies, and other appropriate entities, including the use of those capabilities to support efforts to defend against weapons of mass destruction.

Subtitle F—Definitions

SEC. 3281. 50 U.S.C. 2471 DEFINITIONS.

For purposes of this title:

(1) The term ‘‘national security laboratory’’ means any of the following:

(A) Los Alamos National Laboratory, Los Alamos, New Mexico.

(B) Sandia National Laboratories, Albuquerque, New

(C) Lawrence Livermore National Laboratory, Livermore,

California.
(2) The term ‘‘nuclear weapons production facility’’ means

(A) The Kansas City Plant, Kansas City, Missouri.
(B) The Pantex Plant, Amarillo, Texas.
(C) The Y–12 National Security Complex, Oak Ridge,

(D) The Savannah River Site, Aiken, South Carolina.
(E) The Nevada National Security Site, Nevada.
(F) Any facility of the Department of Energy and Nuclear Security that the Secretary of Energy and Nuclear Security, in consultation with the ~~Administrator~~ Director
and the Congress, determines to be consistent with
the mission of the ~~Administration~~ ONS.
(3) The term ‘‘classified information’’ means any information

No. 12333 of December 4, 1981 (50 U.S.C. 401 note), Executive
Order No. 12958 of April 17, 1995 (50 U.S.C. 435 note), or successor
orders, to require protection against unauthorized disclosure
and that is so designated.
(4) The term ‘‘Restricted Data’’ has the meaning given

(42 U.S.C. 2014(y)).
(5) The term ‘‘congressional defense committees’’ means—
(A) the Committee on Armed Services and the Committee
on Appropriations of the Senate; and
(B) the Committee on Armed Services and the Committee
on Appropriations of the House of Representatives.
(6) The term ‘‘nuclear security enterprise’’ means the physical
facilities, technology, and human capital of the national security
laboratories and the nuclear weapons production facilities.

Subtitle G—Amendatory Provisions, Transition Provisions,

SEC. 3291. 50 U.S.C. 2481 FUNCTIONS TRANSFERRED.
(a) TRANSFERS.—There are hereby transferred to the ~~Administrator~~ Director
all national security functions and activities performed immediately
before the date of the enactment of this Act by the following
elements of the Department of Energy and :
(1) The Office of Defense Programs.
(2) The Office of Nonproliferation and National Security.
(3) The Office of Fissile Materials Disposition.
(4) The nuclear weapons production facilities.
(5) The national security laboratories.
(6) The Office of Naval Reactors.
(b) AUTHORITY TO TRANSFER ADDITIONAL FUNCTIONS.—The
Secretary of Energy and Nuclear Security may transfer to the ~~Administrator~~

Director any other
facility, mission, or function that the Secretary, in consultation
with the ~~Administrator~~ Director and Congress, determines to be consistent
with the mission of the ~~Administration~~ ONS.
(c) ENVIRONMENTAL REMEDIATION AND WASTE MANAGEMENT
ACTIVITIES.—In the case of any environmental remediation and
waste management activity of any element of the ~~Administration~~ ONS,
the Secretary of Energy and Nuclear Security may determine to transfer responsibility
for that activity to another element of the Department.
(d) TRANSFER OF FUNDS.—(1) Any balance of appropriations
that the Secretary of Energy and Nuclear Security determines is available and needed to
finance or discharge a function, power, or duty or an activity that
is transferred to the ~~Administration~~ ONS shall be transferred to the ~~Administration~~ ONS
and used for any purpose for which those appropriations
were originally available. Balances of appropriations so transferred
shall—
(A) be credited to any applicable appropriation account of
the ~~Administration~~ ONS; or
(B) be credited to a new account that may be established
on the books of the Department of the Treasury;
and shall be merged with the funds already credited to that account
and accounted for as one fund.
(2) Balances of appropriations credited to an account under
paragraph (1)(A) are subject only to such limitations as are specifically
applicable to that account. Balances of appropriations credited
to an account under paragraph (1)(B) are subject only to such limitations
as are applicable to the appropriations from which they are
transferred.
(e) PERSONNEL.—(1) With respect to any function, power, or
duty or activity of the Department of Energy that is transferred to
the ~~Administration~~ ONS, those employees of the element of the Department
of Energy from which the transfer is made that the Secretary
of Energy determines are needed to perform that function, power,
or duty, or for that activity, as the case may be, shall be transferred
to the ~~Administration~~ ONS.
(2) The authorized strength in civilian employees of any element

so transferred.
[Section 3292 repealed by section 3132(c)(1)(B) of division C of
Public Law 112–239.]

SEC. 3293. PAY LEVELS.
[Omitted-Amendment]

SEC. 3294. CONFORMING AMENDMENTS.

[Omitted-Amendment**]**
[Section 3295 repealed by section 3132(c)(1)(C) of division C of Public Law 112–239.]

SEC. 3296. 50 U.S.C. 2484 APPLICABILITY OF PREEXISTING LAWS AND REGULATIONS.

With respect to any facility, mission, or function of the Department of Energy that the Secretary of Energy and Nuclear Security transfers to the ~~Administrator~~ Director under section 3291, unless otherwise provided in this title, all provisions of law and regulations in effect immediately before the date of the transfer that are applicable to such facility, mission, or function shall continue to apply to the corresponding functions of the ~~Administration~~ ONS.
[Section 3297 repealed by section 3132(c)(1)(D) of division C of Public Law 112–239.]

SEC. 3298. 50 U.S.C. 2401 note CLASSIFICATION IN UNITED STATES CODE.

Subtitles A through F of this title (other than provisions of those subtitles amending existing provisions of law) shall be classified to the United States Code as a new chapter of title 50, United States Code.

SEC. 3299. 50 U.S.C. 2401 note EFFECTIVE DATES.

(a) IN GENERAL.—Except as provided in subsection (b), the provisions of this title shall take effect ~~on March 1, 2000.~~
~~(b) EXCEPTIONS. (1) Sections 3202, 3204, 3251, 3295, and 3297 shall take effect on the date of the enactment of this Act.~~
~~(2) Sections 3234 and 3235 shall take effect on the date of the enactment of this Act. During the period beginning on the date of the enactment of this Act and ending on the effective date of this title, the Secretary of Energy shall carry out those sections and any reference in those sections to the Administrator and the Administration shall be treated as references to the Secretary and the Department of Energy, respectively.~~

Appendix D
Testimony, Site Visits, and Interviews

Table D-1. Testimony of Government & Weapons Complex Officials

Name	Role
Atkins-Duffin, Cindy	Assistant Director for Nuclear Matters, Office of Science and Technology Policy
Barton, Matthew	Special Assistant to the Acting Director, Domestic Nuclear Detection Office, DHS
Beausoleil, Geoffrey	Field Office Manager, Sandia National Laboratory
Benedict, Terry	VADM U.S. Navy, Director, Strategic Systems Program (SSP)
Cook, Donald	Deputy Administrator for Defense Programs, NNSA
Creedon, Madelyn	Assistant Secretary of Defense (Global Strategic Affairs)
Dearolph, Douglas	Field Office Manager, Savannah River Site
Elliott, Michael	Director for Strategic Programs, The Joint Staff
Epstein, Jon	Professional Staff, Senate Armed Services Committee
Erhart, Steven	NNSA Production Office Manager, Pantex and Y-12 Plants
Falcone, Patricia	Associate Director for National Security and International Affairs, OSTP
Gentile, Chris	Plant Manager, Kansas City National Security Campus
Harencak, Garrett	US Air Force, Strategic Deterrence & Nuclear Integration
Held, Bruce	Acting Administrator, NNSA
Holecek, Mark	Field Office Manager, Kansas City National Security Campus
Hommert, Paul	Director, Sandia National Laboratory
Juzaitis, Ray	Plant Manager, Nevada National Security Site
Kendall, Frank	Under Secretary for Acquisition, Technology, and Logistics,
Khol, Curl	Professional Staff, Cost Assessment and Program Evaluation (CAPE), OSD
Knapp, Bret	Acting Director, Lawrence Livermore National Laboratory
Kusnezov, Dimitri	Senior Advisor to the Secretary, DOE
Lawrence, Steven	Field Office Manager, Nevada National Security Site

Name	Role
Lebak, Kimberly	Field Office Manager, Lawrence Livermore National Laboratory
Limage, Simon	Deputy Assistant Secretary of State, Bureau of International Security & Nonproliferation, DOS
McMillan, Charles	Director, Los Alamos National Laboratory
Moniz, Ernest	Secretary of Energy
Moody, III David	Plant Manager, Savannah River Site
Morrison, Timothy	Professional Staff, House Armed Services Committee
Poneman, Daniel	Deputy Secretary, DOE
Reis, Vic	Special Advisor to the Secretary, DOE
Soofer, Robert	Professional Staff, Senate Armed Services Committee
Spencer, Chuck	Plant Manager, Y-12 Plant
Tomero, Leonor	Professional Staff, House Armed Services Committee
Trautman, Steve	Deputy Director, Naval Reactors
Walter, Drew	Professional Staff, House Armed Service Committee
White, William	Field Office Manager, Los Alamos National Laboratory
Winokur, Peter	Chairman, Defense Nuclear Facilities Safety Board (DNFSB)
Woolery, John	Plant Manager, Pantex Plant

Table D-2. Testimony of Independent Experts

Name	Role
Beckner, Everet	Former Director, Defense Programs
Brooks, Linton	Former Administrator, NNSA
Browne, John	Former Director, Los Alamos National Laboratory
D'Agostino, Thomas	Former Director, NNSA
Davis, Jay	Former Director, Defense Threat Reduction Agency
Deutch, John	Former Deputy Secretary, DOD
Guidice, Steve	Former Production Program Director, DOE Defense Programs
Harvey, John	Former PDASD, Nuclear, Chemical, Biological Defense Programs
Hunter, Thomas	Former Director, Sandia National Laboratory
John, Mim	Former Director, Sandia National Laboratory, Livermore
Kuckuck, Robert	Former Director, Defense Programs
Lehman, Ronald	DOD-NNSA
Miller, George	Former Director, Lawrence Livermore National Laboratory
Miller, Neile	Former Deputy Director, NNSA
Nanos, George	Former Director, Los Alamos National Laboratory
Ostendorff, William	Member, Nuclear Regulatory Council
Przybylek, Charles	Former Associate Director, NNSA
Robinson, Paul	Former Director Sandia National Laboratory
Selden, Robert	Former Deputy Director, Los Alamos National Laboratory
Smolen, Robert	Former Deputy Director, NNSA
Tegnelia, James	Former Director, Defense Threat Reduction Agency
Younger, Steven	Former Director, National Nuclear Security Site

Table D-3. Testimony of British Nuclear Program Experts

Name	Role
Baker, Michael	British Defense Staff
Mackinder, Andy	AWE (UK)
Taylor, Paul	AWE (UK)
Pinfield, Lynsey	British Defense Staff

Table D-4. Testimony of Lead Authors of Key Prior Studies

Name	Study
Chiles, Henry (Hank)	*Report of the Commission on Maintaining United States Nuclear Weapons Expertise*
Foster, John	*Report of the Defense Science Board Task Force on Nuclear Capabilities*
Overskei, David	*Recommendations for the Nuclear Weapons Complex of the Future*
Patel, C. Kumar	*The Quality of Science and Engineering at the NNSA National Security Laboratories*
Schwitters, Roy	JASONs
Shank, Charles	*Managing for High Quality Science and Engineering at the NNSA National Security Laboratories*
Turpen, Elizabeth	*Leveraging Science for Security: A Strategy for the Future of the Nuclear Weapons Laboratories*
Welch, Larry	*Report of the Defense Science Board Task Force on Nuclear Capabilities*

Table D-5. Testimony of Officials from M&O Contractors' Parent Organizations

Name	Organization
Howanitz, John	Bechtel
Johnson, Ray	Lockheed Martin
Madsen, Michael	Honeywell
Mara, Glenn	University of California

Table D-6. Organizationally Focused Fact Finding

Organizational Site Visits / Interviews	
AFL-CIO	
Civil nuclear power industry	
Various (on non-attribution basis)	
Congress	
Congressman James Cooper	Senator Jefferson Sessions
Congressman Michael J. Rogers	Senator Mark E. Udall
Congressman Adam Smith	
Congressman Mack Thornberry	
Committee Staffs	
House Committee on Appropriations, Energy and Water subcommittee	House Committee on Armed Services, Strategic Forces subcommittee
House Committee on Energy and Commerce	Senate Committee on Armed Services, Strategic Forces subcommittee
House Committee on Energy and Commerce, Oversight and Investigations subcommittee	Senate Committee on Energy and Natural Resources
Defense Nuclear Facilities Safety Board (DNFSB)	
Department of Defense	
Vice Chairman, Joint Chiefs of Staff	Assistant Secretary of Defense, Global Strategic Affairs
Under Secretary of Defense (Acquisition, Technology and Logistics)	OSD, Cost Assessment and Program Evaluation
Under Secretary of Defense (Policy)	Assistant Secretary of Defense (Nuclear, Chemical and Biological Defense Programs)
Deputy Assistant Secretary of Defense (Nuclear Matters)	
Department of Energy Headquarters	
Chief Financial Officer	Health, Safety, and Security
Environmental Management	Human Capital
Health, Safety and Security	Nuclear Energy
Human Capital	Office of Management
Inspector General	Office of Science
International Affairs	S&T Advisor
International Nuclear Energy Policy	

Organizational Site Visits / Interviews

Department of Energy Field	
Los Alamos National Laboratory	Kansas City Plant
Lawrence Livermore National Laboratory	Pantex
Sandia National Laboratories	Savannah River Site
Nevada National Security Site	Y-12
Department of Homeland Security	
Domestic Nuclear Detection Office	Science & Technology
Office of National Laboratories	
Department of Health and Human Services	
Centers for Disease Control and Prevention	
Department of Justice/Federal Bureau of Investigation	
Weapons of Mass Destruction Directorate	
Department of State	
Arms Control and International Security	Arms Control, Verification and Compliance
Federal Aviation Administration	
Air Traffic Organization	
National Aeronautics and Space Administration (NASA)	
Department of the Navy	
Naval Reactors	Strategic Systems Programs (SSP)
Nuclear Regulatory Commission	
Office of the Director of National Intelligence	
National Counterproliferation Center	
Office of Management and Budget (OMB)	
Occupational Safety and Health Administration (OSHA)	
Office of Science and Technology Policy	

Appendix E
Alternative Structural Models

As directed by Congress, the panel explored a range of options for the organizational structure of the nuclear enterprise. Any possible variation has both strengths and weaknesses. There is no ideal organizational structure for an orphaned mission of exceptional significance to U.S. national security posture and global leadership position. The panel's overarching conclusion was that, regardless of placement within the government, systemic and cultural barriers must be addressed to ensure the enterprise's ultimate success and sustainability. The organizational problems inherent in the current *separately organized* model, which are not insignificant, exacerbate the existing cultural proclivities within the current DOE/NNSA governance approach. In sum, a risk-averse organizational culture is exacerbated by the lack of leadership, insufficient clarity regarding authorities and the absence of integrated decision making.

The panel first considered the option of reorganizing NNSA, but maintaining its semi-autonomous status within DOE (effectively, an improved status quo). This was rejected because numerous studies and the panel's own fact-finding revealed that the *semi-autonomous* model has failed. The panel found no evidence to suggest that previous attempted reforms have improved effectiveness or that mission execution and proven management principles can be implemented within the existing organizational structure. The current system is broken and minor adjustments are not sufficient to correct either the organizational or cultural problems.

The panel also explored the notion of NNSA as an independent agency; namely, the panel evaluated in detail the National Aeronautic and Space Administration (NASA) as a potential model. Although some aspects of this model are incorporated in the panel's management recommendations on integrated decision making and M&O fee structures, the panel concluded that an independent NNSA was not a viable option for several reasons: First and foremost, the panel concluded that a mission this important to U.S. national security requires Cabinet-level ownership and support. Secondly, an independent agency would require a high-level commitment and consistent support across the Executive Branch and Congress. Such a commitment must convey from administration to administration. Given the shortfalls in national leadership enumerated elsewhere in this report, this seemed politically infeasible and costly in the short-term and very high-risk with respect to providing a sustainable solution. Third, the transition to an independent agency would be a protracted and costly undertaking. The panel also evaluated three variants of a greater role for the Department of Defense. As the most radical version of the three, all elements of NNSA's national security programs would be fully incorporated into DOD. This option did not appear appropriate for several reasons. First, moving the enterprise to DOD would not necessarily solve the fundamental problem of ensuring a coherent, fully financed, and executable weapons program. Second, there is considerable uncertainty about DOD's willingness and ability to integrate an organization with a very different scientific and civilian culture. Stated simply, the need to nurture world-class, leading-edge scientific laboratories is not a strong suit of the Department of Defense. Lastly, the panel questioned the viability of other elements within NNSA's portfolio, as well as the weapons work, within a DOD environment and concluded that such a move could be deleterious to both.

A second, less radical option would be for the Department of Defense to act as the weapons program customer, remaining in control of the funding, and also providing for recapitalization in support of the weapons work. This model would be highly similar to how current Interagency Work (formerly "Work for Others") projects are initiated, funded, and executed. While this approach might be helpful in obtaining incremental deliverables specific to warheads, it is circumscribed by the weapons-specific function of the enterprise as opposed to NNSA's broader portfolio.

Finally, the panel also considered the idea of creating a dual-hatted position, one in which the NNSA Deputy Administrator would also have a senior-level position in DOD, perhaps as Assistant Secretary of Defense (Nuclear, Chemical, Biological). This position would parallel the Naval Reactors model of dual-hatted leadership. While this could simplify cross-fertilization between NNSA and DOD, the panel concluded that a one-person solution would not be able to address the plethora of challenges facing NNSA. In addition, the portfolio across NNSA and ASD(NCB) is much more complex and wide-ranging than is the case for Naval Reactors. Whether one individual could effectively manage the scope and tasks across both agencies is highly questionable.

The panel therefore has concluded that the best option is to bolster ownership and accountability at the Secretary level within the newly-named Department of Energy and Nuclear Security and amend portions of the NNSA Act to eliminate duplication and ensure mission performance. This option assumes changes beyond DOE and NNSA as well—particularly from the White House and Congress; it also will require sweeping reform within the Department.

Appendix F
Benchmarking

To make informed recommendations for revising the governance structure, mission, and management of the nuclear security enterprise it was necessary for the panel to examine other organizations engaged in high-risk, technologically complex work and ask what characteristics are most commonly associated with success. Specifically, are there organizations more effective than NNSA in performing similar functions? If so, why do they perform better? And, what lessons can be extracted and applied to improve NNSA's performance?

Although the nuclear security enterprise embodies a unique combination of missions and facilities, a number of organizations engaged in dangerous technological endeavors, requiring high reliability and involving government-private sector collaborative relationships, were identified that provide a reasonable basis for comparison. These include government-owned contractor-operated relationships as well as private industry subject to strict Federal regulation. It would be fair to say that all the organizations identified would currently be judged as performing better than NNSA; however, the duration of high performance varies from decades-long high performers to organizations that have only recently achieved high levels of success.

The analytical approach taken was to first review the literature on high-reliability organizations (HRO)—organizations engaged in hazardous operations that manage to sustain near error-free performance over long periods of time. Later, fact-finding interviews were conducted with HROs and other organizations involved in high-risk, technologically complex work. For both the literature review and interviews, the objectives were to

- Document the relevant governance and management approaches employed in these activities, and, as appropriate, the organizations' assessments of their successes and problems
- Identify common best practices
- Assess the strengths and weaknesses of these approaches as models for employment in the nuclear security enterprise

Literature Review Summary

For over thirty years there has been a significant interdisciplinary research program devoted to the study of HROs, with recent work moving beyond hazardous industries to study "reliability-seeking" more generally. Much of this program is built on a few early detailed case studies in areas such as defense, energy, and aviation. Overall, the literature suggests certain traits are more commonly associated with *successful* organizations than others. While they may not be present in every single case, or to the same degree, the following principles appear to be highly correlated with a *culture of reliability*:

- Focus on eliminating failure at the lowest level
- Continuous learning and improvement
- Fluid and open communication channels
- Extremely competent personnel
- Clearly defined roles and responsibilities
- Redundancy
- Interdependence
- Program and management stability

A focus on failure as opposed to success is an essential, yet counterintuitive principle of HROs. Rather than encourage success and repress failure, these organizations explicitly acknowledge the fallible and dangerous nature of their operations, and because of this, relentlessly seek out error in an attempt to eliminate or remediate it at the lowest levels possible in the organization, thereby becoming successful. To accomplish this, HROs are in a perpetual training mode. New personnel master standard operating procedures while more experienced individuals socialize incremental improvements through lessons learned, technical diffusion, and controlled innovation. Equally important, information moves easily and quickly throughout the organization, both upstream and downstream, so that leadership is made aware of potential problems and staff has a clear understanding of mission priorities. The end result of this emphasis on failure and training in an open environment is extremely competent personnel, confident and responsible to root out and fix problems.

A number of vital structural conditions support the principles of a culture of reliability. First, from the organization's mission to all other aspects of the organization, there are clearly defined roles and responsibilities that are well known and codified. This provides the direction necessary to instill a sense of organizational and personal responsibility but also ensures obvious lines of accountability. Second, in addition to technical redundancies there are also organizational redundancies, such as duplicate monitors, that protect against single points of failure in critical areas. Although these redundancies would be seen as inefficient in most other organizations, they are a necessary component of high-reliability operations. Third, interdependence among units, as opposed to strong separation (stove piping), creates a shared responsibility for group performance and further enables redundancy through personnel cross-training and organizational awareness. Fourth, without program stability and management constancy these principles cannot be sustained and lines of accountability erode.

Fact Finding Interviews

To more deeply understand organizational success, interviews were conducted with numerous HROs and other organizations engaged in high-risk, technologically complex work. Participants included the following: (1) Navy's Strategic Systems Programs (SSP), (2) Naval Reactors, (3) NASA, (4) Centers for Disease Control & Prevention's National Center for Environmental Health chemical weapons demilitarization program, (5) Civilian nuclear power industry,[84] (6) Federal Aviation Administration's Air Traffic Organization (ATO), (7) DOE Office of Science, and (8) UK Atomic Weapons Establishment. For those organizations with their own operations and for which sufficient information was available, Table F-1 demonstrates how they accord with the HRO principles previously mentioned.

Table F-1. High Reliability Organization Principles

HRO Principles:	SSP	Naval Reactors	NASA	Civilian Nuclear	ATO
Focus on eliminating failure at the lowest level	Strong; disciplined	Strong; highly disciplined	**Unknown*	Strong; Disciplined	*Unknown*
Continuous learning and improvement	Strong; deliberate staff planning	Strong; deliberate staff planning	Aided by evolving missions	Strong; deliberate staff planning; industry support	Strong
Fluid and open communication channels	Strong	Strong; regimented	Collaborative model	Strong	Strong
Extremely competent personnel	Strong	Strong; highly disciplined	Strong	Strong	Strong
Clearly defined roles and responsibilities	Strong; clear risk owner	Strong; clear risk owner	Documented model	Strong; clear risk owner	Strong
Redundancy and interdependence	Self assessment; oversight offices	Individual responsibility; correspondence; oversight offices	Refocused intensity	Self assessment; industry support	*Unknown*
Program and management stability	Reliable program; career oriented	Reliable program; career oriented	Program flux; career oriented	Reliable program; career oriented	*Unknown*

**Unknown*: Not enough information obtained to comment

[84] Non-attributable.

Conclusion

It became clear following the interviews that there are a number of characteristics which contribute to organizational success both including, and in addition to, those typically associated with reliability. No single trait or sub-set of traits is sufficient. Instead, it seems a large variety of interdependent and reinforcing qualities work together over time to produce and sustain highly effective organizations. These characteristics, delineated in Table F-2, collectively represent an archetype for the successful management of high-risk, technologically complex enterprises.

Table F-2. Criteria for Success

General	• Universally understood and accepted purpose • Effective culture developed over many years by transformative leadership and maintained by mentoring carefully selected personnel • Adequate visibility with external stakeholders
Structure	• Clearly established, codified, and reinforced lines of authority, responsibility, and accountability • Formal, inclusive, decisive, prompt, and documented decision-making processes • Deliberative body, such as a Board of Directors or Management Council, which obliges the organization to collectively engage in risk-based resource allocation decisions to accomplish mission • Mission and support functions are separate but line management is responsible for both
Personnel	• Long-tenured director and/or senior leadership with extensive experience • Technically proficient and accomplished staff • Exceptional candidates recruited early in their careers to instill and sustain culture • Professional development programs emphasizing problem identification/solving, continuous learning, leadership, and the socialization of best practices
Commun-ications	• Organization priorities are aligned with mission and frequently communicated by senior leadership • Information flows freely and quickly up and down the organization, and decisions are made at the appropriate levels • Few if any obstacles (people or processes) prevent bad news from moving up the chain of command • Mechanisms exist for field oversight offices and site managers to communicate regularly and directly with the head of the organization
Planning and Budget	• Single strategic planning reference document guides all decisions • Unwavering adherence to a disciplined planning and budget process, which is comprehensive and detailed

Program Management	• In a government operation, government program managers oversee efforts, but contractors execute the work within established policies • Lean and authoritative field offices have sufficient technical and operational expertise to effectively oversee the work • Stakeholders are included early in project life cycle and strive to understand all requirements and regulations upfront • Technical and financial elements of programs are scrutinized in order to validate efforts and control costs • The more hazardous the operation, the more safety is considered part and parcel of mission performance • Specialized ES&H and security standards are used only when more generally accepted standards (e.g., industrial standards, OSHA standards) are shown to be inadequate or unclear
Contracts	• Contracts focused and evaluated on costs and mission performance, not award fees related to aspects other than meeting the mission • Contracts consolidated where appropriate to achieve economies of scale • Contracts typically are Cost Plus Fixed Fee (with very low fees for labs and FFRDCs) with no incentive/bonus awards or Fixed Price Incentive (based on mission performance), depending on the work being done

Appendix G
References

Albright, Penrose C., Charles F. McMillan, and Paul J. Hommert. "The Model for the National Nuclear Security Administration and its Laboratories: Recommendations for Moving Forward." Letter, 17 April 2012.

Chiles Commission. *Report of the Commission on Maintaining United States Nuclear Weapons Expertise.* Washington, DC: DOE, 1999.

Commission on Maintaining United States Nuclear Weapons Expertise. *Report of the Commission on Maintaining United States Nuclear Weapons Expertise*. 1999.

Commission on Science and Security. *Science and Security in the 21st Century*. Washington, DC: Center for Strategic and International Studies, 2001.

Committee to Review the Quality of the Management and of the Science and Engineering Research at the Department of Energy's National Security Laboratories. *Phase I, Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories*. Washington, DC: National Academies Press, 2012.

Congressional Budget Office. *Projected Cost of U.S. Nuclear Forces, 2014 to 2023*. Washington, DC: CBO, 2013.

Congressional Commission on the Strategic Posture of the United States. *America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*. Washington, DC: United States Institute of Peace, 2009.

Defense Science Board (DSB). *Report of the Defense Science Board Task Force on Nuclear Capabilities*. Washington, DC: DOD, 2006.

Defense Science Board (DSB). *Report of the Defense Science Board Task Force on Nuclear Deterrence Skills*. Washington, DC: DOD, 2008.

Department of Defense (DOD). *2014 Quadrennial Defense Review*. Washington, DC: DOD, 4 March 2014.

Department of Defense (DOD). *Nuclear Posture Review Report*. Washington, DC: DOD, 6 April 2010.

Department of Energy (DOE). *Departmental Directives Program.* DOE O 251.1C. Washington, DC: Office of Management, 2009.

Department of Energy (DOE). *FY2015 Stockpile Stewardship and Management Plan.* Washington, DC: DOE, 2014.

Government Accountability Office (GAO). *Annual Assessment of the Safety, Performance, and Reliability of the Nation's Stockpile.* Washington, DC: GAO, 2007.

Government Accountability Office (GAO). *Modernizing the Nuclear Enterprise: New Plutonium Research Facility at Los Alamos May Not Meet All Mission Needs.* Washington, DC: GAO, 2012.

Government Accountability Office (GAO). *Modernizing the Nuclear Enterprise: NNSA's Budgets Do Not Fully Align with Plans.* Washington, DC: GAO, 2013.

Government Accountability Office (GAO). *National Nuclear Security Administration: Additional Actions Needed to Improve Management of the Nation's Nuclear Programs.* Washington, DC: GAO, 2007.

Government Accountability Office (GAO). *Nuclear Nonproliferation: Action Needed to Address NNSA's Program Management and Coordination Challenges.* Washington, DC: GAO, 2011.

Government Accountability Office (GAO). *Nuclear Nonproliferation: Further Actions Needed by U.S. Agencies to Secure Vulnerable Nuclear and Radiological Materials.* Washington, DC: GAO, 2012.

Haber, Sonja B. Haber, Patrick Calahane, Kim Gallegos, David A. Holm, Suzanne Mellington, Deborah A. Shurberg, Michael E. Stein, Rasheem Wright, and Michael Zamorski. "An Evaluation of Organizational Safety Culture at the U.S. Department of Energy National Nuclear Security Administration." Washington, DC: Defense Nuclear Facilities Safety Board, 2 July 2013.

"Joint Explanatory Statement to Accompany the National Defense Authorization Act for Fiscal Year 2014." Congressional Record 159: 176. H7968. 12 December 2013.

Mies, Richard. *NNSA SECURITY: An Independent Review*. Washington, DC: Sage/LMI, 2005.

National Academy of Public Administration. *Positioning DOE's Lab's for the Future: A Review of DOE's Management of Oversight of the National Laboratories.* Washington, DC: National Academy of Public Administration, 2013.

National Research Council. *Managing for High Quality of Science and Engineering at the NNSA National Security Laboratories.* Washington, DC: National Academies Press, 2012.

National Research Council. *The Quality of Science and Engineering at the NNSA National Security Laboratories.* Washington, DC: National Academies Press, 2013.

National Nuclear Security Administration Act. Title XXXII, National Defense Authorization Act for Fiscal Year 2000. Public L. No. 106-65.

National Nuclear Security Administration. *Report to Congress on the Organization and Operations of the National Nuclear Security Administration*. Washington, DC: DOE, 2002.

Office of Management and Budget (OMB). *Preparation, Submission, and Execution of the Budget.* OMB Circular A-11. Washington, DC: Executive Office of the President, 2013.

Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile. *FY 1999 Report of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile*. Washington, DC: 2000.

Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile. *FY 2000 Report of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile.* Washington, DC: 2001.

Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile. *FY 2001 Report of the Panel to Assess the Reliability, Safety, and Security of the United States Nuclear Stockpile.* Washington, DC: 2002.

President's Foreign Intelligence Advisory Board. *Science at its Best, Security at its Worst*. Washington, DC: PFIAB, 1999.

Schlesinger, James R., Chairman, Report of the Secretary of Defense Task Force on Nuclear Weapons Management. *Phase II: Review of the DOD Nuclear Mission*. Washington, DC: DOD, December 2008.

Secretary of Energy Advisory Board Task Force. *Alternative Futures for the Department of Energy National Laboratories.* Washington, DC: DOE, 1995.

Secretary of Energy Advisory Board. Recommendations for the Nuclear Weapons Complex of the Future. *Report of the Nuclear Weapons Complex Infrastructure Task Force*. Washington, DC: DOE 2005.

Spies, Stephanie, and John K. Warden. *Forging a Consensus for a Sustainable U.S. Nuclear Posture.* Washington, DC: CSIS, 2013.

Turpen, Elizabeth, Director, Stimson Center Task Force. *Leveraging Science for Security: A Strategy for the Future of the Nuclear Weapons Laboratories*. Washington, DC: Stimson, 2009.

Welch, Larry D., Chairman, The Defense Science Board Permanent Task Force on Nuclear Weapons Surety. *The Unauthorized Movement of Nuclear Weapons*. Washington, DC: DOD, April 2008 (revised).

Appendix H
Acronyms

AFB	Air Force Base
AFL-CIO	American Federation of Labor and Congress of Industrial Organization
ALOO	Albuquerque Operations Office
AOA	Analysis of Alternatives
CAPE	Cost Assessment and Program Evaluation
CMRR	Chemistry and Metallurgy Research Replacement
DART	Days Away Restricted or Transferred (Case Rate)
DHS	U. S. Department of Homeland Security
DMAG	Deputy Management Action Group
DNFSB	Defense Nuclear Facilities Safety Board
DOD	U. S. Department of Defense
DOE	U. S. Department of Energy
DOE&NS	Department of Energy and Nuclear Security
DSB	Defense Science Board
DSW	Defense Stockpile Work
ECF	Extended Core Facility
ES&H	Environment, Safety, and Health
FAR	Federal Acquisition Regulation
FFRDC	Federally Funded Research and Development Center
FTE	Full Time Equivalent
FY	Fiscal Year
FYDP	Future Years Defense Program
FYNSP	Future Year Nuclear Security Plan
GAO	Government Accountability Office

GOCO	Government-contractor
HASC	House Armed Services Committee
HSS	Health, Safety and Security (DOE)
ICBM	Intercontinental Ballistic Missile
ICE	Independent Cost Estimate
ISO	International Organization for Standardization
IW	Interagency Work
JASPER	Joint Actinide Shock Physics Experimental Research Facility
LANL	Los Alamos National Laboratory
LDRD	Laboratory Directed Research and Development
LEP	Life Extension Program
LLC	Limited Liability Company
LLNL	Lawrence Livermore National Laboratory
M&O	Management and Operating
MEC	Mission Executive Council
MESA	Microsystems and Engineering Sciences Application
MOU	Memorandum of Understanding
MOX	Mixed-Oxide Fuel Fabrication Facility
NA-APM	NNSA – Acquisition & Project Management
NA-MB	NNSA – Management & Budget
NA-SH	NNSA – Safety & Health
NA-00	NNSA – Infrastructure & Operations
NA-10	NNSA – Defense Programs
NA-20	NNSA – Defense Nuclear Nonproliferation
NA-40	NNSA – Emergency Operations
NA-70	NNSA – Defense Nuclear Security
NA-80	NNSA – Counterterrorism and Counter-proliferation
NASA	National Aeronautics and Space Administration

NNSA	National Nuclear Security Administration
NNSS	Nevada National Security Site
NSC	National Security Council
NWC	Nuclear Weapons Council
NWSM	Nuclear Weapon Stockpile Memorandum
NWSP	Nuclear Weapon Stockpile Plan
OAPM	Office of Acquisition and Project Management
OCL	Obligation Control Level
OIG	Office of the Inspector General
OMB	Office of Management and Budget
ONS	Office of Nuclear Security
OSD	Office of the Secretary of Defense
OSHA	Occupational Safety and Health Administration
PEP	Performance Evaluation Plan
PF-4	Plutonium Facility at Technical Area 55 (TA-55), LANL
PIDAS	Perimeter Intrusion Detection and Assessment System
PM	Program Manager
PPBS	Planning, Programming and Budgeting system
PPD	Presidential Policy Directive
R&D	Research and Development
RTFB	Readiness in Technical Base and Facilities
S&T	Science and Technology
SASC	Senate Armed Services Committee
SES	Senior Executive Service
SNL	Sandia National Laboratories
SSMP	Strategic Stockpile Management Plan
SSC	Standing and Safety Committee
SSiFR	Sandia Silicon Fab Replacement

SSP	Strategic Systems Programs, U.S. Navy
STEM	Science, Technology, Engineering and Mathematics
TRC	Total Recordable Case (Rate)
UPF	Uranium Processing Facility
Y-12	Y-12 National Security Complex

U.S. DEPARTMENT OF ENERGY

NNSA National Nuclear Security Administration

National Nuclear Security Administration Comments on the Final Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

Report to Congress
May 2015

National Nuclear Security Administration
United States Department of Energy
Washington, DC 20585

Administrator's Letter of Transmittal

This report provides the National Nuclear Security Administration's (NNSA) response to the Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, as required by Section 3134 of the National Defense Authorization Act for Fiscal Year 2015. My comments, as Under Secretary for Nuclear Security and Administrator, NNSA, have been coordinated with the Secretary of Energy.

NNSA continues to make improvements in the leadership and management of its unique roles and responsibilities within the larger nuclear security enterprise; consequently we are pleased that much of the work that we have already undertaken and the changes that we are making are supported by the findings of this report. We know that we have additional work to do, and we are committed to making the NNSA a highly effective and continuously improving organization. This report highlights actions NNSA and the Department of Energy (DOE) have implemented or are currently underway, and addresses those recommendations of the Congressional Advisory Panel that we plan to pursue.

Pursuant to statutory requirements, this report is being provided to the following Members of Congress:

- **The Honorable John McCain**
  Chairman, Senate Committee on Armed Services

- **The Honorable Jack Reed**
  Ranking Member, Senate Committee on Armed Services

- **The Honorable Mac Thornberry**
  Chairman, House Committee on Armed Services

- **The Honorable Adam Smith**
  Ranking Member, House Committee on Armed Services

- **The Honorable Thad Cochran**
  Chairman, Senate Committee on Appropriations

- **The Honorable Barbara A. Mikulski**
  Ranking Member, Senate Committee on Appropriations

- **The Honorable Harold Rogers**
  Chairman, House Committee on Appropriations

- **The Honorable Nita M. Lowey**
  Ranking Member, House Committee on Appropriation

If you have any questions or need additional information, please contact me or Mr. Clarence Bishop, Associate Administrator for External Affairs, at (202) 586-7332.

Sincerely,

Frank G. Klotz
Under Secretary for Nuclear Security
Administrator, NNSA

Message from the Secretary

The programmatic success of the Department of Energy (DOE) and its National Nuclear Security Administration (NNSA) in sustaining the nuclear deterrent for over two decades without testing, in reducing the nuclear danger by securing or eliminating a very large amount of weapons-usable nuclear materials, in providing nuclear propulsion for a Navy with global reach, and in carrying out critical nuclear analysis and counterintelligence for the Administration at large must be preserved and extended. To do so requires addressing governance issues that could compromise continued success in the coming decades or elevate costs in doing so. The task of evaluating these issues, which have been present since the establishment of NNSA fifteen years ago, and of recommending solutions was given to the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, commonly referred to as the Augustine-Mies panel. The Augustine-Mies report to Congress provides a welcome perspective on the state of nuclear security governance and the key steps needed from the Administration and the Congress for improvement of governance for the long term.

The quality and collective experience of the Augustine-Mies panel members are to be applauded. They and their staff did a very thorough job of fact finding and objective analysis. In that vein, their conclusions and recommendations deserve the full attention and appropriate response from both the Administration/DOE/NNSA and from the Congress. This message represents the initial response from the Secretary of Energy and the NNSA Administrator/Under Secretary for Nuclear Security.

To help frame the response, I charged the Secretary of Energy Advisory Board (SEAB) to present their observations on the panel report. The SEAB letter report (at Attachment), led by the Honorable Brent Scowcroft as chair of the SEAB Nuclear Security Subcommittee, strongly endorses the key Augustine-Mies findings and recommendations, thereby lending even further support to the Augustine-Mies conclusions from distinguished contributors to our nation's security over a long time.

The overarching conclusions of the Augustine-Mies panel are the need to "strengthen national leadership focus, direction and follow-through" with respect to the nuclear mission and "to solidify Cabinet Secretary ownership of the mission." Let me state clearly that as Secretary, I place the highest priority on "ownership" of the nuclear security mission, and spend a significant portion of my time and energies advancing its key goals. Further, in building the DOE/NNSA leadership team that includes Deputy Secretary Sherwood-Randall, Administrator Klotz, and Principal Deputy Administrator Creedon, the President has clearly appointed a group well versed and deeply engaged in nuclear security science, technology, management and policy. In my time as Secretary, I have seen how mission ownership has materially impacted NNSA directions and resources in support of key mission responsibilities. The appointment of Secretary Carter at the Department of Defense has further strengthened the Administration's nuclear security team.

A major conclusion of the panel was that, after evaluating several governance models, "the solution is not to seek a higher degree of autonomy for NNSA, because that approach would only further isolate the enterprise from needed Cabinet Secretary leadership. Instead it is recommended that Congress place the responsibility and accountability for the mission squarely on the shoulders of a qualified Secretary, supported by a strong enterprise Director with unquestioned authority to execute nuclear enterprise missions consistent with the Secretary's policy direction." We emphatically concur and would add to this that rebuilding national leadership focus on nuclear security will also require strengthening regular communications between the Secretary and the relevant Congressional leaders on the various policy elements that make up the nuclear security mission. As part of this, we propose to carry out the SEAB recommendation for a regular semi-annual report and briefing to Congress on progress in carrying out Augustine-Mies recommendations and updates on both progress and challenges in executing the mission continuously over short, intermediate and long time frames. The Deputy Secretary and the NNSA Administrator will lead the group that monitors our progress. The group will seek input enterprise wide and also from those outside DOE, such as the members of the Augustine-Mies and SEAB panels.

The panel goes on to offer important findings and recommendations about management practices. The panel states that "A major overhaul will be needed to transform the organization into one with a mission-driven management culture," with "strong program managers focused on mission deliverables" and "clear accountability." The panel observes that "an arm's length, customer-to-contractor and, occasionally, adversarial relationship" has become too common and that a rebuilding of the trust that is a critical element of an FFRDC relationship is needed. I believe the panel is correct in these findings. When I became Secretary, I committed to restoring a more strategic relationship with the laboratory directors (not just NNSA) and I believe that we have made progress in this direction. This has been helped with some new institutional structures but even more, in my opinion, by more open communications about how the Department should pursue its multiple missions. This has benefitted both the Department and the laboratories, which of course is the objective of the FFRDC relationship.

I believe that various specific approaches to management processes are beginning to pay dividends, some of which are indicated in the Administrator's accompanying report. However, notwithstanding some progress, there is a long path to follow to reach the management goals laid out by the panel. The report included an apt Peter Drucker quote at the beginning of Chapter 3: "Culture eats strategy for breakfast." Culture change is not easy, and we do need such a change to restore primary focus on collaborative mission accomplishment throughout the system, with mission support in its very important role of helping that accomplishment take place safely, securely and efficiently. This applies both to labs and to other nuclear sites. Culture change requires strong trusted relationships advancing sound risk management understood by all levels of the organization. This will take some time, and certainly any progress that we make over the next couple of years needs to have roots deep enough to cross different management styles and managers. Our DOE enterprise-wide team will continue to work hard to set the right directions.

The final major set of recommendations involved strengthening "customer collaboration ... and a shared view of mission success." This refers principally to the DoD-DOE relationship with regard to the deterrent. Here again there are examples of progress, such as a better functioning Nuclear Weapons Council, but there are also specifics on which we clearly need to improve, such as streamlining how work is done for other national security agencies (DoD, Intelligence, DHS), even though the report does note considerable satisfaction as to how many capabilities and services are provided by the DOE laboratories and sites. However, there is an important point here on which I disagree with the panel. The report consistently refers to a "customer" relationship between DoD and DOE. This framing of the relationship is actually at the root of some tension. The two agencies have synergistic responsibilities for supporting our country's nuclear defense posture and the President and Congress ultimately have responsibility for allocating resources for maintaining our national security. Furthermore the nuclear security mission is broader than deterrence, including the nonproliferation, naval propulsion, intelligence and environmental cleanup missions that reside with DOE. None of this excuses either DoD or DOE from carrying out its responsibilities in the most cost effective fashion, but the framework for discussion should be optimization of our national security needs among several agencies with complementary capabilities. DoD is not our customer, and we are not a vendor; together we bear the serious responsibility to deliver a safe, secure and effective deterrent for the American people.

The accompanying report from Administrator Klotz provides more detailed responses to the Augustine-Mies recommendations. I repeat that we are very appreciative of the panel's work and of its thoughtful findings and recommendations. The panel lays out a challenging agenda, and we welcome it as an important contribution to assuring our country's nuclear security for the long term. We look forward to working with the Congress and with other stakeholders on implementation.

Sincerely,

Ernest J. Moniz
Secretary of Energy

Executive Summary

This report provides the Department of Energy (DOE)/National Nuclear Security Administration's (NNSA) comments with respect to the November 2014 Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, *A New Foundation for the Nuclear Enterprise*, as required by Section 3134 of the National Defense Authorization Act for Fiscal Year 2015.

The Department of Energy (DOE) and the NNSA express their deep appreciation to the members and staff of the Congressional Advisory Panel for their service and for their exceptional contribution to our national security in rendering their comprehensive and insightful report.

DOE and NNSA have carefully reviewed the report's findings, conclusions and recommendations. We are pleased that the report recognizes many of the successes that the DOE and the NNSA have achieved as we carry out our important and enduring nuclear security missions, including conducting a science-based Stockpile Stewardship Program to annually certify the safety, security and effectiveness of American nuclear arsenal without nuclear explosive testing for over 20 years.

We also believe that the report correctly identifies and accurately describes the leadership, management, and cultural challenges that confront the nuclear security enterprise. To address these issues, the report makes 19 primary recommendations and 63 sub-recommendations to improve performance, efficiency and accountability--both now and in the future. Most of these can be implemented under the existing authorities of the Secretary of Energy and the NNSA Administrator. As described in detail in the pages that follow, DOE and NNSA have in fact already taken a number of actions that fully align with the panel's recommendations. Additional steps can and will be undertaken, informed by the work of the Congressional Advisory Panel, as well as other ongoing reviews. .

NNSA is committed to working with the Administration, Congress, our partners and other stakeholders to address the challenges and recommendations identified by the Congressional Advisory Panel in a comprehensive, forthright and transparent manner. Our highly talented NNSA team, comprised of our federal workforce and our Management and Operating (M&O) and other contractor partners, is committed to continuous improvement and achieving excellence in all that we do. Above all, NNSA remains dedicated to carrying out our nuclear and other national security missions, while being mindful of our obligation to continuously improve our business practices, to develop our people, and to be responsible stewards of the resources Congress and the American people have entrusted to us.

National Nuclear Security Administration

National Nuclear Security Administration Comments on the Final Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

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I. Legislative Requirement

SEC. 3134. COMMENTS OF ADMINISTRATOR FOR NUCLEAR SECURITY AND CHAIRMAN OF NUCLEAR WEAPONS COUNCIL ON FINAL REPORT OF CONGRESSIONAL ADVISORY PANEL ON THE GOVERNANCE OF THE NUCLEAR SECURITY ENTERPRISE.

Not later than 90 days after the date of the enactment of this Act, the Administrator for Nuclear Security and the Chairman of the Nuclear Weapons Council (established by section 179 of title 10, United States Code) shall each submit to the congressional defense committees the comments of the Administrator or the Chairman, as the case may be, with respect to the findings, conclusions, and recommendations included in the final report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise under section 3166(d)(2) of the National Defense Authorization Act for Fiscal Year 2013 (Public Law 112-239; 126 Stat. 2209), as amended by section 3142 of the National Defense Authorization Act for Fiscal Year 2014 (Public Law 113-66; 127 Stat. 1069).

II. Introduction

The DOE and the NNSA thank the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise for its in-depth analysis of the nuclear security enterprise, with particular emphasis on the weapons program. We are pleased that the panel recognized some of the considerable successes that the DOE/NNSA have achieved as we carry out our important and enduring nuclear security and deterrence mission. The final report makes 19 primary recommendations for consideration by the Administration, the DOE, the NNSA and the Congress. We believe that these recommendations fall into three general categories: (1) recommendations that could be implemented within the existing authorities of the Secretary of Energy and the NNSA Administrator and would not require legislative action; (2) recommendations that apply to the Congress or are otherwise not in the control of the Department of Energy; and (3) recommendations that would require legislation to implement. My comments will focus primarily on the first category. As will be explained below, many of these recommendations have already been implemented, or are in the process of being implemented, by DOE/NNSA.

In May of 2013, immediately after being sworn in, Secretary of Energy Ernest Moniz provided the leadership, guidance and support the Department and the NNSA needed to address and resolve many of the systemic problems that the panel recognized in its final report. Since that time, we have begun to implement many of the panel's key recommendations, particularly those associated with organizational and management structures; cost estimation; and program, project and construction management. Many of these actions have already demonstrated tangible results, while others will take more time to implement fully.

The panel's report identifies a number of leadership and cultural challenges confronting the Department and the NNSA, many of which are well known and long-standing, but have proven difficult to resolve. These include identifying the correct incentive structure for the management and operating contractors (M&Os), as well as establishing the right level and focus of oversight to meet legal requirements and the expectations of our many stakeholders, including the American people. Other issues, such as inadequate funding for aging infrastructure, have lingered for over 20 years and will require the cooperation and attention of both Congress and the Executive branch to resolve.

We have closely reviewed the 19 primary recommendations, as well as the 63 sub-recommendations, and look forward to working within the Department of Energy and with the Congress, the executive branch, and our stakeholders as we work to improve NNSA's capabilities to meet its full national security mission set for years to come. The challenges before us are significant; but working with the extraordinary people of the NNSA, including the federal workforce and our M&O partners, we commit to address them in a comprehensive, forthright, and open manner.

Background

Although only in existence since 1977, the DOE/NNSA traces its lineage to the Manhattan Project effort to develop the atomic bomb during World War II and to the many energy-related programs that previously had been dispersed throughout various Federal agencies. When the Department was formed, it brought together organizations from the Departments of Agriculture, Commerce, Interior, Housing and Urban Development, and Transportation, and absorbed the Federal Energy Administration and the Energy Research and Development Administration -- organizations with different cultures, and with different missions.

The end of the Cold War saw a paradigm shift in the weapons research, development and production mission of the DOE, a new awareness of the environmental contamination and waste generated during the Cold War, and a growing and evolving imperative to prevent, counter, and respond to nuclear proliferation at all levels. These changes have resulted in what the panel describes as competing priorities in the role of the nuclear enterprise.

The priority for nuclear weapons during the Cold War was, as the panel described, the cycle of "design, test, and build." Since the United States voluntarily adopted a moratorium on nuclear explosive testing in 1992, the focus has shifted to science-based stockpile stewardship to support surveillance, sustainment, life extensions, and weapons dismantlement. No new weapons have been built or tested.

Threats have also changed in those 20-plus years as radiological and weapons-usable material, technology, and expertise became more pervasive. As a result, the need to focus on controlling special nuclear material, and preventing, countering and responding to a range of nuclear and radiological threats has increased.

These mission sets, along with the need to ensure the next generation of nuclear reactors to support the Navy's surface ships and submarines, are the core missions of the NNSA. We recognize that while there are various views and opinions as to what should take priority among these mission sets, our goal at NNSA is to execute all three in order to meet well-established national security goals and policies.

The broad yet interdependent missions, and the capabilities that underpin them, were the driving factors that led to the creation of the NNSA in the National Defense Authorization Act for Fiscal Year 2000. Preserving and enhancing these capabilities, and the importance of maintaining the stockpile and the Naval reactors, while addressing the range of global nuclear security challenges, was made clear in NNSA's statutorily mandated missions. The NNSA was designed to develop a focus on these missions, free from what were perceived at the time as the competing demands for attention and resources in the larger DOE. As the panel's report highlights, these missions are "fundamentally interrelated." Over the coming years, the NNSA will continue to evolve to meet the ever changing threat and will continue to take actions that reflect the more complex and challenging international security environment. As the panel noted, we cannot turn back the clock.

Preserving the Science

The success of the U.S. nuclear security enterprise, dating back to the Manhattan Project and the early days of the Cold War, has always been firmly grounded in science, technology, and engineering. Today, the DOE national laboratory system delivers the innovative and transformative scientific and technical solutions to national security, energy security, and economic and environmental challenges facing the United States in the 21st century. This system—comprised of 17 laboratories across the country—is the core asset for bringing science and technology to bear on a wide range of issues. They are, as Secretary Moniz describes them, our nation's "Science and Technology Powerhouse." The labs solve problems, steward capabilities, operate unique assets, and deliver innovations for future prosperity. NNSA operates three of these laboratories, but uses the capabilities and expertise of most of them. Similarly, the other elements of DOE draw upon the capabilities and expertise of the NNSA laboratories to solve their many scientific and other challenges.

A common thread of the five chapters of the Congressional Advisory Panel's report is NNSA's relationship with the laboratories and sites, not only within the nuclear security enterprise, but more broadly with all of the DOE laboratories. Today we are working with the DOE and NNSA laboratory directors in a more strategic way, while also working with our interagency partners to ensure that our laboratories are able to deal with and anticipate the hard problems of today, and remain on the cutting edge of science and technology for tomorrow.

Meeting the Mission

At the core of the NNSA's success is the science-based stockpile stewardship program. The remarkable achievements of our laboratories and facilities have enabled us to ensure a safe, secure and effective nuclear deterrent without nuclear explosive testing. That our laboratories and sites met this challenge through a new paradigm and set of capabilities is a feat that was much in doubt for many years. There were many skeptics, both in scientific and policy circles; but today, after significant investments in new experimental and diagnostic facilities, coupled with high performance computing capabilities to model and simulate test data and validate our experiments, we now know more about how nuclear weapons work than we did in the days of nuclear explosive testing.

This achievement supports our fundamental mission of certifying the safety, security and reliability of the stockpile each year to the President, and provides the scientific and engineering basis to meet our broader nuclear and national security challenges. With the knowledge and capabilities of the stewardship program, we can understand and respond to the nuclear proliferation threats of the future, and anticipate the development and advances of nuclear weapons and proliferant states. These capabilities have also allowed our complex to address a broad range of national security threats from improvised explosive devices (IEDs) to novel and emerging conventional capabilities.

Leadership, Management and Performance

The leadership team within the DOE/NNSA, from Secretary Moniz on down, is committed to moving toward a more integrated management construct. This new approach will enable DOE/NNSA to address the leadership and cultural challenges discussed in the panel's report and develop a more forward-looking and enterprise-wide approach. To achieve the full potential of this integration, DOE/NNSA will work to avoid duplicating work and eliminate many of the redundancies identified in the report.

In some areas more responsibility can be delegated to NNSA, and in other areas NNSA may be able to defer activities to DOE. This is particularly true in some administrative and support functions. Secretary Moniz has stated that his vision is to manage the DOE through the three Under Secretaries, including the Under Secretary for Nuclear Security, all of whom are acting pursuant to the DOE policies in an integrated fashion. There are many areas where the DOE is developing uniform approaches, including program and project management, establishing priorities across the Department for the disposition of excess facilities, and cyber and physical security. NNSA is a full and equal participant in all of these endeavors. All of these improvements have been put in place without the need for legislation. The leadership team at the DOE/NNSA is fully committed to making NNSA's national security mission a success, and where appropriate, shifting responsibilities to eliminate redundancies.

Leadership actions to bring about a cultural shift started with reorganizing the Department to institutionalize management and performance as a core element of the broader DOE mission. In July 2013, Secretary Moniz implemented a fundamental structural change organizing the Department around three Under Secretaries. Each was assigned clear responsibility for the three major mission areas of the DOE: energy and science, nuclear security, and management and performance.

Flowing from this reorganization, and the emphasis on management and performance, is a change to the Department's approach to construction project management—a problem that has long plagued the DOE and one that the entire Department is committed to fix. At the end of 2014, the DOE released its "Improving Project Management" report, which reviewed project ownership, independent oversight, funding, and front-end planning. With the lessons learned from this report, DOE implemented a three-fold process to improve construction project management at DOE by: 1) re-establishing the Energy Systems Acquisition Advisory Board to be an institutionalized body; 2) creating a Project Management Risk Committee to ensure a corporate style of risk evaluation and risk management; and 3) improving the lines of responsibility and the peer review process under each of the three Under Secretaries.

NNSA is applying this new approach to management and performance across the board, including for the uranium manufacturing capabilities at the Y-12 National Security Complex in Oak Ridge, Tennessee. For years, we had been planning a new multi-billion dollar construction project to replace the Cold War-era uranium manufacturing facilities. As we started to see cost overruns, schedule delays, and the inability of the design to meet the requirements, we stopped the project. Using the new approach, NNSA is developing a new concept that leverages existing facilities and adopts a multi-building approach to the construction of new facilities based on safety and security requirements specifically targeted to the work to be performed in each building. NNSA has appointed federal program and project managers and is now clarifying those requirements, completing the design, and ensuring that the costs are sound. Under this approach we have set a goal to remove the highest hazard operations from Building 9212 by 2019. The uranium construction projects, like all first-of-a-kind, complex nuclear construction projects will be held to the standard of achieving 90-percent design complete before a cost baseline is established.

In many instances of cost growth, particularly for large complex construction projects, requirements, costs, and risks were not well understood, and designs were immature when initial cost estimates were announced. Under the new approach NNSA will not establish a cost and schedule baseline for our technically complex and nuclear projects until the design is 90 percent complete.

On the other hand, we have been successful with construction projects under $750 million, with these projects coming in on or under budget. In recognition of this effort NNSA is off the GAO high risk list for projects under $750 million for the 4th year in a row!

Incentives

Finally, as we continue to partner with our M&Os and other contractors, we will seek to find the correct incentive structure for each contract. DOE/NNSA is unique in the extensive use of government-owned contractor-operated (GOCO) facilities. This unique arrangement is further complicated as our laboratories, which are also operated by M&O contractors, are also Federally Funded Research and Development Centers (FFRDC). FFRDCs have their own special status in performing specialized, long-term R&D work for the Government.

NNSA's recently revamped performance assessment structure uses six primary criteria for determining the incentive portion of the fees earned by our M&Os, and uses the contractor assurance reports as input to that process. Our goal is to be open and transparent in our assessment determinations. We must also find the right incentive structure to ensure that all our contractors provide outstanding performance as we execute our national security missions. Our M&O contractors manage and operate disparate activities, ranging from research and development to industrial production. Accordingly, when it comes to contracting approaches, one size does not fit all. As a result, we will work to develop the right incentives for each circumstance and for each of our contracts. We do this while we also continue to look to our contractors to provide the management, support, and guidance that will enable excellence in the workforce at our facilities.

III. NNSA Response to the Final Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

1. Strengthen National Leadership Focus, Direction, and Follow-Through

Panel Recommendations

1. *The President should provide guidance and oversight sufficient to direct and align nuclear security policies, plans, programs, and budgets across Departments.*

2. *Congress should establish new mechanisms to strengthen and unify its leadership and oversight of the nuclear enterprise and its missions.*

Overview

The recommendations in Chapter 2 of the report are addressed to the President and the Congress and focused on the panel's recommendations to achieve focused consistent leadership and direction from the executive and legislative branches. These actions are needed to correct the "lack of strong, focused political leadership".

While clearly neither nuclear weapons nor the nuclear weapons complex play as prominent a role in American politics, culture or national awareness as they did in the Cold War, an assured reliable deterrent is still an important part of the National Security Strategy. Beginning in 2009 in Prague, and continuing through the 2010 Nuclear Posture Review, the 2013 Nuclear Weapons Employment Strategy of the United States, the 2014 Quadrennial Defense Review, and the 2015 National Security Strategy, the President has articulated a comprehensive nuclear security vision. This leadership from the President has resulted in a clear set of requirements and baseline strategy that the NNSA and Department of Defense (DoD) developed within the Nuclear Weapons Council to reduce our reliance on nuclear weapons while ensuring the viability of a smaller nuclear stockpile for decades to come.

On the other hand, in recent years DOE and DoD have both struggled to meet these requirements within the funding provided. Since the attacks of September 11, the focus, attention and priorities of the country have simply not been the nuclear weapons complex.

Recent reviews and awareness however, have regained the attention of the National Security Council (NSC) and the Office of Management and Budget (OMB). NSC, OMB, DOE and DoD collectively approach the needs of the nuclear enterprise and address them holistically.

This renewed awareness of the needs of the nuclear weapons complex is reflected in the NNSA's budget request for fiscal year 2016 and in the direction and guidance provided to both departments to align NNSA and DoD requirements, plans and resources.

Whether NNSA will be successful in implementing the programs that are outlined in the budget request for fiscal year 2016 is heavily dependent on receiving the requested funding in the requested manner. If the funding caps contained in the Budget Control Act are kept in place, NNSA will not meet it missions.

All of the NNSA missions are important since each mission addresses a vital aspect of nuclear security. Advocates often contend that one mission should have more prominence over the others. It is DOE's task, however, to ensure that all of its missions are met through a balanced approach. Putting priority on one over the other overlooks the interdependency of the missions, and the importance of the scientific and engineering capabilities that must be sustained to execute them.

2. Solidify Cabinet Secretary Ownership of the Mission

Panel Recommendations

3. *Congress should amend the NNSA Act and related legislation to clarify Departmental leadership roles. The Secretary "owns" the nuclear enterprise missions, sets Departmental policy for the nuclear enterprise, and is accountable to the President and Congress for the enterprise. The Director, Office of Nuclear Security (ONS), has full authority to execute the nuclear enterprise missions consistent with the Secretary's policy. Departmental missions-support staffs advise and assist the Director in executing enterprise missions.*

4. *The Secretary should implement Departmental management processes that specify the Director's authorities for executing nuclear enterprise missions. These authorities include: Line management authority for the safe, secure, and environmentally responsible execution of nuclear security missions; Management authority for missions-support staffs assigned to the Office of Nuclear Security; Concurrence authority for Departmental rulemaking on ONS matters.*

5. *The Secretary and Director should reform DOE regulation to strengthen risk management.*

Overview

NNSA is aware of the 50-plus reviews, studies, and audits of various aspects of the NNSA management and of the nuclear security missions. Many other studies predate the NNSA, including the January 1999 report of the President's Foreign Intelligence Advisory Board (PFIAB), which recommended creating NNSA as a semi-autonomous agency. In the majority of these studies, having a committed Secretary of Energy is highlighted as an essential ingredient of success. Similarly there have been concerns over the years, including in the PFIAB report, about whether the work of what is now the NNSA would compete successfully among the many priorities of the DOE bureaucracy in the absence of such leadership. While there are many organizational options available to ensure that there is sufficient priority, focus and attention paid to the national security missions, there is no substitute for strong cabinet ownership.

NNSA has the benefit of DOE senior leadership--Secretary Moniz and Deputy Secretary Elizabeth Sherwood-Randall—with a strong interest in the success of NNSA and the national security mission. Ensuring that this attention remains in the future will take vigilance and commitment from both future Congresses and future Administrations. Even if the Congress were to enact legislative changes in the near term, having committed leadership, including a Secretary who as the panel stated "owns the nuclear enterprise missions," is not guaranteed. As far back as 1985, the Blue Ribbon Task Group on Nuclear Weapons Program Management recommended "that one of the two top positions in DOE should continue to be manned by an individual knowledgeable in national security matters and included in the National Security Council Process."

DOE oversight, provided by an experienced Secretary and Deputy Secretary, serves the needs of the Department and NNSA. The statutes governing the NNSA clearly provide the authority the Administrator needs to execute the missions of the NNSA. However, NNSA recognizes that over time duplicative DOE and NNSA actions have been put in place that have caused delay and frustration amongst the federal work force and our M&O contractors. Secretary Moniz has directed NNSA to work within DOE to eliminate much of the duplication. The right balance is being reestablished because in the end, as the panel recognizes, the Secretary is accountable for the nuclear enterprise and the effective execution of its missions.

Specific Comments

A. Clarified Management Authorities. Secretary Moniz has made significant strides to demonstrate leadership and ownership of the nuclear security mission. For example, in July 2013, Secretary Moniz changed the DOE structure and clarified the roles of the Department's leadership. The three Under Secretaries were assigned clear responsibility for the three DOE mission areas: 1) nuclear security; 2) energy and science; and 3) management and performance. For nuclear security, the NNSA Administrator has clear authority to execute the nuclear security missions under the NNSA Act, consistent with the Secretary's policies. These decision-making practices are now included in the DOE policy documents.

Recently, DOE completed a review and revision of all DOE safety directives. NNSA was deeply involved in the process and as a result, duplicative DOE/NNSA requirements were eliminated. Most of the revised directives have now been implemented in M&O contracts.

DOE/NNSA has also ensured that roles and responsibilities for different functions, particularly for critical line functions such as nuclear safety, have been included in the revised orders. The most recent revision of the *NNSA Functions, Responsibilities and Authorities (FRA) Document for Safety Management* defines, identifies, and clarifies the NNSA safety management functions, responsibilities, risk acceptance authorities, and associated delegations within NNSA Headquarter (HQ), Field Offices, line, program, and functional management organizations, to ensure that work is performed safely.

Another example of an effective and collaborative approach to decision making and policy development is the recently established DOE Chief Security Officer Council. This Council makes sure that the Department's nuclear security missions are executed consistently across the Department and comply with Secretary's policies. The Council meets monthly to discuss security concerns, make policy recommendations, and address common special interest topics to ensure that the special nuclear material, the facilities and the people are adequately protected. The security polices recognize that there are purposeful differences in security requirements across the Department (e.g., to address differences in special nuclear material across sites) and ensure the Administrator has the ability to address those differences. They provide the Administrator authority to approve supplemental directives and authorize exceptions and equivalencies to implement security at NNSA sites. Because security is a line management responsibility, NNSA implements security and DOE oversees that implementation on behalf of the Secretary.

B. Strengthened Risk Management. NNSA has strengthened its analytical expertise and processes for assessing risks, especially for nuclear and other high hazard functions by implementing a Safety Basis Professional Program. This program provides training for the development of new safety professionals, as well as a venue for continuous training for those already filling these assignments.

In November 2014, DOE issued a revision to its guidance for preparing Documented Safety Analyses. The revision incorporated changes to allow probabilistic assessment to be used as part of the safety analyses for nuclear facilities. Future efforts will include publishing a new Accident Analysis Handbook that will include risk analysis consistent with national and international standards.

NNSA also works within DOE to develop coordinated responses to Defense Nuclear Facility Safety Board (DNFSB) recommendations and inquiries. The NNSA Administrator holds routine discussions with the DNFSB members to exchange information and maintain mutual awareness of ongoing issues. In addition, senior NNSA and DNFSB staff members meet routinely to exchange more detailed technical information, discuss a wide range of issues to maintain open lines of communications and to manage risk and expectations related to ongoing inquiries, findings and recommendations.

NNSA tries to innovate where possible. One example is the Kansas City Plant (KCP), where NNSA relies on industry best practices. Lessons learned from the KCP continue to be exported and adopted at the other sites for activities that do not involve high hazard operations, nuclear material or explosives. In fact, NNSA has been applying, where appropriate, site-specific substitution of commercial standards in place of DOE/NNSA standards, and as allowed by these standards, since 2006. NNSA will continue to expand the use of commercial standards where and as appropriate. During FY 2015, M&O partners will evaluate additional opportunities to replace non-nuclear DOE/NNSA requirements with commercial standards. NNSA will continue to balance new approaches to business and other practices with the necessary rigor needed in operational safety and security for nuclear and high hazard activities to ensure worker and public safety. As the panel said "the consequences of failure are enormous, potentially placing large numbers of lives at risk and even changing the course of history."

These examples demonstrated that we have "Cabinet Secretary ownership" of the nuclear security mission and that we have clarified leadership roles, ensuring NNSA has full authority to execute its missions and reform regulations to strengthen risk management. NNSA will continue to work within the DOE on these efforts.

C. Management Authority for Mission- Support Staffs. Secretary Moniz has already taken a number of steps to improve management authority for mission-support staff, and has clarified roles and responsibilities to reduce duplication of work within the DOE. We recognize, however, that more work remains. For example, NNSA's Office of Management and Budget participates in all Department-wide financial and accounting issues in support of requirements of the DOE Chief Financial Officer (CFO) including a clean audit opinion. NNSA has been an integral part of the Secretary's Project Management Working Group and has implemented the recommendations contained in it to ensure all NNSA work follows DOE Orders and Department best practices. In addition, NNSA has moved to consolidate several NNSA offices to clarify responsibilities and authority within NNSA. For example, on January 5, 2015, NNSA stood up the new Office of Safety, Infrastructure & Operations (NA-50) to consolidate safety, infrastructure and enterprise-wide service functions, which had previously been performed by three different offices. In addition to consolidating these three functions, the new NA-50 ensures that safety and infrastructure issues are considered in a holistic, integrated manner that is complementary to programmatic needs, while ensuring that safety remains NNSA's first priority.

3. Adopt Proven Management Practices to Build a Culture of Performance, Accountability, and Credibility

Panel Recommendations

6. *To begin reforming the DOE&NS culture, the Secretary and Director should develop within six months a plan for continuous management learning and improvement, including an implementation plan for the panel's recommendation with milestone target dates.*

7. *The Secretary and Director should implement industry best practices for shaping and building the enterprise workforce.*

8. *The Secretary should establish trusted Cost Analysis and Resource Management staffs, tools, and data; the Director should be responsible for this process for ONS.*

9. *The Director should establish a simple, clear line-management operating structure that both synchronizes activities across programs, mission-support functions, and operating sites and provides leadership focus for key programs.*

10. *The Director should establish program managers who are provided necessary authorities and resources, and who are held accountable for major mission deliverables.*

11. *The Congress, Secretary, and Director should adopt a simplified budget and accounting structure (by reducing budget controls lines) that aligns resources to achieve efficient mission execution while providing sufficient visibility to enable effective management oversight.*

12. *The Director should develop a strategy and plan to reshape the weapons complex to meet future needs.*

13. *The Secretary and Director should continue ongoing efforts to improve construction project management capabilities (at all levels) by introducing disciplined management practices in order to recapitalize infrastructure on time and on budget.*

Overview

The NNSA is a multi-site entity with six large M&O contractors operating these sites, a number of other prime and subcontractors (including many small businesses), and a relatively small cadre of federal employees who establish requirements, provide program guidance and direction, and conduct oversight. NNSA relies heavily on the technical expertise of the M&O contractors to manage the laboratories and facilities, as well as on the technical expertise of the wide variety of other contractors who provide services that include security forces, architectural and construction expertise, and independent technical advice. The federal employees define the programs, develop and defend the budgets, and ensure the contractors are implementing the tasks safely and securely, in accordance with applicable DOE orders. In addition, NNSA and its contractors must ensure that they adhere to a wide range of external statutory and regulatory regimes, some of which are government-wide. In many instances, additional restrictions and limitations are uniquely imposed on specific NNSA operations in annual congressional appropriations and authorization bills.

After a period of emphasis and investment in the scientific aspects of the complex, including the development of a variety of experimental facilities and computational tools needed to maintain the stockpile without testing, NNSA has now turned its attention to long overdue improvements to the operational facilities. One recent example of this shift in attention is the new National Security Campus facility in Kansas City, MO, which began operations in August, 2014. The new, smaller campus will generate a 25 percent reduction in operating costs in a physical footprint of only 1.5 million square feet, down from 3.2 million square feet in the old facility. This project is a case study for a successful public/private partnership in which DOE/NNSA signed a 20-year GSA occupancy agreement to eliminate $140 million in annual facility costs at the old Bannister facility in exchange for a $60 million annual lease payment for the new campus. This commitment enabled the developer to secure third party financing to build and deliver the new campus below the cost and timeline that could have been delivered under a traditional line item project. Overall, the project will create cumulative annual savings that will exceed all project costs, even including the cost of moving from the old Bannister Complex[1] to the new campus.

NNSA is now focused on upgrading and replacing the old and decaying uranium and plutonium facilities. At Los Alamos, the new plutonium laboratory is now open, upgrades to PF-4 are ongoing, and NNSA is working on a design for plutonium modules to meet the long term requirement to have the capability to manufacture 50 – 80 pits per year. At Y-12, site preparations and design activities are ongoing for the construction of new uranium facilities, new uranium processing and manufacturing technologies are in development and upgrades to some existing buildings are also in design. NNSA must also address the substantial back log of deferred maintenance activities and replace several outdated administrative buildings, notably at the Pantex site in Amarillo, Texas, and in Albuquerque, New Mexico.

While NNSA generally executes projects under $750 million on budget and on schedule, large, first-of-a-kind complex nuclear facilities and programs have proven to be very difficult. Recent high profile problems have been due, in many cases, to immature or inadequate designs, lack of technical understanding, inadequate program or project discipline, and lack of adequate oversight—due in large part to a shortage of technically qualified federal staff, over emphasis on cost cutting, and a shortage of qualified materials and labor.

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[1] DOE/NNSA provided its integrated plan for the disposition of the old Kansas City Plant facility in its report to Congress, *Disposition of the Bannister Federal Complex* (August 2014).

Over the course of the last two years, NNSA looked closely at the lessons learned from the previous problems and has put in place a number of initiatives to address the issues identified in the panel's report and elsewhere. These include continuing to grow the capabilities and expertise of our Office of Acquisition and Program Management, established in 2011, to ensure the rigor required by DOE Order 413; and, standing up the Office of Cost Estimating and Program Evaluation (CEPE) in September, 2014.

NNSA, with the support of Secretary Moniz, is focused on replacing the many outdated facilities and reducing the multi-billion dollar backlog of deferred maintenance.[2] NNSA has thousands of outdated facilities that need attention in addition to the high profile outdated plutonium and uranium facilities at Los Alamos and Y-12. Much of the operating and scientific equipment across the complex is also outdated and must be replaced if NNSA is perform its mission and recruit top scientific, technical and engineering talent. Although NNSA has already increased its funding for updating facilities and equipment, additional funding will be needed to resolve the backlog.

NNSA aspires to be a high-performing organization with clear missions and objectives in support of the national interest. Achieving this goal will take, at a minimum, adequate funding and the right number of people, greater discipline in all aspects of program and project execution, and support for and confidence in the federal and contractor workforce. Outlined in the specific comments below are many of the actions that NNSA has already taken. Improving the NNSA will take the commitment not only of the DOE/NNSA leadership; it will take the support of the Congress and our many stakeholders.

As discussed earlier in this response, DOE/NNSA has received over 50 reports examining governance, science, operations, security, safety, too much or too little oversight, and project and program management. Each of the various reports has offered solutions to the various issues and problems. Similarly, the panel's report discusses both new and old issues and problems and makes recommendations. NNSA takes seriously the various recommendations and will closely track those that it is implementing.

Specific Comments

A. Established Continuous Improvements Mechanisms. The DOE/NNSA have several ongoing efforts to help build a stronger performance culture and institute processes for continuous management learning and improvement as well as metrics to measure the progress. For example, NNSA recently completed safety culture surveys of the M&O and Federal workforce,

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[2] NNSA seeks to accomplish the disposition of excess facilities judiciously, consistent with the availability of funding, as reported in its report to Congress, *Fiscal Year 2014 NNSA Facilities Disposition Report,* dated September 2014.

to understand cultural and workplace challenges and best practices. NNSA and its M&O partners are developing safety culture plans to guide and sustain improvements. Since the survey, NNSA has held two meetings department-wide meetings with both Federal and M&O senior leadership to share lessons learned and best practices from these efforts.

Building on the work done at DOE/NNSA sites, the Department is establishing a Safety Culture Improvement Panel that will help sustain the overall momentum. Among other responsibilities, the Panel will review significant Departmental changes for potential impacts on safety culture. This group will be a forum to share best practices and lessons learned between and among Departmental organizations.

NNSA has also initiated robust and frequent internal communication to ensure the overall success of reform plans and objectives. NNSA holds semi-annual off-site meetings with all NNSA Senior Executive Service members, quarterly meetings with all Laboratory leaders, quarterly meetings with Field Office managers, semi-annual joint meetings with the Laboratory and Production Plant leaders, and frequent all-hands meetings and engagements with the contractor and federal workforce.

NNSA is also in the process of finishing a new strategic vision document that will layout the NNSA vision for the future, core values, and priorities for the entire nuclear security enterprise. NNSA has also been criticized for weak internal communications. As a result we are improving routine internal communication mechanisms, which will be used not only to communicate reform plans and objectives, but also the NNSA mission, vision, and other enterprise-wide information to institute a performance-based culture.

Finally, NNSA will continue to capitalize on lessons learned across the nuclear security enterprise. We will continue to ensure that there are no seams between our field offices and headquarters offices and that we all work together to identify and share lessons learned across the complex. NNSA is committed to the contractor assurance systems as part of efficient federal oversight and we will utilize lessons from the successful oversight improvement pilot program at the Kansas City Plant where appropriate.[3]

B. Implemented Workforce Best Practices. A technically capable and competent workforce that clearly understands its roles, responsibilities, and authorities is paramount to properly executing the NNSA mission. NNSA recognizes the importance of eliminating redundant and conflicting responsibilities and authorities across the NNSA complex (i.e., line-management, mission-support, and field offices), and establishing career and leadership development programs for the federal and contractor workforce. NNSA also must ensure that the federal workforce is large enough to carry out all of its duties. The NNSA workforce today is 10 percent

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[3] As reported to Congress, *Extension of Program Principles from the Kansas City Plant Oversight Pilot,* October 2014.

smaller than it was just 5 years ago and has much more work on its plate. NNSA is actively engaged in hiring the right skills needed to support the NNSA for years to come, and to ensure orderly succession planning, but is currently hampered by congressional hiring restrictions.

To date, NNSA has implemented several best practices for shaping and building the enterprise workforce to increase performance, accountability, and credibility. For example, NNSA has increased the use of rotational assignments between Headquarters and Field Offices to share best practices, consolidate and synchronize guidance, and serve as professional development. NNSA has also completed a strategic review of staffing plans to ensure that the vacancies that are filled are most critical to the enterprise; align with core mission, tasks, and functions; and support effective workforce planning and position management. These actions will help meet staffing requirements and develop effective leaders.

C. Enhanced Cost Analysis Capabilities. NNSA agrees that effective cost analysis and resource management are central to effective program and project execution, as they establish both discipline and accountability. The NNSA is improving these capabilities and will use them in our revitalized Planning, Programming, Budgeting, and Evaluation (PPBE) process.

As mandated by the FY 2014 National Defense Authorization Act, the NNSA established the Office of Cost Estimating and Program Evaluation (CEPE) to provide independent, data driven analysis on all aspects of the nuclear security enterprise, leading to better mission planning, budgeting and performance. The office stood up in September and a permanent CEPE director will be announced soon.

CEPE will build capability in several key areas: cost estimation; program evaluation; cost data collection; and systems engineering. It will lead the analyses of alternatives process for major programs and projects, which will serve as the basis for assessing and validating program requirements. CEPE has started early stage cost estimates for the Domestic Uranium Enrichment capability project. As capacity permits, CEPE cost estimators, in coordination with DoD CAPE, will begin baselining other activities, including the B61 LEP and the W88 Alt in advance of their Phase 6.4 milestones in 2016. Additionally, CEPE is providing programming guidance for the FY 2017 budget request and will lead the program review. Although CEPE has started to build its internal cost estimating ability, in the near term NNSA will engage outside experts to conduct independent cost estimates for other capital asset projects, such as the U.S. Army Corps of Engineers and Parsons.

CEPE's cost estimating capability will not replace the necessary ability of the NNSA program offices to estimate costs. The relationship between NNSA program cost offices and CEPE is modeled after the relationship between CAPE and a military Service-level cost center, where CAPE acts as a DoD-wide capability that provides analysis independent of Service interests, while the military Service cost centers provide detailed estimates for use by the Services.

CEPE and the program cost offices will work together to ensure that requirements, policies, processes, and procedures are uniform across all NNSA cost estimates, thus establishing a uniform NNSA federal cost analysis capability. CEPE and the relevant program cost offices will reconcile their estimates to provide the acquisition executive validated insight on risk, cost, and schedule for programs including the life extension programs. By statute, CEPE does not provide cost estimates for capital construction projects.

NNSA's Office of Acquisition and Project Management (APM), which was established in 2012, is focused on the major capital construction projects. This office is working to enhance contract and project management practices and has lead the NNSA's effort to deliver results by supporting rigorous and well-justified alternatives assessments and evaluations, and improving cost and schedule performance. These efforts are bearing positive results. In 2013, GAO recognized DOE's progress in executing projects under $750 million, and now only the three NNSA large nuclear construction projects costing more than $750 million remain on the list.

D. Designated Program Managers. NNSA agrees that capable and well-trained program managers are critical to ensure performance, accountability and credibility. As a result, NNSA is working to ensure managers have the resources, skills and management authorities necessary to execute the mission and are then be held accountable for their performance. NNSA has designated program managers for each LEP and starting in 2014, we implemented a similar approach for NNSA's key nuclear materials or commodities. These program managers have been provided the necessary authorities and resources, albeit within constrained budgets, and are held accountable for their deliverables. They have control over personnel assigned to their programs and over funds uniquely identified for their programs.

Over the past year, the Secretary and the NNSA Administrator have implemented a new vision for "program" managers, as distinct from "project" managers. The program managers are focused on mission need and resource management, whereas project managers are focused on delivering major capital construction projects and supporting infrastructure projects on time and on budget, consistent with the DOE *Implementing Project Management* report. Commodity managers have been established for the major nuclear enterprise commodities, including uranium, plutonium, tritium and domestic uranium enrichment. This ensures there is one senior executive who works closely with the federal project directors while overseeing all programmatic aspects for each of our major nuclear commodities.

The Uranium Program Manager (UPM), created in July, 2014, was the first commodity manager. The UPM has the responsibility to develop, approve, and oversee the execution of a uranium program strategy, and ensures NNSA maintains its uranium capabilities in support of mission requirements. More specifically, the UPM has created an overarching uranium manufacturing strategy reflected in the mission Program Requirements Document (PRD). NNSA has also accelerated efforts to reduce the material-at-risk within existing Y-12 facilities, identified the suite of projects necessary to support the full uranium manufacturing mission, and is developing designs and estimates for projects to recapitalize existing facilities and process systems to be relocated from Building 9212, and those facilities that will replace Building 9212.

The domestic uranium enrichment, plutonium, and tritium mission managers have the similar responsibility to develop, approve, and oversee the execution of their respective commodity program strategies.

For management of the LEPs, NNSA has designated federal program managers for the major LEP activities underway, the W76-1, the B61-12 and W70-4, as well as the W88 ALT 370. NNSA recently implemented earned value management principles for LEP activities across all NNSA sites. The NNSA organizations work closely with the labs and plants to detail work scope and schedules for specific activities needed to support the LEPs. These actions will improve NNSA's LEP management, coordination and decision-making rigor.

E. Simplified Budget Structure. NNSA agrees that a simplified budget and accounting structure would improve NNSA's ability to manage the mission and still provide transparency into programmatic activities. NNSA has already taken a number of steps to simplify its budget structure, reduce the number of internal accounting codes, and implement improvements in financial integration across the nuclear security enterprise.

NNSA agrees with the Congressional Advisory Panel that Congress should reduce the number of budget control lines for the major program and mission-support functions, and looks forward to continuing this effort that began in 2014. NNSA has reduced the number of internal Budget and Reporting (B&R) codes by 30 percent since 2011 and is looking at ways to eliminate more B&R codes, particularly those with little to no funding, while also maintaining sufficient visibility into program and project performance.

The President's fiscal year 2016 budget request realigns the budgets managed by the Office of Defense Nuclear Nonproliferation into the following programs: Material Management and Minimization, Global Material Security, Nonproliferation and Arms Control, Nonproliferation Construction, and Defense Nuclear Nonproliferation Research and Development. The request also moves the Nuclear Counterterrorism Incident Response (NCTIR) and Counterterrorism and Counterproliferation Programs (CT/CP) budget lines from the Weapons Activities appropriation to the Defense Nuclear Nonproliferation appropriation. This change aligns all NNSA funding for preventing, countering, and responding to global nuclear dangers in one appropriation, and strengthens existing collaborations among these mission areas.

The Department is also working to improve the quality and consistency of financial information tracked across the enterprise. Improved data will provide cost estimators, program managers, leaders and oversight authorities with insight needed to support analysis and decision-making, and instill confidence in NNSA's stewardship of taxpayer dollars.

F. Sustaining Base Capabilities in the Enterprise. NNSA agrees that addressing the deferred maintenance backlog, providing cost-effective, requirements-driven infrastructure, maintaining a skilled workforce, and investing in innovative research are vital to ensure NNSA can meet future requirements. NNSA has been building its capabilities to provide independent, data-driven analysis on infrastructure and workforce planning that will lead to better budget formulation and mission performance.

Under Secretary Moniz's leadership, DOE/NNSA have prioritized efforts to halt and reduce deferred maintenance. In 2013, DOE/NNSA, through the National Laboratory Operations Board, established an integrated plan to conduct site-wide assessments of general purpose infrastructure across all seventeen DOE/NNSA labs and plants. This was the first time DOE used common standards and an enterprise-wide approach to assess infrastructure. DOE/NNSA use a variation of a Marine Corp rating system that integrates condition with suitability for mission to create ratings of Adequate, Substandard, and Inadequate. The assessment will enable managers to understand where there is excess space, the physical condition of the assets and whether the assets can support the mission. With the results of the assessment, DOE/NNSA will be able to implement infrastructure investment strategies to achieve the Secretary's guidance that deferred maintenance will not grow beyond FY 2015 year end totals.

Other infrastructure initiatives include:

- Implementing DoD's BUILDER Sustainment Management System to track facility condition and modernization requirements.
- Adapting DoD's Mission Dependency Index to provide a quantified, auditable measure of the importance of individual facilities to NNSA missions.
- Improving the way NNSA procures materials and finances buildings. For example, NNSA is increasing its ability to acquire building systems that are common to all sites across the NNSA (e.g., roof, HVAC) via use of strategic procurements. NNSA, working with the GAO, used a public-private partnership for the Kansas City replacement facility and will look at other options, including alternative financing, when the appropriate conditions and business case exists to provide modern facilities for our workforce.

G. Improved Construction Project Management. NNSA agrees that persistent commitment and continuing focus on improving project management is necessary to resolve construction project challenges--an issue that has long plagued the DOE/NNSA, and one which we are addressing in a creative, disciplined and transparent fashion. At the end of 2014, the Secretary released the *Improving Project Management* report, which reviewed project ownership, independent oversight, funding, front-end planning, and culture from experienced project management leaders. Using this report's findings, DOE/NNSA have implemented a three-fold process to better improve construction project management at DOE by: 1) re-establishing the Energy Systems Acquisition Advisory Board (ESAAB) to be an institutionalized body; 2) creating a Project Management Risk Committee to ensure a corporate style of risk evaluation and risk management; and 3) improving the lines of responsibility and the peer review process within the three Under Secretaries, each of which will have their own project assessment office independent of line management responsibility.

NNSA is applying this new management and performance approach to the uranium manufacturing capabilities at the Y-12 National Security Complex in Oak Ridge, TN. For years, NNSA had been planning a new multi-billion dollar, Uranium Processing Facility (UPF) to replace the Manhattan Project-era uranium manufacturing facilities. As NNSA started to see cost overruns, schedule delays, and the inability of the design to meet the requirements, NNSA reassessed its options with its partners and with an independent "red team" review. Using the results of these reviews, NNSA started development of a revised UPF concept that consists of separate buildings, segregated by security and hazard requirements, in order to minimize the nuclear footprint, build non-nuclear facilities where appropriate, and utilize existing infrastructure at Y-12.

To ensure the program and project are fully integrated, NNSA is using the UPM to create a formalized, overarching uranium manufacturing strategy, and the FPD to execute the construction projects. Using this new model, NNSA will modernize and right-size uranium capabilities at Y-12 and meet mission needs in a disciplined fashion. The highest hazard operations will be shut down at Building 9212, once an Electro-Refining capability comes online, which is scheduled to take place in 2021. All other enriched uranium programmatic operations in Building 9212 will end in 2025. The Uranium construction projects, like all complex nuclear capital construction projects will be held to the standard of achieving 90 percent design before a cost baseline is established. NNSA is now in the process of clarifying requirements, completing the design, and ensuring that the estimates are sound.

DOE has designated management and performance as one of the major functions of the Department to deliver projects on time and on budget. NNSA has been an integral part of the Secretary's Project Management Working Group and has implemented the recommendations provided by it. With two members on the Project Management Risk Committee, NNSA is ensuring that all work follows DOE Orders and, more importantly, the best practices of the Department. To implement these improvements, NNSA has instituted specific policy changes via memorandum and business operations procedures for 90 percent design policy, cost estimating, peer reviews, and beneficial occupancy. NNSA has realigned the peer review reporting requirement to the Principal Deputy Administrator to ensure visibility of this important function at the most senior level. Finally, regarding staffing, every capital asset project managed by DOE Order 413 has a staffing review performed as part of the Critical Decision 2 (Approve Project Baseline) process to ensure appropriate trained staff is available and assigned to the project. If appropriate staff is not available, the project budget is increased to procure the necessary support from the U.S. Army Corps of Engineers and/or support service contractors.

As a result of improvements NNSA has made to project management over the past three years, NNSA evolved from delivering its projects over budget on a portfolio basis to 7.5 percent under budget on a portfolio basis. Over the past three and a half years, NNSA has delivered its $800 million project portfolio approximately $60 million under its original budget.

These examples represent demonstrated success in adopting proven management practices and industry best practices, increasing cost analysis capabilities, synchronizing program performance and accountability, and improving infrastructure and construction project management practices.

4. Maximize the Contributions of the Management and Operating (M&O) Organizations to the Safe, Secure Execution of the Mission

Panel Recommendations

14. *The Director should reform M&O contracts, replacing the award fee structure with fixed fees for longer (multi-year) award terms and linking performance incentives to the contractual period of performance.*

15. *The Secretary and Director should reinforce the M&O parent organizations' obligations to contribute to enterprise management improvement initiatives.*

16. *The Secretary and Director should eliminate wasteful and ineffective transactional oversight.*

17. *The Secretary, Director, and the National Laboratory Directors should adopt management practices that serve to rebuild the strategic Government-FFRDC relationship.*

Overview

Since its origins in the Atomic Energy Commission (AEC), the nuclear weapons complex has relied on a close working relationship with, and the technical expertise of, the M&O partners, including the national laboratories. Moving to for-profit M&O contractors, particularly at the laboratories, initially at Sandia National Laboratory and later at Los Alamos and Lawrence Livermore National Laboratories, has challenged this relationship. Similar transitions at the other NNSA facilities occurred earlier, and have been less contentious, although even at Sandia the transition was less disruptive then at the other two labs. In the early AEC and DOE contracts the M&O contractors managed the labs for a small, or in some instances, even a token fee. In exchange, the government held all of the risk for programmatic issues, failure, incident, or accident. Changing views, particularly with respect to transparency and accountability, as well as some specific incidents, caused that risk formula to shift more toward the M&O and other contractors, who in turn required more compensation to assume more risk. Finding the right balance of incentive, competition, and compensation, while maintaining the close relationship of a trusted partner has and will continue to be a challenge.

Achieving increased accountability and visibility for all aspects of performance including programmatic, cost, financial, security, and environmental management has indeed reduced the flexibility in many areas of the complex. On the other hand, returning to the attitudes and tolerance levels that existed in the early days of the AEC are neither practical nor possible. As a result, NNSA and its partners must find a balance that works for each and meets the expectations of our stakeholders.

The Congressional Advisory Panel report found "the transition to award fees to encourage competition has created the belief among Federal personnel that greater oversight and transparency is required to monitor M&O performance." NNSA believes that this conclusion is accurate but that the management and operations structure of today reflect the general changes in expectations for risk and accountability that have occurred over the last 40 years. Reinstating the trust and the cooperation on both sides of the equation, federal and contractor, while meeting stakeholder expectations, will remain a challenge. NNSA and its M&O contactors have started to address many of the issues identified in this chapter of the report, but much work remains. Each recognize that their respective reputations are at risk and that the continuous circle of events and incidents and the lack of accountability and transparency leads to more audits, reviews, and investigations, which in turn leads to more oversight and less flexibility, which leads to less trust and mutual respect, which leads to a risk averse environment, which completes the circle, as this leads back to the perceived lack of accountability and transparency every time there is a surprise.

Increasing workloads, budget constraints, increased expectations for transparency and accountability, an increasingly demanding culture across the board, and an inability to turn the clock back will require that all parties in the NNSA nuclear enterprise work to find ways to make the enterprise meet expectations for mission, efficiency, and accountability.

NNSA fully supports the panel's recommendation to maximize the contributions of the M&O Organizations to the safe, secure execution of the mission. NNSA continues to strive for as much standardization as reasonable, but believes that "one size does not fit all" in the nuclear security enterprise when it comes to issues like incentive structure and parent organization oversight model. NNSA is committed to working with its M&O Partners to identify solutions that will motivate the entire nuclear security enterprise workforce to successfully perform the full set of NNSA national security missions.

Specific Comments

A. Improving Performance Incentives. The key to improving contract performance and partnership with the M&O's and other contractors will be a tailored approach to incentives that is appropriate for the unique missions and risks associated with the operation of each NNSA site. NNSA must balance the incentives for the individual M&O Partner against the need to optimize the incentives for enterprise success. We have aimed to institutionalize this through the M&O's Strategic Performance Evaluation Plan, including specific performance objectives and the tailored fee structure for each site. All arrangements must ensure tangible benefits and accountability to the taxpayer. In addition, NNSA will seek standardization in contract structure to the greatest extent practicable, while recognizing that one size does not fit all in the NNSA enterprise.

At the same time, however, we must also ensure that our incentive and contractual structures foster continuing excellence in performing the no-fail mission of the NNSA nuclear enterprise. We can never lose sight of the fact that our people remain our most important asset, and so while we incentivize their performance we must position our M&O partners to recruit and retain the specialized workforce that they need to execute that mission successfully. NNSA will also work to identify those management practices that would help to restore a more strategic FFRDC-like approach.

NNSA fully agrees with the panel's recommendations that the incentive structures need to be modified, particularly for our national security laboratories. We know that one size does not fit all, as even our three national security laborites are different from one another. As we work to identify the incentives that will result in excellence, we will look at the contract structures and the appropriate mix of incentives, including fixed and incentive fees.

NNSA has recently re-established a policy office reporting directly to the Administrator. As one of its first tasks, the policy office will look at the incentive and management structures for all of the M&O contractors at the production facilities, the laboratories, and the Nevada National Security Site. It is important that the incentives in each contract be tailored to the contractor and to the work that the contractor performs.

Change of this magnitude will take time, and the results of such change are not going to be immediately measurable. NNSA will remain dedicated to assessing, discussing, implementing, and fine-tuning incentives tailored for each M&O contract.

B. Strengthening M&O Parent Oversight. NNSA concurs that M&O organizations and their parent corporations make invaluable contributions to the nuclear security enterprise. NNSA believes that a strong M&O parent organization oversight model can ensure that best practices and management expertise contribute both to M&Os management improvements as well as enterprise-wide initiatives. The development of effective and transparent M&O Contractor Assurance Systems is the cornerstone to reducing transactional oversight and ensuring effective M&O performance. NNSA requires the parent organization to both evaluate and contribute to the improved effectiveness of the M&O organizations. The results of these evaluations are used to evaluate the contractor's performance and support continuous improvement.

NNSA leadership routinely talks with the various corporate boards and parent organization executives to better understand their commitment to support the nuclear security enterprise and to reinforce the essential role these companies play in managing and improving that enterprise. M&Os must work in partnership with the DOE/NNSA complex to develop, integrate, and implement enterprise solutions that maximize program outputs at best value to the government.

For example, NNSA initiated an effort to receive annual inputs from M&O organizations describing efficiencies achieved during the prior year and the plan to achieve further efficiencies. As part of this effort, NNSA also asks for input on specific changes NNSA can make that would enhance productivity at each site within our enterprise. NNSA is committed to continuing this effort to make the nuclear security enterprise more efficient and to help our contractors to achieve this goal.

C. Eliminating Ineffective Oversight. NNSA agrees that improving and consolidating the audit process would enhance operations throughout the enterprise. Secretary Moniz recently established the Enterprise Assessment Office to consolidate and manage all Departmental independent safety and security assessments in an effort to streamline the number of assessments. Other assessments required by DOE Directives are managed through the Site Integrated Assessment Planning (SIAP) process. Through the planning for the SIAP, NNSA works to de-conflict and eliminate duplicative assessments.

NNSA Field Offices rely on frequent and unfettered communication with M&O partner staff and a strong and transparent Contractor Assurance System (CAS) to form the foundation the oversight relationship with the M&O. The CAS allows for:

- Performance measures which present a dashboard view of operational factors
- An extensive and rigorous program of self-assessments and continuous improvements
- A formal method for tracking and reporting contract requirements and deliverables
- A lessons learned program to capture and institutionalize best practices
- Risk identification and management protocols
- A performance feedback and improvement system
- A lean six sigma quality improvement program
- An internal audit function for both financial and programmatic audits

C. Rebuilding the Partnership between NNSA and M&O Partners. The single most powerful tool to improve morale, culture, and performance in the nuclear security enterprise is to rebuild the trust and strategic partnership between NNSA and the M&O Partners. This will take commitment and compromise, trust and teamwork on everyone's part. Secretary Moniz has implemented several reforms to improve the strategic partnership, and is leading the way in the strategic planning and the performance evaluation processes to ensure a more strategic, M&O-influenced, and integrated process.

Recent reforms at NNSA have aided in reinvigorating the strategic dialogue including:

- A demonstrated commitment from the NNSA Administrator and Principal Deputy Administrator to travel to the sites frequently to engage with Laboratory, Plant, and Federal Field leadership and staff.

- Creation of the NNSA Council where the NNSA Administrator and other senior NNSA Federal Leadership meet quarterly with the laboratory directors and plant managers to discuss strategic direction and resolve issues.
- Establishment of the NNSA Operations Board where NNSA senior Program Managers, Field Office Deputy Directors, and M&O Chief Operating Officers meet quarterly to improve coordination and collaboration across the nuclear security enterprise.
- Increased frequency and improved timeliness in providing quarterly performance feedback to M&O leadership by the NNSA Principal Deputy Administrator.
- Direct reporting from the NNSA. In 2014, the NNSA Administrator expanded his weekly NNSA leadership meeting to include all Field Office Managers.
- Frequent meetings between NNSA Field Office Managers and M&O leadership at their respective sites.

These examples highlight the actions that NNSA/DOE have taken to maximize M&O contribution by taking a graded, tailored approach to contract performance incentives; engaging M&O parent organizations; reducing unnecessary transactional assessments; and rebuilding trust.

5. Strengthen Customer Collaboration to Build Trust and a Shared View of Mission Success

Panel Recommendations

18. *The Secretary should collaborate with the Secretary of Defense to better align the planning, resourcing, and execution of sustainment and modernization programs for nuclear weapons and their supporting infrastructure with DOD's delivery platforms.*

19. *The Secretary and Director should align and streamline processes for collaboration with Interagency customers.*

Overview

Over the last few years, the pace of the life extension programs has expanded, the challenges of aging manufacturing facilities became more significant and urgent and the considerable challenges of maintaining the stockpile without explosive nuclear testing became clear. During this time, the relationship between DoD and NNSA became strained. The tension was exacerbated by significant budget pressures and misunderstandings about the roles and responsibilities of each agency. With the development of the fiscal year 2016 budget request, these tensions abated and the relationship is on a good path. The current relationship is more open, with extensive, detailed and transparent discussions, and a better understanding of what each agency needs to meet the requirements of the nuclear weapons mission.

One of the sources of the problem was the very term –"customer"—that the panel uses in the title of chapter 5. This view that DoD is a customer actually led to misunderstandings. Both agencies have moved to a more complete understanding of the relationship, their respective missions and the role of the Nuclear Weapons Council (NWC). DoD establishes the military requirements of the nuclear weapons. NNSA has its own separate mission to ensure that the technology and scientific base is fully capable of maintaining a safe, secure, reliable and effective stockpile. This responsibility includes the independent ability to certify annually the reliability of the weapons. NNSA continues the tradition of the Atomic Energy Commission (AEC) to ensure that weapons surety is a primary consideration in all LEPs.

The NWC-approved acquisition process, also known as the 6.x process, develops the scope and costs associated with the LEPs. NNSA and the DoD are committed to ensuring that this tried and true process retains its rigor and that corners are not cut. NNSA, through its CEPE organization and associated program cost organizations, is committed to ensuring that the costs for the LEPs are more accurate as it builds a historical cost database. The 6.x process will inform and enable the panels' recommendations to "coordinate budget development for the relevant portions of the warhead and strategic systems budgets."

Chapter 5 of the report also discusses the relationships that DOE/NNSA has with its interagency partners, the Departments of Defense, State, Homeland Security and the Intelligence Community, outside of the nuclear weapons work. The scientific, engineering and manufacturing skills that the NNSA laboratories and facilities bring to the Nation have improved conventional warfighting and other capabilities of the DoD and the Military Services. In addition, these capabilities have also improved the wide range of activities that support the national goal of preventing, countering and responding to nuclear proliferation and terrorism. Support to the Intelligence Community has enabled unique in-depth analysis of various foreign activities, developments, and trends. This work, accomplished mostly through the Strategic Partnership Program (formerly Work For Others), allows the interagency to benefit from the special skills resident in the NNSA complex, while allowing the NNSA complex to grow and refine its own mission skills. This work also allows a measure of creativity, not otherwise found outside of the NNSA LDRD program, and helps in the effort to recruit and retain the best engineers and scientific and technical talent for the complex.

The DOE/NNSA labs and facilities bring unique capabilities to solve the problems of the interagency, but the challenge of the strategic partnership program, as the panel identified, lies in the generally piecemeal nature of the work. The Mission Executive Council (MEC) was established to bring a more strategic understanding of the capabilities needed for the labs and facilities to serve the agencies' missions. Unfortunately, budget pressures on individual agencies have led to the inability of the MEC to deliver this strategic approach, but in time, if budgets allow, the goals of the MEC could be realized. While DOE/NNSA is committed to the future success of the MEC, further development of this strategic concept is required, as well as the involvement and commitment of the agencies for which the NNSA facilities perform their good work.

Specific Comments

A. Strengthened Program Alignment with DoD. NNSA's goal is to provide confidence to the White House, Congress, DoD and the Nation that requirements and priorities communicated through the NWC mechanism will be accomplished effectively and within established program parameters, taking into account budgetary challenges. As an example, in the fall of 2014, NNSA's national security laboratories were charged to investigate and determine the need to refresh W88 conventional high explosives (CHE). NNSA worked closely with DoD, through the NWC, to define the scope and costs needed to resolve the issue, which is reflected in the fiscal year 2016 budget request.

Mechanisms are currently in place to foster daily communications, information sharing, and transparency between the DoD and NNSA on NWC-related activities. NWC executive action officers meet and interact regularly, acting on behalf of their respective members, on all NWC-related business. Additionally, respective weapon-system project officer groups (POG), meet regularly to deliberate on technical weapons and related delivery platform issues that affect the health and welfare of the nuclear stockpile.

The NWC develops an annual joint memorandum to the President, signed by the Secretaries of Defense and Energy, certifying that the stockpile is safe secure and reliable and whether explosive nuclear testing is needed. Each of the laboratories and the US Strategic Command (STRATCOM) submit their independent assessments with the memorandum.

In an effort to improve the process, during the upcoming annual assessment cycle, NNSA will arrange a briefing by the three laboratory directors and the STRATCOM Commander for the NWC on their respective assessment letters and offer a briefing by the laboratory directors to the Secretary of Defense.

NNSA has taken tangible steps to promote a cooperative relationship with our DoD partners. Specific examples include invitations to program workshops on Tritium Demand/Production, continued collaborations with the Navy on W88 CHE refresh, collaboration with the Air Force on LRSO, open invitations to NWC members and support staff on 90-day conceptual studies, and quarterly program reviews for LEPs. We work closely together to develop and deliver key annual reports to Congress and the President, including the Section 1043 Report, the Stockpile Stewardship and Management Plan, the NWC Chairman's Annual Report to Congress, the Joint Surety Report, the Nuclear Weapons Stockpile Plan, and the aforementioned Report on Stockpile Assessments. Additionally, NNSA continues to work collaboratively with DOD and OMB each year to make sure the President's Budget requests are properly aligned with the President's nuclear weapons policy and priorities.

These collaborative efforts are essential to ensuring that DOE/NNSA is doing everything possible to meet the Nation's nuclear deterrent objectives.

B. The Mission Executive Council. The Mission Executive Council (MEC) is an Under Secretary-level body that focuses its efforts on improving interagency strategic planning for the science, technology, and engineering (ST&E) capabilities resident in DOE's laboratories and sites that are of cross-cutting strategic national security interest. NNSA's Office of Strategic Partnership Programs is responsible for reviewing the execution of interagency work including identifying opportunities to improve the overall strategic process. The MEC is improving planning and coordination of key national security areas based on a process of identifying technical issues, assessing existing capabilities, then developing a strategic plan to address gaps. In addition, initiatives such as the DOE's Strategic Approach to Work for Others Study, comprised of the national laboratories, DOE's Office of Science and Energy, and NNSA, created a Community of Practice for discussing collaborative mechanisms and additional improvements. Current members of the Community of Practice routinely engage with the MEC, taking advantage of opportunities to leverage existing efforts and include MEC input.

The MEC has not been as successful as originally anticipated for a variety of reasons, but primarily as a result of budgetary pressures. While DOE/NNSA is committed to the future success of the MEC, further development of this strategic concept is required, as well as the involvement and commitment of the agencies for which the NNSA facilities perform their good work.

IV. Conclusion

NNSA appreciates the Panel's in-depth analysis of the nuclear security enterprise, and recognizes the challenges that lie ahead. NNSA is committed to working with the Administration, Congress, our partners, and other stakeholders to address these challenges, as well as the Panel's recommendations, in a comprehensive and transparent manner. The actions DOE and NNSA have already completed are key to governance reform and consistent with the Panel's recommendations, but there is much more to be done. Ensuring world-class science and technology, in partnership with our laboratories, and collectively improving our management performance through creative solutions, will enable the nuclear security enterprise to cost-effectively achieve our vital national security mission, but it will take time and the partnership of our stakeholders and partners.

Appendix: Full Set of Recommendations from the Congressional Panel on the Governance of the Nuclear Security Enterprise[4]

Strengthen National Leadership Focus, Direction, and Follow-Through

The President should provide guidance and oversight sufficient to direct and align nuclear security policies, plans, programs, and budgets across Departments.

1.1. The President should reaffirm the importance of the mission and align DOE&NS and DOD priorities through an expanded President's annual stockpile guidance.
1.2. The President should require annual OMB joint budget reviews to shape and align DOE&NS and DOD programs and budgets.
1.3. The President should require annual NSC joint program reviews to shape and align DOE&NS and DOD programs and policies.

Congress should establish new mechanisms to strengthen and unify its leadership and oversight of the nuclear enterprise and its missions.

2.1. Congress should add Senate Armed Services Committee approval to the confirmation and reporting requirements for the Secretary and Deputy Secretary of DOE&NS (and continue to have the Director, ONS be approved by the Senate Armed Services Committee).
2.2. Congress should require the Secretary to testify annually on the health of the enterprise, and on progress in reforming its governance, to the Senate Energy and Natural Resources and Senate Armed Services Committees and to the House Energy and Commerce and House Armed Services Committees.
2.3. Congress should implement information sharing and collaboration mechanisms to unify and strengthen its mission-focused oversight across cognizant committees and to better harmonize direction and oversight across the enterprise's mission areas.

[4] Table of Recommendations, *A New Foundations for the Nuclear Enterprise*, Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, November 2014, pages xix-xxiv.

Solidify Cabinet Secretary Ownership of the Mission

Congress should amend the NNSA Act and related legislation to clarify Departmental leadership roles. The Secretary "owns" the nuclear enterprise missions, sets Departmental policy for the nuclear enterprise, and is accountable to the President and Congress for the enterprise. The Director, Office of Nuclear Security (ONS) has full authority to execute the nuclear enterprise missions consistent with the Secretary's policy. Departmental missions-support staffs advise and assist the Director in executing enterprise missions.

3.1. The amended legislation should specify the Secretary's leadership responsibilities and define duties that underscore the Secretary's accountability for the nuclear enterprise and its missions.
3.2. The amended legislation should create the Office of Nuclear Security (ONS) within the Department to perform the missions currently assigned to NNSA.
3.3. The amended legislation should designate a Director, Office of Nuclear Security with full authority to execute nuclear enterprise missions under the policy direction of the Secretary. The Director should have tenure of at least six years, be compensated at the rate of executive Schedule Level II, and hold the Departmental rank of a Deputy Secretary or Under Secretary.
3.4. The amended legislation should assign risk acceptance authority and accountability to the Director for ONS mission execution.
3.5. The amended legislation should grant the Director authority to appoint senior officials in ONS, including the conversion of three of the Senate-confirmed direct-report positions (Principal Deputy, Assistant Secretary for Defense Programs, and Assistant Secretary for Non-Proliferation Programs) to Senior Executive Service or Excepted Service positions.
3.6. The amended legislation should emphasize the importance of the nuclear enterprise missions, by changing the name of the Department to the "Department of Energy and Nuclear Security.

The Secretary should implement Departmental management processes that specify the Director's authorities for executing nuclear enterprise missions. These authorities include: Line management authority for the safe, secure, and environmentally responsible execution of nuclear security missions; Management authority for missions-support staffs assigned to the Office of Nuclear Security; Concurrence authority for Departmental rulemaking on ONS matters.

4.1. The Secretary should establish decision-making practices among the senior headquarters staffs that codify the Director's authority to execute the nuclear security missions consistent with the Secretary's policies.
4.2. The Secretary should establish a matrix management structure that: Aligns and codifies roles, responsibilities, authority, and accountability; Specifies the

Director's leadership authority over line-management and mission-support ("functional") staffs assigned to ONS; Eliminates overlapping headquarters staff.

4.3. The Secretary should adopt processes defining the Director's role in ensuring applicable DOE&NS policies, rules, and orders are compatible with the operating circumstances of the nuclear security enterprise.

4.4. The Secretary should designate those senior headquarter positions that have line-management decision authorities and those that are responsible for mission-support functions.

The Secretary and Director should reform DOE regulation to strengthen risk management.

5.1. The Secretary should strengthen the Department's analytical expertise and processes for assessing risks, especially for nuclear and other high-hazard functions.

5.2. The Secretary should direct a comprehensive review and reform of the Department's ES&H and Security Orders and Directives to reflect best industry practices.

5.3. The Secretary (with Congressional concurrence) should establish a mechanism to improve the Department's ability to respond to inquiries, findings, and recommendations of the Defense Nuclear Facility Safety Board.

Adopt Proven Management Practices to Build a Culture of Performance, Accountability, and Credibility

6. To begin reforming the DOE&NS culture, the Secretary and Director should develop within six months a plan for continuous management learning and improvement, including an implementation plan for the panel's recommendation with milestone target dates.

   6.1. The Secretary and Director should urgently develop a more robust, integrated DOE&NS/ONS-wide process to provide accountability and follow-up on findings and recommendations from studies and reviews, both internal and external.

   6.2. The Secretary and Director should establish management metrics for assessing and improving enterprise management.

   6.3. The Secretary and Director should routinely survey personnel to gauge morale, assess cultural changes, and identify the results of efforts to change management practices.

   6.4. The Secretary and Director should aggressively communicate reform plans and objectives.

7. The Secretary and Director should implement industry best practices for shaping and building the enterprise workforce.

7.1. The Secretary and Director should establish strong career and leadership development programs, require rotational assignments, and place greater emphasis on continuing education and professional certifications.
7.2. The Secretary and Director should reshape staffs as needed to implement governance reforms.
7.3. The Secretary and Director should conduct a zero-based personnel review to right-size government staffs consistent with recommended reforms and changing workload since the end of the Cold War; this review should include the consolidation of headquarters activities across DOE&NS's Forrestal headquarters, the Germantown campus, and the Albuquerque complex.

8. The Secretary should establish trusted Cost Analysis and Resource Management staffs, tools, and data; the Director should be responsible for this process for ONS.

8.1. The Secretary and Director should strengthen the Department's efforts to develop independent cost and resource analysis capabilities.
8.2. The Secretary and Director should employ a rigorous Analyses of Alternatives process during program formulation as the basis for assessing and validating program requirements.
8.3. The Secretary and Director should take advantage of established DOD resource analysis capabilities in establishing DOE's cost analysis and resource management capabilities.

9. The Director should establish a simple, clear line-management operating structure that both synchronizes activities across programs, mission-support functions, and operating sites and provides leadership focus for key programs.

9.1. The Director should create operational mechanisms to perform the key synchronization functions that used to be performed by the Albuquerque Operations Office.
9.2. Deputy Directors should be designated to lead in the integrated planning and execution of programs in their mission areas of responsibility.
9.3. The Deputy Director responsible for Life Extension Programs, working with DOD, should create a long-term operating plan to support the nation's warhead modernization strategy; this plan should be designed to create a relatively stable, long-term workload.

10. The Director should establish program managers who are provided necessary authorities and resources, and who are held accountable for major mission deliverables.

10.1. The Director, in coordination with the responsible Deputy Director, should designate program managers for each Life Extension Program and major construction project.

10.2. Program managers should be held accountable to employ effective management practices.
10.3. The Director should delegate to the program managers control of any funds identified as uniquely required to execute their programs.
10.4. The Director should delegate control over personnel assigned to their programs to the program managers.

11. The Congress, Secretary, and Director should adopt a simplified budget and accounting structure (by reducing budget control lines) that aligns resources to achieve efficient mission execution while providing sufficient visibility to enable effective management oversight.

    11.1. Congress should reduce the number of Congressional budget control lines to the number of major programs plus major mission-support functions.
    11.2. The Director should reduce ONS's internal budget control points to the minimum number needed to assign funding for major programs and mission-support activities across the sites.
    11.3. Infrastructure funding that is uniquely required for the execution of Life Extension Programs should be integrated into the portfolio of the Deputy Director for Defense Programs.

12. The Director should develop a strategy and plan to reshape the weapons complex to meet future needs.

    12.1. The Director should ensure that the strategy and plan identify and addresses the deferred maintenance backlog.
    12.2. The Director should ensure that the strategy and plan match (and, in many cases, reduce) the infrastructure needed to meet requirements.
    12.3. The Director should ensure that the strategy and plan identify investments in the needed skills in the workforce.
    12.4. The Director should ensure that the strategy and plan specify investments in capabilities, including the sites' use of internally directed research and development. The panel recommends Laboratory Directed Research and Development (LDRD) funding of no less than 6 percent, which is needed to sustain leadership in nuclear science, engineering, and manufacturing.

13. The Secretary and Director should continue ongoing efforts to improve construction project management capabilities (at all levels) by introducing disciplined management practices in order to recapitalize infrastructure on time and on budget.

    13.1. The Director should strengthen infrastructure project management skills, tools, and the collection and analysis of data.

13.2. The Director should build on recent efforts to adopt best practices for managing infrastructure projects, especially the use of external peer review.

13.3. The Secretary and Director should hold managers accountable for adopting the effective practices detailed in the Department's directive on project management (Order 413), consistent with the principles provided in OMB Circular A-11 in infrastructure projects.

Maximize the Contributions of the Management and Operating (M&O) Organizations to the Safe, Secure Execution of the Mission

14. The Director should reform M&O contracts, replacing the award fee structure with fixed fees for longer (multi-year) award terms and linking performance incentives to the contractual period of performance.

 14.1. The Director should adopt market-based fixed fees for new M&O contracts commensurate with M&O-borne risks, M&O investments in the enterprise, and the scale of the undertaking.

 14.2. Where practicable, the Director should convert existing contracts to similar fixed fee arrangements.

 14.3. The Director should base decisions to extend an M&O contract's period of performance primarily on contributions to mission performance; unsatisfactory performance should lead to early termination.

 14.4. The Director should seek greater standardization of contract provisions across similar entities.

15. The Secretary and Director should reinforce the M&O parent organizations' obligations to contribute to enterprise management improvement initiatives.

 15.1. The Director should create collaborative mechanisms to strengthen the joint contributions of the M&O organizations in improving the effectiveness and efficiency of enterprise operations.

 15.2. The Director should task M&O organizations to identify and assess management improvement opportunities, both for mission execution and for mission-support functions.

16. The Secretary and Director should eliminate wasteful and ineffective transactional oversight.

 16.1. The Secretary and Director should direct a reduction in the number of audits, inspections, and formal data calls, and better synchronize those that remain.

 16.2. The Secretary and Director should eliminate transactional oversight in areas where there are better mechanisms for certifying contractor performance, to include reform of the field office's staffing levels and performance criteria.

17. The Secretary, Director, and the National Laboratory Directors should adopt management practices that serve to rebuild the strategic Government-FFRDC relationship.

    17.1. The Secretary and Director should continue to reinvigorate the strategic dialog with the Laboratory Directors.
    17.2. Leaders in both the government and M&Os should prescribe and enforce behaviors that rebuild credibility and trust.
    17.3. The appropriate government officials (e.g., Deputy Directors, project managers) should meet at least monthly with the M&O leadership, and preferably have daily informal interactions.

Strengthen Customer Collaboration to Build Trust and a Shared View of Mission Success

18. The Secretary should collaborate with the Secretary of Defense to better align the planning, resourcing, and execution of sustainment and modernization programs for nuclear weapons and their supporting infrastructure with DOD's delivery platforms.

    18.1. The Department Secretaries should direct activities that foster collaboration and communications among the principals and staffs supporting the Nuclear Weapons Council (NWC).
    18.2. The Department Secretaries, supported by the chairman and members of the NWC, should reinvigorate its working-level elements.
    18.3. The Department Secretaries should establish transparent information sharing mechanisms and increase direct staff collaboration on a daily basis to address persistent communications and trust issues.
    18.4. The Department Secretaries should confer on each Department's proposed co-chair to the Standing and Safety Committee (SSC), which reports to the NWC.
    18.5. The Department Secretaries should involve the NWC in drafting and reviewing the annual assessment to the NSC of progress on meeting Presidential guidance.
    18.6. The Director should strengthen the roles, responsibilities and accountability of the senior military officer assigned to ONS in order to improve DOE&NS-DOD collaboration.

19. The Secretary and Director should align and streamline processes for collaboration with Interagency customers.

    19.1. The Secretary, working through the Mission Executive Council, should improve coordination for planning and executing of Interagency Work.
    19.2. The Mission Executive Council should annually conduct a review of the execution of Interagency Work across the nuclear security enterprise to identify improvement opportunities in working relationships, collaborative mechanisms, and management practices.

SECRETARY OF ENERGY ADVISORY BOARD

MEMORANDUM FOR:	SECRETARY OF ENERGY
FROM:	John Deutch John Deutch Chair, Secretary of Energy Advisory Board (SEAB)
CC:	Deputy Secretary of Energy and SEAB Members
DATE:	February 17, 2015
SUBJECT:	SEAB comments on the Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise

You requested that your Secretary of Energy Advisory Board review the recent *Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise* (Augustine-Mies Panel) and give you its opinion about how the department should respond to the advisory panel's recommendations.[1] This letter report, prepared by six members and approved by the board, transmits our views.[2]

Congress established the Augustine-Mies Panel and charged it to address the many concerns that have existed for some time about impediments to the NNSA performing its vital national security mission of maintaining the nuclear weapons stockpile, advancing U.S. nonproliferation policies and programs, and supporting the nuclear navy. The concerns are wide-ranging and include cost and performance of the weapons program, maintaining the morale and quality of the technical staff, avoiding cost overruns of major projects, and reducing program management and direction from NNSA that encourages risk avoidance, excessive control, and inadequate attention to program outcomes.

The Augustine-Mies Panel was directed to examine alternative models that would enable

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[1] *A New Foundation for the Nuclear Enterprise*, Report of the Congressional Advisory Panel on the Governance of the Nuclear Security Enterprise, co-chaired by the Honorable Norman Augustine and Admiral Richard Mies, USN (Ret.), November, 2014.

[2] The six SEAB members are: Brent Scowcroft, Chair SEAB Nuclear Security Subcommittee, Al Carnesale, John Deutch, Steven Koonin, Richard Meserve, and Ellen Tauscher.

transformation and dramatic improvement in the DOE/NNSA enterprise. The Panel considered four different models: (a) maintaining the current somewhat ambiguous quasi-independent status of the NNSA within DOE, (b) recreating the NNSA as an independent agency, (c) transferring responsibility for the NNSA to the Department of Defense, and (d) moving from a separately organized NNSA within DOE to a new Office of Nuclear Security, ONS, integrated into a DOE that is led by a cabinet secretary who is committed to and knowledgeable about nuclear security issues. The Director of ONS would be given substantial authority and responsibility for implementing the department's nuclear security program.

The Augustine-Mies Panel recommends the last option: integrating a new ONS into DOE with an obligation that DOE leadership, the secretary and deputy secretary, have knowledge and commitment to the nuclear security responsibilities of the department.

The members of SEAB, many of whom have deep experience with DOD and DOE, unanimously and strongly agree with the Augustine-Mies Panel that a new ONS should be integrated into DOE and that the leadership of DOE should have knowledge of, and commitment to, the nuclear security responsibilities of the department. SEAB stresses that the consequence of taking no action risks continuing deterioration of DOE's ability to fulfill its national security mission and the morale throughout the complex. We urge you to encourage the administration and Congress, vigorously and vocally, both publicly and within the DOE/NNSA community, to endorse the Panel's constructive approach and implement the needed legislative change to the DOE Organization Act.

SEAB believes you demonstrate that there are individuals who can provide the kind of secretarial leadership that is needed to make *A New Foundation for the Nuclear Enterprise* a success, and your example was not insignificant in bringing the Panel to its organizational recommendations.

The Panel helpfully proposes in Appendix C of their report changes to the language in the 2000 statutory amendment establishing the NNSA in the 1977 DOE Authorization Act.

SEAB believes that these changes are directionally correct; however balance with the energy mission should not be forgotten. Several of the Panel's suggestions are intended to underscore the importance of national security, especially the nuclear weapons program, in the department missions. Suggestions such as changing the name of the department, requiring both the Armed Services and Energy and Natural Resources Committees to confirm the Secretary and Deputy Secretary, establishing qualifications of the president's nominees for these positions, and extending the term of the Director of ONS are sure to provoke considerable debate. We did not discuss the pros and cons of these suggestions but are prepared to do so if you believe it would be useful to have SEAB's opinion.

The Augustine-Mies Panel does a thorough job of identifying changes that are needed to bring their vision of a *New Nuclear Enterprise* into a reality. The Panel presents a daunting list of 65 recommendations organized into five broad categories. Those with senior government management experience (and many members of the Panel have such experience) will recognize that the phrases in these recommendations such as "The Secretary should..." or " the Director of ONS should..." do not indicate an immediate way forward to implementation. It will take more than a few years to achieve the result the Augustine-Mies Panel seeks. The Panel lists 15 useful indicators of progress in the desired realignment and suggests a follow-on evaluation in two years; SEAB suggests you might consider establishing a process to report semi-annually to Congress on the progress made in implementing the recommendations.

SEAB wishes to offer remarks on five issues that the board believes deserve your special attention.

- The DOD is the main customer for DOE's weapons technology and products. The Nuclear Weapons Council is the principal mechanism for harmonizing requirements and resources that define an executable five-year plan. The Panel identifies current weakness in this mechanism, but stops short of recommending a high-level, DOD executive who has experience and expertise in the weapons complex to support the Council and to manage the DOD's role in the day-to-day matters between the two agencies. If the principal customer and the supplier of defense programs are not in agreement about requirements and resources, it is inevitable that differences will be resolved by less qualified individuals and result in adoption of a less sound program with unsatisfactory cost and performance outcomes.

- The Panel gives a thorough and telling account of the breakdown in the working relationship between the NNSA and its M&O contractors. It is basically a story of a change from a mission and outcome driven FFRDC orientation to an excessive transactional, cost minimization, and risk avoidance orientation. But in our view the Panel falls short in suggesting convincing, concrete steps that will reestablish the credibility and trust between the government and the M&O contractors.

  The Panel recommends a shift from reliance on award fees to fair fixed fees with contract renewal and extension as the main mechanism to reward or penalize contractor performance. SEAB agrees that too much reliance has been placed on the award fee as a performance incentive tool but doubts the change recommended by the Panel is sufficient to reestablish an FFRDC relationship.

  The SEAB National Laboratory Task Force believes that in addition, more attention needs to be placed on restoring clarity and non-overlapping responsibility and accountability for programmatic, functional, and financial activities among the various stakeholders: NNSA headquarters, field sites, M&O contractors, and laboratory management. In short, there is no sure formula for reestablishing an effective and collaborative working relationship, but as the Panel's report makes clear, doing so remains a key objective.

- The Panel makes many important suggestions about improving operations at the laboratories and planning for necessary infrastructure modernization and renewal. While the Panel acknowledges the importance of human capital in one of its recommendations, SEAB believes that substantially more attention should be paid to improving the morale and creative atmosphere at the weapons laboratories and the production facilities.[3] The tension that has existed between the NNSA and M&O contractors is corrosive to maintaining the technical excellence that is the essential underpinning of the laboratory capability. Finding and keeping the most talented employees is the responsibility of every part of the management chain, especially the laboratory leadership. The Panel recognizes the importance of the Laboratory Directed Research & Development (LDRD) program for this purpose and endorses a funding level no less than 6%; SEAB agrees.

- SEAB believes there is significant opportunity for greater programmatic connections between the NNSA and the other DOE science/energy national laboratories that would further the integration objective advanced by the Augustine-Mies panel. Areas where increased collaboration has promise are high performance computing, nuclear physics, fusion, and materials science.

- The unique skills of the nuclear security laboratories are important to other agencies: including the Department of Defense, the Department of State, the Department of Homeland Security, and the Intelligence Community. This work for others, WFO, is growing at the labs and presents management challenges: the non-DOE agencies pay for a portion of the project cost, but not as a general matter the investment necessary to maintain the intellectual and physical infrastructure of the laboratories; a need to assure that the work does not interfere with the fulfillment of the labs weapons mission; and confirmation that the work is consistent with the laboratory's mission. Non-DOE customers object to the cost, the complex and long approval process, and delays in completion of the work.

  Congress clearly intends that the laboratories contribute to a broad range of national security missions and provide assistance to the non-DOE agencies. The Mission Executive Council (MEC) was launched by agreement among the principals of the affected agencies to facilitate coordination among the group so that the laboratories

[3] The Panel Recommendation 12.3 is: "**The Director should ensure that the strategy and plan identify investments in the needed skills in the workforce.** There needs to be an analysis of the level and skill mix of the workforce necessary to meet future requirements, and an assessment of the steps required to recruit and retain them."

could serve this broader mission. The Panel notes that the MEC has not been fully effective to date and makes recommendations to improve its functioning. While DOE shoulders the central responsibility for assuring the health of the laboratories, their management and funding, we agree that the Secretary of Energy and the Director of the ONS should revitalize the MEC as a means for improving coordination among the agencies. The aim should be to assure that the agencies are aware of the special capabilities of the labs and that the laboratories are aware of the emerging challenges confronting the agencies. We understand that the National Academies have prepared a report for NNSA that explores these issues more fully.

SEAB strongly supports the Augustine-Mies report and we stand ready to receive further tasking from you to assist the department in this important realignment process.

Report of the Secretary of Energy Task Force on DOE National Laboratories

June 17, 2015

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EXECUTIVE SUMMARY

This interim report of the Secretary of Energy Advisory Board (SEAB) National Laboratory Task Force (TF) identifies the constraints on and evaluates the effectiveness of laboratory operations that impact the performance and efficiency of the DOE national laboratories. The TF stresses the overriding importance of two actions: clarifying the authorities and responsibilities of the entities involved in laboratory management and adopting a disciplined process for implementing change.

The TF report further proposes targeted “experiments” in three areas: (1) the management and operation (M&O) contracting system that the U.S. Department of Energy (DOE) uses to run the laboratory system; (2) technology transfer as a means for creating value for the private sector; and (3) Laboratory Directed Research and Development (LDRD). The discussion and recommendations in each of the three areas are mutually reinforcing. For example, reducing the time and streamlining the complex bureaucratic procedures required for DOE National Laboratories to get approvals from DOE will facilitate greater cooperation with industry.

Each of the targeted “experiments” the TF recommends can be conducted using existing DOE authorities and should be abandoned or expanded according to results. The TF expects that these experiments would run for 12 to 24 months.

Relieving management constraints on the DOE laboratories enables better technical outcomes and greater efficiency but it does not guarantee this desirable outcome. Success requires disciplined and continuing integration of planning for the R&D program and management to implement productive change. This TF report does not address important integration issues.

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Acronyms and Abbreviations

ACT	Agreement for Commercializing Technology
ANL	Argonne National Laboratory
BNL	Brookhaven National Laboratory
CFR	Code of Federal Regulations
CRADA	Cooperative Research and Development Agreement
DOD	U.S. Department of Defense
DOE	U.S. Department of Energy
DSSG	Defense Science Study Group
EERE	Energy Efficiency and Renewable Energy
EH&S	environment, health, and safety
ESSG	Energy Science Study Group
Fermilab	Fermi National Accelerator Laboratory
FFRDC	Federally Funded R&D Centers
FNAL	Fermi National Accelerator Laboratory
GOCO	Government-Owned Contractor-Operated
GOGO	Government-Owned Government-Operated
INL	Idaho National Laboratory
JPL	Jet Propulsion Laboratory
KCP	Kansas City National Security Campus
LANL	Los Alamos National Laboratory
LBNL	Lawrence Berkeley National Laboratory
LDRD	Laboratory Directed Research and Development
LLC	limited liability corporation
LLNL	Lawrence Livermore National Laboratory
LOB	Laboratory Operations Board
LPC	Laboratory Policy Council
M&O	management and operation
NASA	National Aeronautics and Space Administration
NLDC	National Laboratory Directors' Council
NNSA	National Nuclear Security Administration
NREL	National Renewable National Laboratory
NNSS	Nevada National Security Site
ORNL	Oak Ridge National Laboratory
Pantex	Pantex Plant

PDRD	Plant Directed Research and Development
PEMP	Performance Evaluation and Measurement Plan
PNNL	Pacific Northwest National Laboratory
PPPL	Princeton Plasma Physics Laboratory
R&D	research and development
RFQ	Request for Quotations
SAR	synthetic aperture radar
SC	(U.S. DOE) Office of Science
SDRD	Site Directed Research and Development
SEAB	Secretary of Energy Advisory Board
SNL	Sandia National Laboratories
SPP	Strategic Partnership Projects
SRNL	Savannah River National Laboratory
TF	Task Force
TJNAF	Thomas Jefferson National Accelerator Facility
WFO	Work for Others
Y-12	Y-12 National Security Complex

CONTENTS

FIGURES

TABLES

FRAMEWORK

"A proliferation of duplicative and burdensome requirements are choking the DOE National Laboratories."

This interim report of the Secretary of Energy Advisory Board (SEAB) National Laboratory Task Force (TF) proposes a series of new mechanisms and procedures to enhance the performance of the DOE National Laboratory system through targeted "experiments" in three key areas: (1) the management and operation (M&O) contracting system that the U.S. Department of Energy (DOE) uses to run the laboratory system; (2) technology transfer as a means for creating value for the private sector; and (3) Laboratory Directed Research and Development (LDRD). Each of these targeted experiments can be conducted using existing DOE authorities and resources, and could be scaled and replicated if successful. The discussion and recommendations in each of the three areas are mutually reinforcing. For example, reducing the time and streamlining the complex bureaucratic procedures required for DOE National Laboratories to get approvals from DOE will facilitate greater cooperation with industry.

DOE and its predecessor agencies have been stewards of the national laboratory system, a vital national asset. DOE's duty is to maintain the quality of its personnel and the scientific and technical excellence of the national laboratories so this capability can be brought to bear on major national problems (e.g., national security, energy, and economic well-being). The DOE national laboratories remain unequaled and envied by other countries. Nevertheless over the years many questions have been raised about the management and performance of this system.

Congress and others have commissioned many studies analyzing the purpose, organization, performance, and cost of the DOE National Laboratory system. A number of recent and prospective studies are given in the reference section at the end of this report. The Secretary of Energy has asked the SEAB to form a DOE National Laboratory Task Force to (1) review past studies and to address specific issues where the Secretary of Energy has the authority to take action to improve the effectiveness and efficiency of the DOE National Laboratories and (2) remain informed about the findings and recommendations of in-progress studies and provide advice regarding the DOE's response. The Secretary of Energy's Terms of Reference are included in Appendix A, and the membership of the DOE National Laboratory Task Force is given in Appendix B.

TF findings and recommendations are based on an extensive review of applicable reports issued primarily over the past decade (see the Reference section at the end of this report) and on meetings with DOE officials, laboratory directors, management and operations (M&O) contractors, directors of other federal agency laboratories operated using the (M&O) contractor model, and members of industry (Appendix C). Many TF members also draw upon direct experience in the National Laboratories and/or the DOE.

The TF approach is to propose specific actions rather than new general policies and procedures. The TF suggests that actions that do not require modification of existing regulations or authorities be undertaken as 'experiments' that would be abandoned or expanded according to results. The TF expects that these experiments would run for 12 to 24 months.

STRENGTHENING THE FRAMEWORK

DOE operates 17 laboratories at an annual cost to the DOE and other government agency sponsors (which account for roughly 15%) of about \$13.5 billion.[1] The 17 DOE National Laboratories, managed by the Under Secretary for Science & Energy, the Under Secretary for Management and Performance, and the National Nuclear Security Administration (NNSA) Administrator, are aligned with DOE's four missions – science, energy, nuclear security and environmental management (see Table 1). In addition, Table 1 indicates four production facilities that are closely related to the DOE's national security mission.

Table 1. Laboratory types and stewardship roles for DOE National Laboratories and NNSA production sites. The DOE Office stewarding each laboratory is given in parentheses.

Under Secretary for Science and Energy			NNSA Administrator		Under Secretary for Management & Performance
Small/ Single-Program Science Laboratories	Energy Laboratories	Large Multi-Program Science Laboratories	National Security Laboratories	National Security Production Facilities	Environmental Management Laboratory
Ames (SC)	INL (NE)	ANL (SC)	LLNL (NNSA)	Pantex (NNSA)	SRNL (EM)
Fermilab (SC)	NETL (FE)	BNL (SC)	SNL (NNSA)	Y-12 (NNSA)	
PPPL (SC)	NREL (EERE)	LBNL (SC)	LANL (NNSA)	KCP (NNSA)	
TJNAF (SC)		ORNL (SC)		NNSS (NNSA)	
SLAC (SC)		PNNL (SC)			

SC = Office of Science; NE = Office of Nuclear Energy; FE = Office of Fossil Energy; EERE = Energy Efficiency and Renewable Energy; NNSA = National Nuclear Security Administration; EM = Office of Environmental Management
Ames = Ames National Laboratory; Fermilab = Fermi National Accelerator Laboratory; PPPL = Princeton Plasma Physics Laboratory; TJNAF = Thomas Jefferson National Accelerator Facility; SLAC = SLAC National Accelerator Laboratory; INL = Idaho National Laboratory; NETL = National Energy Technology Laboratory; NREL = National Renewable Energy Laboratory; ANL = Argonne National Laboratory; BNL = Brookhaven National Laboratory; LBNL = Lawrence Berkeley National Laboratory; ORNL = Oak Ridge National Laboratory; PNNL = Pacific Northwest National Laboratory; LLNL = Lawrence Livermore National Laboratory; SNL = Sandia National Laboratories; Los Alamos National Laboratory; Pantex = Pantex Plant; Y-12 = Y-12 National Security Complex; Kansas City = Kansas City National Security Campus; NNSS = Nevada National Security Site; SRNL = Savannah River National Laboratory

Figure 1 shows the growth in DOE expenditures on laboratories compared to the growth in the DOE budget from Fiscal Year (FY) 2000 to FY 2014. Expenditures on laboratories have commanded a slightly larger portion of the DOE budget since FY 2008 (ranging from 39% to 45%). Between FY 2000 and FY 2013, DOE expenditures increased by approximately 50

[1] See Appendix D for current laboratory contract details

percent while laboratory budgets, which include sub-contracts, increased by approximately 67 percent. Laboratory staffing increased by about 5 percent during this period, with greater growth at NNSA laboratories than at science laboratories.[2] In short, the laboratories have experienced stable budgets since 2000.[3] The chart shows much greater variability after 2008, due in part to the effect of a sharp, one-time increase of American Recovery and Reinvestment Act of 2009 (ARRA) and the effects of sequestration.

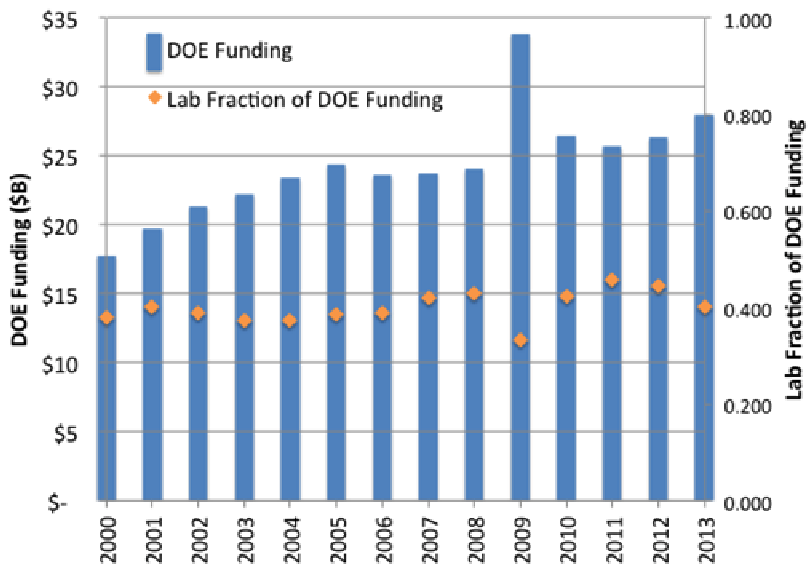

Figure 1. Total DOE appropriations (blue columns; left axis) from FY 2000 to FY 2013, along with fraction of appropriations budgeted to all 17 DOE National Laboratories (orange diamonds; right axis) over the same period.

Unfortunately, over the past decade or so, budget pressures, unattended infrastructure needs,[4] significant cost over-runs, and a massive increase of headquarters-applied regulations and oversight contributes to a situation—widely described as a breakdown in trust—between many laboratories and certain DOE programs. While tension exists throughout the laboratory complex, the greatest feeling of dissatisfaction exists in the large NNSA weapons laboratories (i.e., LLNL, LANL, and SNL). The National Laboratory Directors' Council has been active in suggesting steps to remove burdensome oversight and operational requirements from the laboratories. Nevertheless, little progress has been made on reducing burdensome requirements, as indicated in a recent National Association of Public Administration report, which presents a formidable partial list of the directives with which laboratories must comply.[5]

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[2] Based on data obtained from the DOE Office of the Chief Financial Officer.
[3] The science and energy laboratories have fared better in the 2000 to 2013 period than the NNSA laboratories.
[4] See, for example, the National Research Council Report, *Intelligent Sustainment & Renewal of DOE Facilities*, 2004.
[5] These examples are given in National Academy of Public Administration Report on the Department of Energy, *Positioning DOE's Labs for the Future: A Review of DOE's management and oversight of the national laboratories*, January 2013. These requirements are beyond the considerable reporting burden include the annual performance evaluation and the elaborate "contractor assurance system."

Congress, too, has directed several different studies to review the effectiveness of the DOE National Laboratories, notably establishing a commission in Section 319 of the 2014 Omnibus Appropriation Bill.[6]

RECOMMENDATIONS

The TF found that proliferation of duplicative and burdensome requirements are choking the DOE National Laboratories. The first TF recommendation is for DOE to remove or reduce the many overlapping control points imposed on the laboratories and to lessen the expensive administrative effort required to gain approval for laboratory work. For convenience, we have included all the TF recommendations in Table 2 at the end of this section.

Recommendation 1.1: Clarify the roles and responsibilities for mission execution at the laboratories. The Secretary of Energy should lead the Laboratory Policy Council in clarifying roles and responsibilities and direct the Under Secretary for Management and Performance to lead the Laboratory Operations Board in implementing these changes.

Six organizational units have roles in managing DOE National Laboratories:

- The laboratory director and the director's leadership team
- DOE Headquarters (HQ) sponsoring program offices
- DOE Site Offices (called Field Offices in NNSA)
- DOE Service Centers
- DOE operational oversight offices (e.g., the Office of Independent Enterprise Assessment)
- The M&O contractor.

Between them, these organizations have the responsibility and authority for all laboratory activities, which include:

- technical (i.e., planning and executing the technical program)
- financial (i.e., budget, procurement, and financial reporting and controls)
- personnel (i.e., hiring, retention, benefits, and diversity)
- site operations (i.e., facilities, construction, and environmental remediation)
- environment health, and safety (EH&S) practices
- security
- other (e.g., legal, collaborative agreements, work-for-others, and operating user services).

The TF believes that the efficiency and operations of the laboratories would be greatly improved if there were greater clarity about how the authority, responsibility, and potential for liability for each of these activities were more clearly assigned across the six, or fewer, organizational units listed above. These clarified assignments should align incentives for achieving key technical objectives at specified cost and schedule and, most importantly, should remove duplicative decision authority and reporting requirements.

[6] The mandated study is directed in Section 319 of the 2014 Consolidated Appropriation Act.

Secretary Moniz recognizes the need to address the laboratory problems and has taken steps to do so.[7] He has established the DOE National Laboratory Policy Council (LPC) and a Laboratory Operations Board (LOB). Secretary Moniz meets with laboratory directors on a regular schedule and has continued taking action on the 20 recommendations made in 2010 by the National Laboratory Directors' Council. For example, his action to merge the activities of the Office of Science and the Energy Program Offices under a single Under Secretary for science and energy will also enable a more streamlined approach to managing the DOE National Laboratory system.

The TF's vision is that the LPC, chaired by the Secretary with all the Under Secretaries as members, sets laboratory policies. In particular, the LPC should undertake the great simplification cleanup objective as stated in Recommendation 1.1 as one of the seven objectives listed in its charter (Appendix E).

The LOB, composed of the next level of department leadership (e.g., the Principal Deputy Under Secretaries), is charged with implementing the policies of the LPC. The LOB board coordinates implementing actions, which remain the responsibility of the Under Secretary or Administrator of NNSA to execute. In sum, the TF believes the LOB should focus on implementing changes that will improve the performance, the efficiency, and morale of the DOE National Laboratories.

Recommendation 1.2: The Under Secretary for Management and Performance should lead a process to establish a structure and process that replicates the Office of Science (SC) Office of Laboratory Policy for the NNSA and the Energy laboratories.

The DOE National Laboratory categories shown in Table 1 cover a wide variety of missions, scales, technical communities, and facilities. Therefore, the welfare of each laboratory should be the responsibility of a single DOE secretarial program office with clear separation between the secretarial office that is responsible for implementation at the laboratory and the DOE headquarters offices responsible formulating laboratory policy.

Up to the present, the LOB's activities have focused on assessing operational and performance matters that affect all DOE National Laboratories, especially the adequacy of the existing laboratory infrastructure to support the mission and maintain the core capabilities of each laboratory. The LOB has not moved to build a professional career staff for each area charged with implementing policy, rapidly resolving laboratory issues, and communicating best practices. Only SC and NNSA have formal annual laboratory policies and evaluation processes in place for each of their laboratories that include public evaluation reports. However, those reports are often not very enlightening because the very narrow performance grades are often insufficient to identify and advance laboratory best practices.

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[7] A brief, informative description of *Distinctive Characteristics of DOE's National Laboratories* is available on the DOE's Office of Science Laboratory Policy and Evaluation website: http://science.energy.gov/lpe/

SC is unique in having a dedicated office, the Office of Laboratory Policy to manage and coordinate all matters related to SC laboratory interactions.[8] The functions of the Office of Laboratory Policy include:

- facilitate the laboratory appraisal and planning processes
- support the SC Head of Contracting Activity on all procurement matters
- coordinate uniform policy with regard to contractor human resource management, LDRD, technology transfer, and Work for Others[9] and provide advice to the SC Deputy Director for Field Operations on these matters.
- manage the SC LDRD and WFO programs
- coordinate the reporting and approval of all SC conference expenses
- support SC headquarters program offices and site offices by lending technical expertise to advise and/or assist in resolving issues
- represent SC on DOE and inter-agency working groups and councils whose focus relates to the general health, utilization, and vitality of the DOE National Laboratory system.

The TF believes that the Office of Laboratory Policy, staffed by a small team of career professionals, has over the years accumulated experience and gained broad respect in the management of DOE science laboratories and laboratory–department relationships. There is no equivalent office for the NNSA or Energy laboratories, nor is there a tradition of a small cadre of career staff to facilitate laboratory-DOE headquarters interactions. This absence is particularly evident for the NNSA laboratories who uniformly express frustration at the length of time and difficulty required to resolve operating issues that arise daily. The TF has been unable to identify a philosophy or management process that NNSA uses to manage its laboratories similar to that employed by SC.

The TF recommends the DOE structure its decision-making and policy implementation as illustrated in Figure 2. The DOE energy and science offices were only recently organized under a single Under Secretary (as was the case in the beginning of DOE's history). Over time, modifying the proposed organizations to include only two laboratory policy offices—national security and energy/science—may be desirable. In addition, the TF suggests changing the name "Office of Laboratory Policy" to "Office of Laboratory Policy Implementation" to underscore that the purpose of these groups is implementation, not definition, of policies. Finally, rather than have an additional Office of Laboratory Stewardship for Environmental Management with stewardship of a single laboratory, an option is to have the Applied Energy Office of Laboratory Stewardship be responsible for Savannah River National Laboratory.

The overriding purpose of the proposed organization is to facilitate operations and associated operational efficiencies with each laboratory, and to expedite resolution of the numerous issues that regularly arise that impede program execution and unnecessarily increase costs. The focus

[8] http://science.energy.gov/lp/

[9] Although WFO was recently changed to Strategic Partnership Programs, or SPP, we use WFO throughout to maintain continuity.

should be both on improving program outcomes and managing cost and risk. These changes will enable more effective laboratory performance. However, the Task Force emphasizes these management changes must be integrated with the planning of laboratory programs.

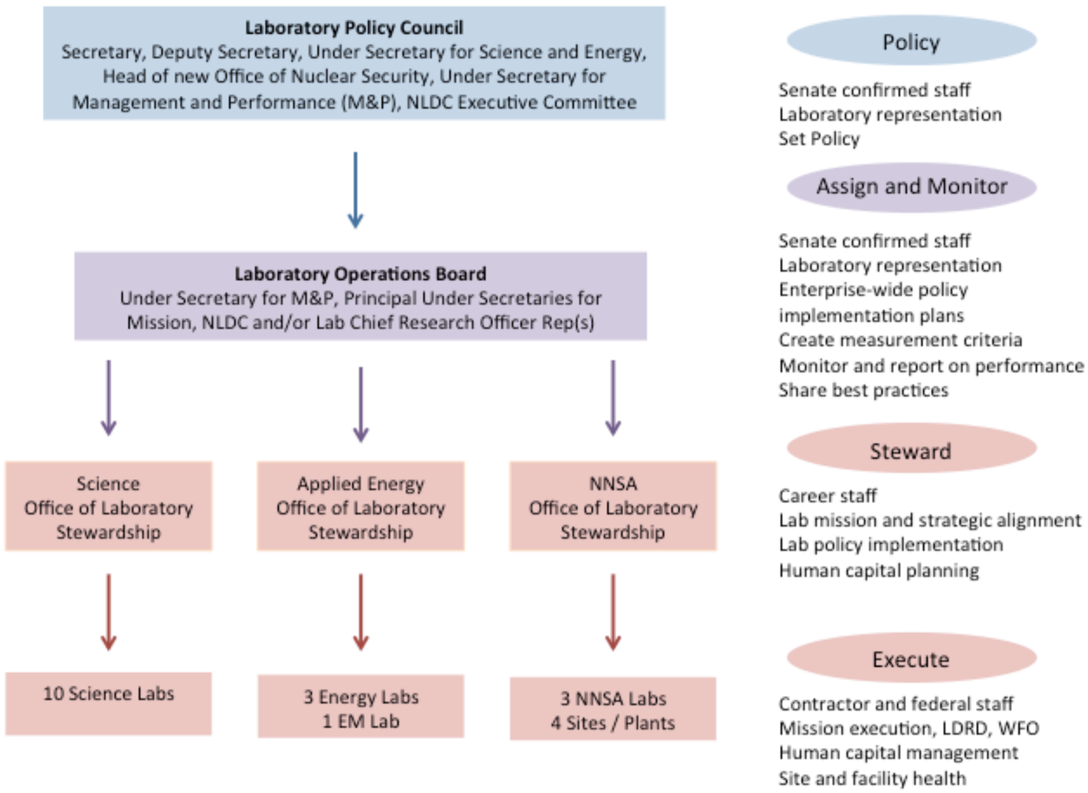

Figure 2. Decision and implementation workflow.

The TF recommendations are broadly consistent with the charter of the LOB, chaired by the Under Secretary for Management and Performance:

> The objectives of the National Laboratory Operations Board ("Board") are to strengthen and enhance the partnership between the Department and the National Laboratories, and to improve management and performance in order to more effectively and efficiently execute the missions of the Department and the National Laboratories. The Board will contribute to an enterprise-wide effort to identify, manage, and resolve issues affecting the management, operations, and administration of the National Laboratories.

This recommendation shifts the emphasis for how the LOB should organize its efforts to facilitate laboratory operations and performance and improve program execution. The LOB's approach should be coordination and encouraging "best practices" across the DOE system, not setting direction. The LOB should be an instrument of change rather than another headquarters rule maker.

Proposed Next Steps for the SEAB National Laboratory Task Force

This interim TF report addresses three topics of importance to the DOE National Laboratory system: (1) M&O contracts, (2) technology transfer, and (3) LDRD.

The two objectives that have guided the TF's work are (1) to propose actions within the Secretary of Energy's existing authority and (2) to implement many of the actions as 'experiments' that may justify broad adoption only after evaluation of results.

During its second phase, which extends until December 2015, the TF will address both aspects of Secretary Moniz's charge (see Appendix A) and three additional specific issues:

1. Work for others (WFO). The emphasis will be on WFO for federal agencies since non-federal WFO is addressed in the Technology Transfer section of this interim report.
2. Cooperative efforts among laboratories, especially cooperation between the SC and NNSA laboratories and between NNSA laboratories and NNSA production facilities.
3. The morale, mentoring, and professional development of the technical workforce at the DOE National Laboratories, recognizing the additional challenges posed by the security nature of research at the three major NNSA laboratories (i.e., LLNL, LANL, and SNL).

In addition, the TF will review the findings and recommendations of recent studies that bear on the DOE National Laboratories. At least three studies will be reviewed:

1. The Congressional Panel report, *A New Foundation for the Nuclear Enterprise*, (The Augustine-Mies report), November 2014.
2. The National Research Council report, *Aligning the Governance Structure of the NNSA Laboratories to Meet 21st Century National Security Challenges*, Jan-Feb 2015.
3. The Phase I report of *The Commission to Review the Effectiveness of the National Energy Laboratories,* released February 13, 2015.

For each study, the TF will meet the Secretary of Energy's request and take the following actions:

1. review the findings and recommendations of these studies
2. identify actions that DOE should take to implement such recommendations
3. provide an implementation plan for each recommended action.

Table 2. Summary of TF Recommendations

	Recommendation	Owner	Time TF Assessment
1.1	Clarify roles and responsibilities for mission execution at the laboratories.	Laboratory Policy Council, chaired by the Secretary of Energy	60 days
1.2	Extend responsibilities of *Laboratory Operations Board* for Science, Energy and NNSA Laboratory Policy & Program Execution Offices	Under Secretary for Management and Performance (M/P)	90 days
2.1	Complete study to evaluate options for changes to the contracting model.	Director, Office of Science	90 days
2.2	Authorize experiments, including establishing timelines, to reduce and simplify control authority for certain operational procedures for laboratory management.	Under Secretary for M/P	30 days
3.1	Issue policy statement that technology transfer activities are part of the DOE National Laboratories' mission.	Secretary of Energy	30 days
3.2	Organize technology transfer activities using a decentralized approach, including flexible experimental agreements to facilitate rapid Laboratory-industry engagements.	Under Secretary for Science and Energy (S/E) NNSA Administrator	90 days
3.3	DOE should create fast-track Cooperative Research and Development Agreement (CRADA) and non-federal WFO processes supported by dedicated laboratory/DOE team of legal and procurement experts with a leader to shepherd each agreement to completion, and pilot at three laboratories.	Under Secretary for S/E NNSA Administrator	120 days
3.4	Each DOE National Laboratory should adopt an entrepreneurial leave program for a limited number of staff with assurance of appropriate resources upon return to restart a research program.	Laboratory Directors	180 days
3.5	Each DOE National Laboratory should track its impact on the industry.	Laboratory Directors	180 days
4.1	The National Laboratory Directors' Council should prepare and share a best practices document for managing LDRD programs.	National Laboratory Directors' Council (NLDC)	90 days
4.2	Set LDRD cap at 6% of laboratory budget.	Secretary	30 days
4.3	Provide enhanced reporting by the DOE on the substance and value of LDRD.	Under Secretary for S/E NNSA Administrator Under Secretary for M/P	180 days
4.4	Pilot independent peer review of LDRD program impacts and process of four laboratories, evaluating up to ten years of projects.	NLDC	180 days
4.5	Pilot LDRD approach where laboratories define project scientific areas, but do not obtain approval of specific tasks.	Under Secretary for S/E NNSA Administrator	180 days
4.6	Design Energy Sciences Study Group for launch	NLDC	90 days

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Management and Operations (M&O) Contracting

Background

> ***"The increasing number and complexity of government entities within and outside the DOE that exercise decision and oversight roles is leading to a highly burdensome operating environment."***

The efficacy of the DOE National Laboratories is shaped by their Government-Owned Contractor-Operated (GOCO) management structure, in which DOE program offices contract with external partners to oversee M&O of laboratory work on a day-to-day basis for 16 of the 17 DOE National Laboratories.[10] However, the increasing number and complexity of government entities within and outside the DOE that exercise decision and oversight roles is leading to a highly burdensome operating environment that severely diminishes the effectiveness of this arrangement.

It is important that laboratories are aligned to DOE and national priorities, and that the DOE, laboratory management, and contractor management are all aligned with the goals and mission of the program offices (i.e., NE, SC, EERE, NNSA, EM, FE) in charge of each mission. While a number of well-functioning models exist within the framework of the current M&O contracting model, there is ample room for improvement.

Historical Context

At the inception of the DOE National Laboratories, during the 1940s and 1950s, laboratory management was regarded as a national service and was accomplished through an essentially no-fee/no-liability arrangement by major research universities (e.g., the University of California system) or major industrial concerns (e.g., Union Carbide, Western Electric, Monsanto, and DuPont).[11] In these arrangements, the M&O contractor organizations brought significant technical, industrialization, and/or program management expertise to the laboratories. In return, their service to the nation added to the reputation of the contractor, and often provided career-development experience for emerging contractor leaders. In the broadest terms, these arrangements were true strategic partnerships and represented pure GOCO endeavors: the government defined the mission, provided the funding, and assumed the liability, while the contractor directly managed the laboratory operations and personnel.

Since the creation of the DOE in 1977, there have been a variety of M&O contracting arrangements, and the laboratory missions have broadened in response to national needs and scientific advances.

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[10] The National Energy Technology Laboratory is a government-owned, government-operated (GOGO) laboratory.

[11] DOE Acquisition Guide, Chapter 17.6, Discussion of the origin, characteristics, and significance of the DOE's M&O form of contract, DOE (2007).

Most of the contractors in the late 1970s (e.g., Western Electric, DuPont, Union Carbide, Monsanto, and the University of California) had maintained these positions since the World War II Manhattan Project that preceded the Atomic Energy Commission. However, beginning in late 1992, Congress and the administration shifted to a more commercial model with contracts and frequent re-competition of laboratory contracts in attempts to improve technical performance, realize cost efficiency, and improve accountability.

Today, M&O contractors often compete on a commercial, for-profit basis, frequently by forming limited liability corporations (LLCs). LLCs are a mechanism to allow separate entities (e.g., Battelle and the University of Tennessee) to join together to compete for a contract. While the LLC mechanism partially shields the parent entity from certain liabilities, DOE's requirement to sign "corporate guarantees" keeps most of the liability with the parent organizations.

The competition for an M&O contract includes little opportunity for negotiation. The DOE issues a Request for Proposal that contains all of the terms and conditions to be included in the final contract. To qualify, a competitor must accept the entire contract and respond with a technical and cost proposal.

It is important to note that the decision to respond to a Request for Proposal represents a significant commitment of cost and human resources on the part of the contractor. The contract terms require the M&O contractor to accept significant liability, which affects the risk-reward proposition for the potential bidders. As contract requirements have become more onerous and the contract process more complex, the number of qualified entities willing to respond has diminished.

The variation in laboratory award fees between Science, Energy, and National Security laboratories has raised questions and concerns among some DOE officials and Congressional committees. M&O contractors understandably expect consideration for the responsibility and the financial and reputational risk they are accepting in the arrangement. Although the size of the management award fee is large for some contracts compared to what it had been before 1990, it is modest when compared to profit on other revenues that most of the participating commercial firms expect.[12] Key contract variables that can also affect the contracts include the allowability of reimbursable costs for operating the laboratories, size of the management award fee, length of the contract, award term considerations, and liability coverage. Further contributing to variability, for-profit organizations are seen to have different motivators compared to universities and nonprofit organizations, which are more focused on strategic research partnering and the ability to attract and retain top quality faculty and researchers.

FINDINGS

Many aspects within the framework of the current M&O contracting model for the DOE National Laboratories work well. The laboratories are an essential part of the national research science and technology portfolio and the envy of the rest of the world. However, when contrasted with

[12] See Appendix D for current laboratory contract details

similar Federally Funded R&D Centers (FFRDCs) within other federal agencies, there is clear opportunity for improvement.

Two notable examples of successful FFRDCs are the U.S. Department of Defense (DOD) Lincoln Laboratory, managed by the Massachusetts Institute of Technology (MIT), and the National Aeronautics and Space Administration (NASA) Jet Propulsion Laboratory (JPL), managed by the California Institute of Technology (Caltech). Both Lincoln Laboratory and the JPL function as autonomous facilities operating independent of their parent organization.[13] According to JPL leadership, NASA provides mission direction and JPL/Caltech takes steps to achieve the mission goals. NASA designates the JPL laboratory director as a Special Government Employee so that the director can be a part of the budget process inside NASA. Such trust is sorely missing in the DOE enterprise, especially within the NNSA laboratories. The success of the FFRDC model implementation found in NASA/JPL and DOD/Lincoln Laboratory provides a pair of useful benchmarks for potential contract and contract management changes at DOE.

Stakeholders in the M&O process have different primary objectives for the management arrangements. DOE mission owners look for laboratories that are scientifically and technically excellent in the execution of their programmatic missions, consistent with cost and process constraints. Office of Management and Budget and procurement personnel in DOE give priority to cost transparency and accountability in the M&O contracting arrangement. Meanwhile, DOE operational oversight organizations (e.g., the DOE Office of Environment, Health, Safety and Security organization, the Office of Independent Enterprise Assessment, and Office of Enforcement) view reduced risk as the primary measure of success. The complications that arise from having so many participants involved in the management and oversight of a laboratory add significant burdens to both the DOE's and the contractor's task in managing the laboratory to deliver on its mission.

"The [Office of Science] laboratory alignment and planning process is a "best practice" that has developed over many years and is culturally institutionalized in headquarters, the field, the science laboratories, and its contractor community"

The SC laboratory alignment and planning process defines a "best practice" that has developed over many years and is culturally institutionalized in headquarters, the field, the science laboratories, and its contractor community. This process ensures that science output is the first and most important measure of success, that operational management and long-term stewardship are visible and shared, and that the M&O Performance Evaluation and Measurement Plan (PEMP) process is aligned to the laboratories annual mission and operating plan. This relationship provides a vehicle for

[13] "The Evolution of Federally Funded Research & Development Centers", J.M. Hruby, D. K. Manley, R, E. Stoltz, E. K. Webb, J. B. Woodard, Public Interest Report, Spring, 2011, pp 24-31

performance and human resource development. Progress has been made over the last few years in establishing a similar culture and process view in the applied energy laboratories.

However, the partnership and stewardship philosophies that exist in the SC system cannot be found in the NNSA system. The lack of clear ownership at the NNSA headquarters level for the laboratories and their alignment with mission, little evidence of an effective joint planning process, and the lack of clear long-term stewardship of the NNSA laboratories make it more challenging to achieve mission success and improved laboratory performance.

RECOMMENDATIONS

To achieve a more efficient DOE–laboratory partnership, the TF reiterates the point made in Recommendation 1.1 of the Framework that the roles and responsibilities of the participants in the process (i.e., Headquarters, laboratory management team, contractor, Service Center, and Site Office) should be continually clarified and communicated. Decisions, requirements, roles, responsibilities, authorities, and accountabilities across these layers must be clarified and implemented at all layers of management and redundancies must be eliminated to achieve the DOE mission objectives in the most cost-effective manner.

Furthermore, a major and growing element of many of the laboratories—WFO, now known as SPP—must be integrated into the M&O contracting and laboratory management landscape as this can comprise a major element of individual laboratories.

Recommendation 2.1: The SC Director should complete, expeditiously, the study currently underway to evaluate options for changes to the contracting model.

SC, at the suggestion of the TF, has established a working group to study potential modifications to M&O contracts for the single-purpose DOE National Laboratories that are overseen by SC. The Terms of Reference for this working group contains five items:

1. Review and summarize present models for the management of Federally Funded Research and Development Centers (FFRDCs).
2. Review and summarize major contract requirements, i.e., contract clauses or contractor requirement documents (CRDs), for DOE M&O contracts.
3. Summarize requirements that are the most problematic for the DOE M&O contractors and laboratories, and assess the need for and/or options to these contract requirements. Summarize the recent activity to identify burdensome practices and the outcomes of that activity.
4. Summarize the various external reviews and inspections at the DOE National Laboratories, and assess the need for and/or options to these reviews.
5. Recommend whether it is feasible and desirable to do an experiment at a single-program Office of Science laboratory with a simplified contractual arrangement, and provide the outline of a recommended experiment, if any.

The TF previously endorsed this work plan in a letter to Secretary Moniz and awaits the outcome and recommendations early in the third quarter of FY2015. The TF urges the SC working group to consider the examples of NASA/JPL and DOD/Lincoln Laboratory provided above in its analysis.

The TF understands that Secretary Moniz is in the process of launching a separate initiative to explore more substantial changes to present M&O contracting practices. The TF supports this initiative as well.

Recommendation 2.2: The Under Secretary for Management and Performance should authorize a number of experiments to move control authority for certain operational procedures to the laboratory management.

As the M&O contract process has evolved, additional and duplicative oversight has been layered onto laboratory operations in response to process lapses, and budget atomization has lowered the threshold level for Site Office, Service Center, and Headquarters financial control. One result is that laboratory authority for decision-making has been reduced.

Over the last several years, numerous study groups and task forces have provided input on operational processes that might be more effectively executed with minimal risk if decision authority were conferred back to laboratory management. The TF reviewed several previous efforts in this regard and also engaged the NLDC.[14]

While a number of viable opportunities exist to test new streamlined processes and to provide more local decision authority with low risk is extensive, the TF proposes seven such experiments that can yield results within a year. **The TF recommends that the Under Secretary for Management and Performance should, within 30 days of the release of this report, establish for each case below the specifics of the plan, the timing to which parties will commit for their respective actions, and the process by which results will be measured and reported over the course of the next year**.

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[14] "Positioning DOE's Labs for the Future: A Review of DOE's Management and Oversight of the National Laboratories", J.D. Breul, D.A. Ink, A. Burman, P.W. Marshall, et al. 2013. Found at: http://www.napawash.org/wp-content/uploads/2013/01/DOE-FINAL-REPORT-1-2-13.pdf.
"Turning the Page: Reimagining the National Labs in the 21st Century Innovation Economy", M. Stepp, S. Pool, N. Loris, J. Spencer. 2013. Found at: http://scienceprogress.org/wp-content/uploads/2013/06/2013-turning-the-page-national-labs.pdf.
"Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories", C. Shank, C.K.N. Patel, J.F Ahearne, W.W. Burke, et al. 2013. Found at: http://www.nap.edu/catalog.php?record_id=13367
"The Quality of Science and Engineering at the NNSA National Security Laboratories", C. Shank, C.K.N. Patel, J.F Ahearne, C. Back, et al. 2013. Found at: http://www.nap.edu/download.php?record_id=18440#.
"Leveraging Science for Security: A Strategy for the Nuclear Weapons Laboratories in the 21st Century", F.F. Townsend, D. Kerrick, E. Turpen, J.J. Czerwinski, et al. 2009. Found at: http://www.stimson.org/imgaes/uploads/research-pdfs/Leveraging_Science_for_Security_FINAL.pdf.
"America's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States", W.J. Perry, J.R. Schlesinger, H. Cartland, J. Foster, et al. 2009. Found at: http://www.usip.org/sites/default/files/America%27s_Strategic_Posture_Auth_Ed.pdf.

2.2.1 Compensation Management: The current compensation approval process is eight times longer than industry norms,[15] and requires excessive data submission. After parameters are received from DOE in late July, laboratories must conduct market surveys and analyses and review affordability, which takes up to one month. This is followed by a white paper presentation and DOE review and approval, which can take a minimum of five weeks. Finally, M&O contractor review and approval takes one week. In total, the current review process can take ten weeks or more, and its variability impacts the laboratories' ability to effectively plan for compensation reviews.

The TF recommends an experiment in which intent and constraints are discussed and agreed upon with the DOE during the first week, and DOE review and approval time is reduced to one week. This will limit the compensation process timeline to six weeks, while still ensuring that total compensation meets DOE strategic intent and constraints.

2.2.2 Labor Negotiations: Currently, the process for labor negotiations is structured around approval parameters for bargaining on discrete elements (e.g., general wages and benefits). These parameters are determined through market surveys and analyses, as well as affordability reviews that are submitted to DOE for approval. Obtaining detailed point-by-point parameters from DOE can take months.

The TF recommends an experiment in which the process shifts to a "not-to-exceed total compensation" budget. The strategic intent and constraints would be discussed and agreed upon with DOE, so that DOE can provide authorization for a total cost ceiling. Such a change would ensure system-level controls are in place, while allowing the laboratories to decrease strike probability, improve the alignment of the contracts and broader strategic intent, and reduce bargaining costs. This process should be limited to a six-week timeframe (not including negotiating time).

2.2.3 Benefits: Currently, DOE utilizes individual reviews for lower-risk laboratory transactions, which is time consuming and can be a net drain on resources. The TF proposes that DOE authorize laboratories to manage benefits below a preset cost threshold. The proposed process will provide the laboratories with improved agility and increase focus on the overall total rewards design while maintaining market-reference and affordability. This process will reduce review and approval time by DOE from a one-month minimum to one week. After a period of 12 months, the program should be reviewed to determine its efficacy at containing benefits costs while still achieving competitive benefits levels and reduced transaction costs.

2.2.4 Annual Pension Funding: The current pension contribution process inhibits laboratories from making pension contributions utilizing a risk-based approach. The current process operates under existing constraints and peer-determined caps. Any pension contributions in excess of the actuarially determined Minimum Required Contribution must be submitted to DOE for approval. This process can take two to three months. In addition, the timing of DOE approval could result in mid-year changes to labor rates.

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[15] Based on the experience of TF members in the private sector.

As an experiment, laboratories should discuss and agree on the strategic intent and constraints with DOE *in advance* of defining an annual pension management plan. The proposed process could help enable long-term strategic pension management and ensure pension plans meet agreed DOE minimum long-term strategic standards.

2.2.5 Conference Management Approvals: The current process for conference participation approval creates lengthy delays and barriers. Conference expenses expected to exceed $100K across all laboratories are routed through DOE for approval, which can take weeks or months. Once approval is secured, laboratories inform conference attendees of whether they are authorized to attend the conference, long after their names are submitted to the conference approval system.

This process hurts morale and hinders the ability of laboratory staff to network with their peers and build their knowledge base. It can also increase costs as later approvals result in higher conference attendance fees (missed early registration pricing) and higher travel costs.

Instead, the TF proposes piloting a new arrangement for two years in which laboratories and DOE agree to an annual ceiling for conference attendance and spending, and then allow the laboratory to make its own decisions on attendance on a conference-by-conference basis.

2.2.6 Outside Legal Counsel: The current process for engaging outside legal counsel requires substantial resources to negotiate low-risk items without commensurate value. Approval process variability can result in increased supplier payments and limit the number of suppliers willing to provide counsel to the laboratories.

The TF recommends directing field offices to streamline billing and for laboratories to provide annual billing submission to DOE, based on agreed upon strategic intent constraints with DOE. By eliminating the current process of field office reviews and Q&A interactions with the laboratories to secure approval, the process can be shortened by up to two months. The future process would support Title 10 of the Code of Federal Regulations (CFR) Part 719 requirements while implementing a streamlined, risk-based approach.

2.2.7 Large Request for Quotations (RFQ) and Contract Awards: The current review process for large RFQ and contract awards, defined here as >$1M, requires three rounds of duplicative reviews (i.e., field office contracting officer, Acquisition Project Management, and Head of Contracting Authority). Further, the reviews often include contradictory guidance/direction from the various reviewers. Consequently, high-dollar procurements are delayed, on average, by six to eight months.

Instead, the TF proposes utilizing a one-week discussion period with DOE to agree upon the strategic intent and constraints, followed by a single federal review once high-dollar RFQs are developed. The proposed process would reduce reviews to one contracting officer and could reduce review time to as little as two weeks.

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Laboratory Value to the Private Sector, Including Technology Transfer

The DOE National Laboratories constitute an unparalleled collection of scientific expertise and facilities, built to address the DOE missions. Although the R&D culture across the DOE National Laboratories is not—and should not be—one of commercialization, the laboratories nevertheless play a vital role in helping the United States maintain the science and technology superiority needed to sustain its economic competitiveness in a highly innovative global economy. Laboratories have a long history of creating value for the private sector through user facilities and direct industry engagement on research collaborations, as well as through the commercialization of laboratory-developed technologies. However, the TF finds that there are further opportunities to significantly improve in this area.

Background

"The DOE National Laboratories have enormous value to industry through a variety of different modalities."

The primary objective of DOE National Laboratories is to maintain scientific and technological leadership in their designated mission areas (i.e., national nuclear security, science, and energy/environment). The scientific and technical missions of the laboratories are not justified solely by cost of operations or short-term return on investment analyses (as might be appropriate for private sector firms), but rather on the basis of developing the facilities and workforces necessary to execute the DOE's core missions.

The DOE National Laboratories have enormous value to industry through a variety of different modalities. For example, the major laboratory user facilities (e.g., light sources, microscopes, and computing resources) combined with the depth and breadth of knowledge of the laboratory staff, offer a world-class capability that is highly valued by the private sector. In addition, numerous laboratory-developed innovations have had significant commercial impact in the private sector—a fact well understood by private sector companies that regularly capitalize on the highly specialized knowledge bases that reside at the laboratories. The Sandia Combustion Laboratory in Livermore, California is an excellent example in how a specialized DOE facility with unique expertise in both combustion experiments and modeling has, over many years, advanced technology in a wide range of industries through long term collaboration. However, there are clear opportunities to improve the rate and impact of industry engagement, including, but not limited to, transfer of laboratory-developed technologies.

Below, the TF provides its findings and proposes a set of recommendations—all of which can be undertaken with existing authorities and budgets—aimed at identifying and disseminating best practices that can improve the overall technology transfer process and dramatically enhance the program's impact.

Historical Context

Technology transfer has been an important consideration at DOE since its founding. During this time, most of the attention has been devoted to how far DOE's energy programs should extend beyond research and development (R&D) to demonstration and deployment, and what mechanisms are appropriate and efficient for the department to employ for this purpose.

Less attention has been given to the important alternative pathway of direct transfer of technology developed at a laboratory to potential industry users. However, almost every DOE National Laboratory has had some effort in place for many years to stimulate technology transfer, at times with particular emphasis on helping local or regional industry.[16]

There is a general impression that the laboratories do not have a strong record stimulating technology transfer, particularly in comparison with universities (which are the strongest engine, after private sector firms, in developing and launching new technology ventures). As an example, although laboratories are barred by law from independently submitting ARPA-E proposals, the laboratories' participation as partners (about 5 percent by dollar value) nevertheless appears very small, and venture capital firms have not championed many laboratory start-ups. The TF estimates that universities create 5 to 8 times more start-up companies on a research adjusted basis than the DOE national laboratories.[17] In response, Congress has consistently encouraged greater technology transfer efforts by the laboratories and enacted a number of measures to achieve this purpose.[18]

The TF was surprised to learn that the department does not have a policy stating that technology transfer is a legitimate laboratory objective. Many laboratory and industry commentators told the TF that such a policy statement would be useful, for instance as an addition to the department's vision statement.

Process and Observations

The TF approached the issue of technology transfer with a focus on the *value* the DOE National Laboratories can offer to industry. On this basis, guided by a set of questions found in Appendix F, the TF conducted a series of interviews with laboratory directors, industry, and DOE staff. Industry representatives were chosen to cover a broad spectrum of small and large

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[16] The 1980 Stevenson-Wydler bill allows each DOE National Laboratory to spend up to 0.5 percent of their R&D budget on technology transfer activities.

[17] Analysis of data obtained from the DOE Office of the CFO, a Brookings Institute report (http://www.brookings.edu/~/media/research/files/papers/2013/11/start-ups-tech-transfer-valdivia/valdivia_tech-transfer_v29_no-embargo.pdf) and the Center for Measuring University Performance at Arizona State University (http://mup.asu.edu/MUP-TARU-Part-II-MUP-Research-Universities.html), not accounting for differences in mission or structure.

[18] The 2005 EPAct requires DOE to spend 0.9% of its applied energy Research, Development, Demonstration and Deployment funds with private partners to encourage commercialization of promising technologies. See a full description and history of relevant legislation as of 2011 at http://globals.federallabs.org/pdf/FLC_Legislation_and_Policy.pdf

businesses that have (or have had) DOE National Laboratory interactions and included researchers, management, technology transfer staff, and others.

The DOE National Laboratories employ four contractual mechanisms to interact with the industry: (1) CRADA; (2) WFO; (3) Agreement for Commercializing Technology (ACT); and (4) licensing of intellectual property.[19] These activities are typically a small fraction (less than 5 percent, excluding federal WFO) of the laboratories' total budget.

With the help of DOE personnel, the TF gathered a large set of data to learn about trends in the laboratory-industry interactions. The most pertinent data sets that the TF collected and analyzed are given in Appendix G.

These data reveal the following:

- In general, DOE National Laboratories seem to prefer WFOs to CRADAs, which may be due to the higher administrative burden associated with CRADAs.
- Most laboratories primarily use either WFOs or CRADAs, not both, which suggests that once a laboratory figures out the process for one mechanism, it uses that mechanism at the expense of others.
- For several laboratories, there are periods of considerable expansion or reduction of CRADAs with industry. Understanding the causes of these periods of decline or expansion should be of interest to the laboratories.
- As expected, a correlation exists between greater number of patents and more income-bearing licenses at a laboratory. While patents and income-bearing licenses are metrics of successful technology transfer, they are not the only metrics. In many cases, stakeholders can benefit indirectly from the technology transfer project (e.g., local communities and state governments), which can add to the value of the laboratories' technology transfer efforts. For instance, an important indicator of success is whether the laboratory-industry cooperation led to value creation in the private sector; however, this value is difficult to measure.
- There is a large variation among the laboratories in royalty income per budget dollar. In general, most royalty income comes from just a few patents, a pattern also found in universities. Laboratories that enjoy a high level of royalty income tend to allocate a larger fraction of this income to industry-engagement activities.
- The highest royalty bearing "blockbuster" patents result from non-exclusive licenses that benefit an entire industry. This is the ideal outcome for collaborative activities that use public funds.

[19] Brief descriptions of these mechanisms are given in Appendix G. More details can be found at http://technologytransfer.energy.gov/doework

FINDINGS

TF discussions with industry representatives revealed that the DOE National Laboratories are highly valued for the technical core competencies they provide via: (1) their scientific infrastructure (e.g., user facilities, computing facilities); (2) the depth and breadth of knowledge and know-how of their staff scientists and engineers; and (3) the technologies that they create. The industry also values the scientific credibility and convening power the laboratories provide.

TF discussions with laboratory directors revealed some important common elements. Laboratory directors are seeking ways to interact with industry and explore new mechanisms. There is an interest in moving collaborations beyond proof-of-concept to proof-of-system (e.g., Cyclotron Road at LBNL) to help spin off start-ups based on laboratory-created technologies. Examples of other experiments include LBNL's CalCharge master CRADA effort,[20] Fermilab's FermiTech experiment,[21] and use of EERE's small-business voucher program[22] to cover some laboratory costs. These experiments should be encouraged and are consistent with the decentralization principle suggested by the TF. The success of these efforts should be monitored, using an appropriately defined return on investment (both for the laboratory and for the industry partners) with attention paid to improved morale and/or enhanced retention of participating laboratory scientists. Those efforts that are deemed particularly successful could then be used as models for other laboratories.

Existing Industry-Laboratory contract practice places all risk on the industry partner and this is reflected in contract terms. There is a balance: if DOE wants to encourage industry to be a facility user and undertake joint projects with the lab, contract terms should support this objective. The present practice with industry does not reflect shared risk. However, the present practice of shared risk in DOE users facilities with non-industry shows that shared risks works effectively. The Task Force believes this practice should be extended to industry partners. The Agreements to Commercialize Technology (ACT) provides a mechanism for accomplishing this objective.

The TF also found that the best approach for laboratories to create value for the private sector is through long-term strategic partnerships between laboratories and industry, when the technical core competence ("technology push") of the laboratories intersects with the needs ("demand pull") of the industry. These partnerships are most productive when the objectives of such

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[20] LBNL has initiated a public-private partnership that implements a master CRADA approach to partnering with universities, non-profit, and for-profit institutions to advance electrochemical energy storage research in California, with SLAC joining the CalCHARGE partnership as well. More information can be found at http://calcharge.org/.

[21] Fermilab is exploring the creation of a non-profit, FermiTech, to serve as a conduit, possibly using a master CRADA approach, to the Illinois Accelerator Research Center (IARC), a new facility scheduled to open in April 2015 jointly funded by the state of Illinois and the DOE. More information can be found at http://iarc.fnal.gov/.

[22] DOE's EERE program is piloting a small business voucher program, which aims to (1) leverage DOE National Laboratory capabilities for economic development by establishing a laboratory voucher program for small business and (2) provide access to expertise, competencies, and equipment at all DOE National Laboratories.

partnerships are clear to the laboratories and firms involved, and are aligned with the goals of both parties. The technical milestones, schedule, and costs should be well understood and transparent.

The top three barriers to such successful strategic partnerships identified by industry and laboratory representatives occurred in the following areas:

Barrier 1 – Centralization: The centralized approach that DOE has pursued with regard to technology transfer efforts at the headquarters level, by defining uniform cooperation mechanisms with industry, approval, and reporting requirements across all the DOE National Laboratories, creates multiple barriers.[23] In part this is a natural bureaucratic tendency to prefer centralized control over distribution of authority. In general, these efforts have not been very successful and have led to three barriers that result from this approach: (a) the slow rate of establishing laboratory-industry partnerships and projects, (b) process complexity that inhibits industry engagement, and (c) lack of flexibility in cost-sharing and intellectual property ownership.

Barrier 2 – Mission: The lack of consistent and sustained expectations by the DOE for engagement with industry by the laboratories has driven inconsistent focus on industry engagement by laboratory management. Many laboratory directors noted the cyclical nature of DOE expectations regarding industry engagement and the uncertainty regarding industry engagement as part of the DOE mission.

"In practice, the time required to negotiate and gain approval for a project is seen both by industry and the laboratories to restrict greatly the number of opportunities that are available."

Barrier 3 – Personnel: The absence of personnel policies that encourage laboratory experts to take time-limited leave to participate in an entrepreneurial or company venture with the opportunity to rejoin the laboratory without loss of career opportunity has reduced staff willingness to start new ventures in private industry.

The CRADA, WFO, ACT, and other contract mechanisms and DOE personnel policies are, in principle, flexible. But, in practice, the time required to negotiate and gain approval for a project is seen both by industry and the laboratories to greatly restrict the number of opportunities that are available.

[23] The 2005 Energy Policy Act requirement suggests a "top down" approach to technology transfer rather than the "bottom up" approach the TF advocates.

Recommendations

Recommendation 3.1: The Secretary of Energy should provide a statement to the DOE enterprise, including DOE staff and the laboratories, that laboratory technology transfer activities intended to create value for industry are part of the mission for DOE National Laboratories. Such a statement should be accompanied by any necessary implementation instructions.

The TF believes that the statement by the Secretary of Energy would create alignment within the DOE about the broader value that laboratories create for industry as defined by their utilization of user facilities, direct engagement in research collaborations and commercialization of laboratory-developed technologies. This recommendation addresses Barrier 2 above.

Recommendation 3.2: The DOE should organize its technology transfer activities using a decentralized approach where industry and laboratory participants interact directly to structure programs. As an experiment, the DOE could consider flexibility in such agreements to facilitate rapid laboratory-industry engagements.

As described previously, the TF believes that the best strategic partnerships between laboratories and industry occur when the technical core competence ("technology push") intersects with the needs ("demand pull") of the industry over a period of time. Every laboratory has a unique history, and laboratory staff members understand the opportunities and challenges in the context of their own unique ecosystem. Hence, the identification of where this intersection creates value is best achieved at the local laboratory level, and not at the DOE. As a concrete step towards decentralization and to speed up the process of engagement, the DOE could try an experiment where the laboratory-industry partnership can occur with decision-making authority at the laboratories, perhaps with time and funding limits on such engagements. Such rapid engagements would allow laboratories and industry to identify whether a longer-term engagement is needed, for which CRADAs, WFOs, and ACTs could then be used. This recommendation addresses Barrier 1 above, especially (c).

DOE headquarters has an important role to play in making a decentralized approach effective. First, broad policies must be established to define the boundaries of approved laboratory practice. Department guidance on initiatives, selection criteria, intellectual property rules, and cost-sharing should be adopted on a broad, as opposed to case-by-case, basis. It is important that DOE HQ track activities underway at the different laboratories and compile accurate data on a department wide basis.[24] In this regard, the TF endorses the work of Dr. Ellen Williams, who acted as the Senior Advisor to the Secretary on Technology Transfer and has now been confirmed as the Director of ARPA-E. The TF believes that someone should be tasked to continue her oversight of the department's technology transfer activities in the Office of Technology Transitions.

[24] All federal agencies are required to file information specific metrics of their technology transfer activities to NIST annually. Additional requirements were added in 2012 Presidential Memorandum -- *Accelerating Technology Transfer and Commercialization of Federal Research in Support of High-Growth Businesses.*

Recommendation 3.3: The DOE should create fast-track CRADA and non-federal WFO contracting and approval processes supported at the laboratory level by a dedicated laboratory/DOE team of legal and procurement experts with a leader authorized to shepherd each agreement to completion, and pilot this process at three laboratories. This recommendation should be implemented by the Under Secretary for Science and Energy and the Administrator of the NNSA.

This is one specific approach to addressing Barrier 1 above, especially (a) and (b). An initiative to simplify greatly existing CRADA and non-federal WFOs contracting procedures and the subsequent DOE approval process would significantly facilitate technology transfer efforts. The TF supports such an initiative but recognizes that it would involve complicated issues and participation of many parties, possibly require Congressional authorization, and take a long period of time. Accordingly, the TF recommends a limited, more targeted experiment to determine the benefits of a simplified process, using the SC Nanoscience Research Center fast-track CRADA as a model.

The TF also suggests examining the ARPA-E solicitation and contracting process, in which a dedicated team of legal/procurement experts take ownership to shepherd each agreement and contract to completion. This arrangement was largely responsible for the success of the agency's solicitation, selection, and contracting effort. The experiment should be implemented for 24 months and evaluated on the basis of reduced agreement execution time, streamlining of the number of stakeholders who participate in an agreement approval, and the degree that the experiment limits laboratory risk exposure to fast-track agreements.

Recommendation 3.4: Each DOE National Laboratory should adopt a personnel pathway that permits a limited number of staff to take entrepreneurial leave for a designated period with the assurance of appropriate resources upon return to restart a research program.

This recommendation addresses Barrier 3 above. Technology transfer is a "contact sport" and the chance of successful technology transfer is greatly increased if experts directly involved in new discovery and invention are also involved in a firm's early development and commercialization efforts. National laboratories need to craft personnel policies[25] that allow a limited number of staff to take leave from the laboratory for this purpose with the option to return to resume at least comparable research positions after a designated period of time. This approach would enhance the laboratory innovation ecosystem and staff retention. Both the DOE program office and the laboratories should explore existing and new mechanisms that could be used to underwrite the cost of providing researchers who take entrepreneurial leave with "safe harbor" should they choose to return to the laboratory. The total number of individuals involved should not be so high as to strain laboratory resources, including LDRD.

[25] Within the GOCO model, entrepreneurial leave policies are determined by the M&O contractor for a particular DOE National Laboratory. For example, ANL provides unpaid leave to qualified employees to pursue entrepreneurial activities using ANL intellectual property (http://www.anl.gov/diversity-inclusion/policies-practices).

Recommendation 3.5: Each DOE National Laboratory should track its impact on the industry.

In addition to addressing the key barriers described earlier, each laboratory should identify quantitative and qualitative metrics to better measure the efficacy of its engagement with industry (e.g., how many technologies have made it to commercial deployment [regardless of revenues, private sector funding, or in-kind support] immediately following licensing or joint development; or the number of patent filings by the commercial entity including inventors from the DOE National Laboratory) and build a historical record of value created by the laboratory for industry. Furthermore, each laboratory should consider benchmarking against other successful partnerships at peer institutions (domestic and international). The DOE should play a role in bringing uniformity to these metrics and creating benchmarks for success.

LABORATORY DIRECTED RESEARCH AND DEVELOPMENT (LDRD)

BACKGROUND

"LDRD is used to leverage the national investment to maintain world-class science and engineering talent and facilities, and to investigate new ideas in the DOE mission areas."

It is near universal practice in industry, universities, academic medical centers, and government to make discretionary resources available to the organization's technical leadership to advance the effectiveness of its innovative activities. For DOE National Laboratories, discretionary resources are allocated through the LDRD program. This program is the only discretionary research funding available to laboratory directors to strengthen core capabilities.

Across the laboratory complex, LDRD is used to leverage the national investment to maintain world-class science and engineering talent and facilities, and to investigate new ideas in the DOE mission areas. Since the inception of the LDRD program, it has been heavily reviewed and improved. The TF suggests the following additional opportunities for increasing its effectiveness in achieving its core aims:

- maintaining the scientific and technical vitality of the laboratories, including through enhanced opportunities for early career research and the development of the future workforce
- positioning the laboratories to better address future DOE/NNSA missions
- fostering world-class creativity and stimulating exploration of forefront science and technology
- serving as a proving ground for new concepts in R&D.

After consultations with a range of stakeholders (e.g., NLDC, management at DOE, management of laboratories outside of DOE in government, and the private sector) and a survey of previous reports, Congressional studies, and DOE reviews concerning laboratory management and the LDRD program, the TF proposes a series of experiments designed to enhance the LDRD program. These initiatives can be conducted using existing authorities and budgets. The TF also recommends an overall level of LDRD funds that will give the laboratories the resources to adequately address current and future DOE mission needs.

HISTORICAL CONTEXT

While the origins of LDRD are found in the *Atomic Energy Act of 1954*, the modern DOE LDRD program is a legacy of the Exploratory Research and Development Program established in 1985, which first allowed the DOE National Laboratories to initiate self-directed R&D projects.[26]

[26] An update to the original order was issued in 1991 that responded to recommendations from various audits of the program, and changed the name of some of the current LDRD programs. Plant-Directed R&D (PDRD) and Site-Directed R&D (SDRD) were authorized for the NNSA production facilities in 2001 and 2002, respectively, by Section 310 of the FY 2001 Energy and Water Development Appropriations Act (P.L. 106-377), Section 3156 of the FY 2001 Floyd D. Spence National Defense Authorization Act (P.L. 106-398), and Section 310 of the FY2002 Energy and Water Development Appropriations Act, 2002 (P.L. 107-66). Over the years there have been additional audits and reviews of the LDRD program, including formal reports from the 1994 Process Improvement Team and 2004 LDRD Core Team.

The LDRD program is governed by DOE Order 413.2B, which sets program requirements such as caps on spending, overhead spending, certifications of the use of LDRD funding, and mandates an annual report to Congress. Further guidance issued by each of the Program Secretarial Offices: Science, Energy, and Nuclear Security details management practices, including DOE oversight and laboratory reporting requirements. An informal working group with representatives from each of the programs with LDRD projects works together as needed to ensure consistency and address policy issues, external review actions, and Congressional requests. The NNSA national security site and plants have analogous programs (i.e., Site Directed Research and Development [SDRD] and Plant Directed Research and Development [PDRD] funds) that serve a similar function tailored to the needs of the site and plants.

FEATURES OF LDRD SPENDING

Current LDRD funding levels are set by the 2014 Energy and Water Appropriations Act (P.L. 113-76), which reduced the maximum allowable funding level of an LDRD program to 6 percent (down from 8 percent) of a DOE National Laboratory's operating/capital equipment budget. The NNSA plants/site have a ceiling of 4 percent on PDRD and SDRD funds.

Currently, all 16 eligible laboratories choose to have active LDRD programs: AMES, ANL, BNL, Fermilab, INL, LANL, LBNL, LLNL, NREL, ORNL, PNNL, PPPL, SLAC, SNL, SRNL, and TJNAF (NETL is not eligible, as a Government-Owned Government-Operated, or GOGO, laboratory).[27] FY 2013 LDRD spending is shown in Figure 3. The funding totals for each of these categories are as follows:

- $150.8M at Science laboratories
- $390.5M at NNSA laboratories
- $32.3M at the NNSA Plants/Site
- $32M at Energy laboratories
- $5.6M at SRNL (EM)

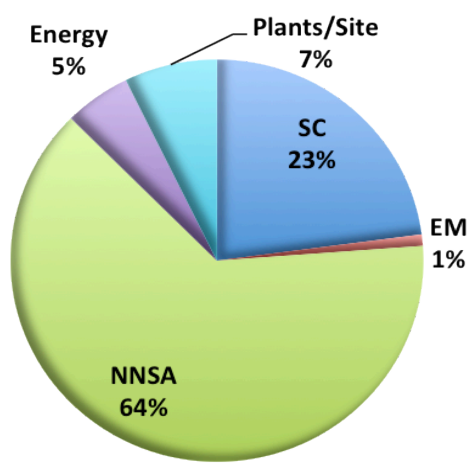

Figure 3. FY 2013 LDRD spending by laboratory steward, with NNSA plants and site included separately.

[27] FNAL and TJNAF initiated LDRD programs in FY 2014.

For FY 2013, the average LDRD spending level of the NNSA laboratories was around 6 percent, while Science laboratories reported spending between 1.5 (SLAC) and 4.9 percent (PNNL). The implementation of LDRD programs varies among laboratories, as they must all balance internal investment for infrastructure and mission support with R&D that supports the future. How LDRD programs are managed is largely discretionary within set guidelines and there is no accepted set of best practices that guides laboratories in managing activities or evaluating outcomes.

The level of investment at individual laboratories does not radically change year-to-year, as most laboratories tend to settle into a budgeting rhythm that creates a balance among the various spending demands. As detailed in Figure 4 and Figure 5, the actual costs and spending percentages for the DOE/NNSA laboratories have not varied significantly since FY 2008. The Science laboratories are generally well below the congressionally mandated cap, with the NNSA laboratories closer to the prior limit of 8 percent.[28]

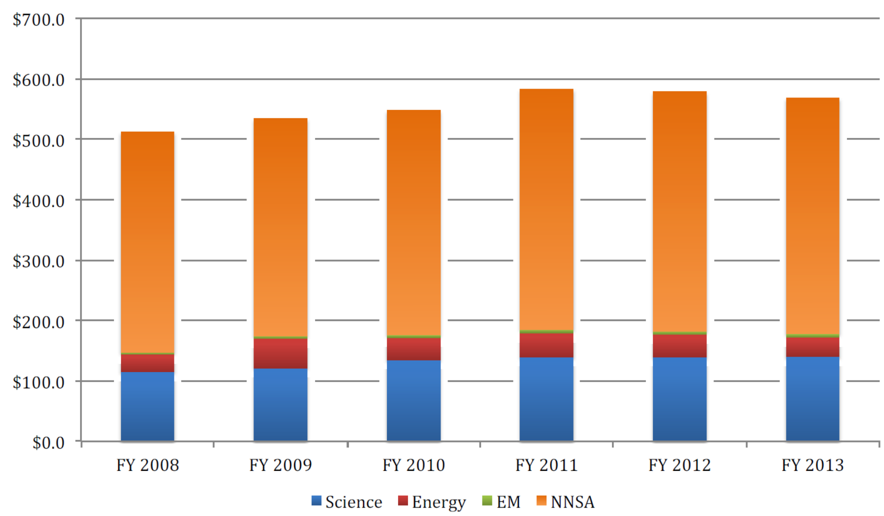

Figure 4. LDRD costs ($M), FY 2008-2013

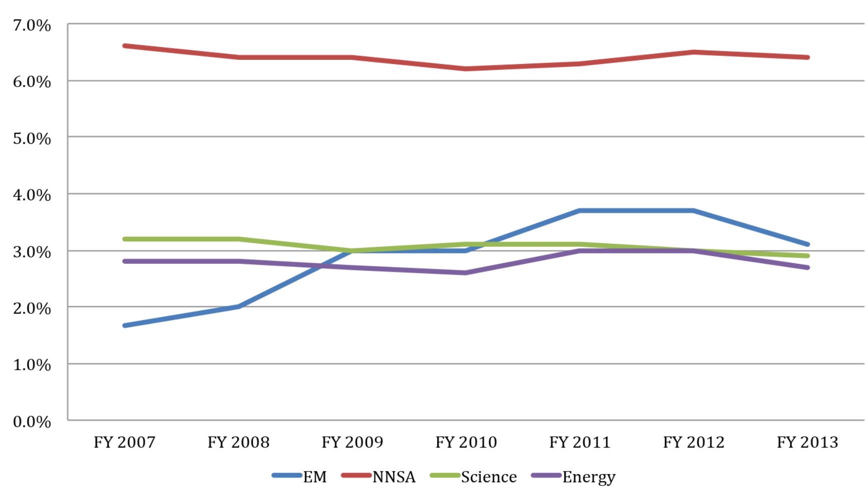

Figure 5. History of LDRD spending percentages from FY 2007-2013.

[28] Note that the limit is 6 percent as of FY 2014.

Other requirements mandated by DOE Order 413.2B include a limit of 36 months per project unless an exception is granted by the appropriate program secretarial officer and a restriction that projects must support areas of science and technology within the DOE mission. Currently, all projects are reviewed and approved by the relevant DOE Site Office.

FINDINGS

Due to differences in scale, mission, and overall investment portfolio, laboratories have developed customized strategies for investing LDRD dollars. However, laboratory directors are accountable to the DOE and their respective contractors for the success of their portfolio of LDRD projects. LDRD makes critical contributions to DOE missions through investments in **personnel**, **research**, and **partnerships**. Figure 6 illustrates the range of program sizes as a function of total laboratory budget among laboratories within the different DOE mission areas; more detail on cost and numbers of projects for FY 2014 is provided in Appendix H.[29]

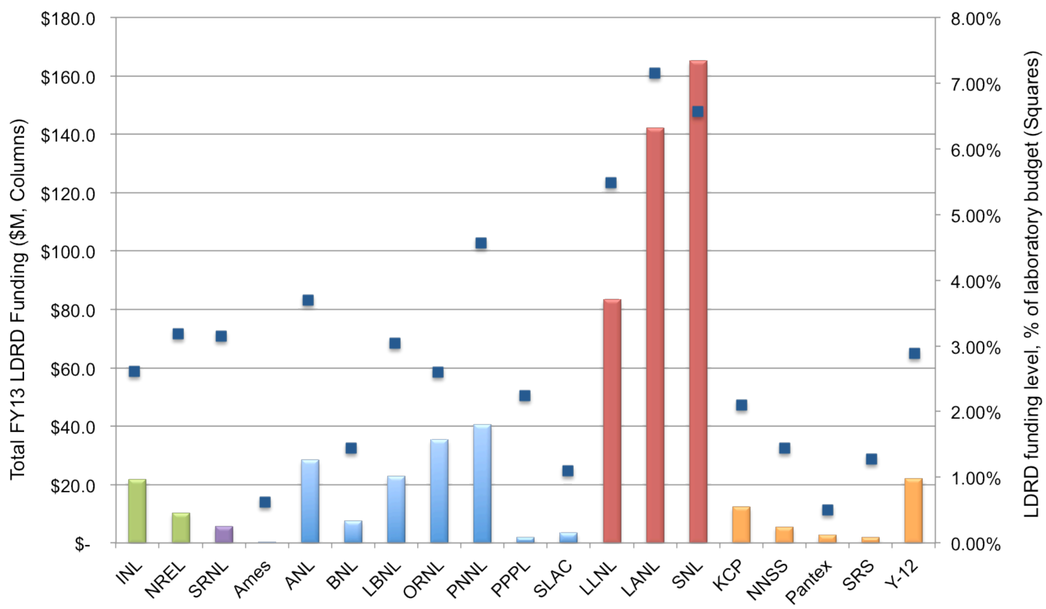

Figure 6. Total FY 2013 LDRD budget (columns; left axis) and LDRD funding as a percentage of laboratory budget for each laboratory, NNSA site and NNSA plant (squares; right axis).

PROGRAM FUNDING LEVEL

The LDRD program funding level is consistent with discretionary funding levels found in other R&D organizations, including industry and government-funded laboratories across the federal government. These levels ranged from 3 to 10 percent, with many organizations devoting 4 to 5 percent of their resources for this purpose.[30]

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[29] Note that the maximum allowable percentage decreased to 6 percent in FY 2014. The laboratories provided the LDRD budget data and the office of the chief financial officer provided the total laboratory budgets.

[30] Comparator laboratories included DOD-funded FFRDCs, a NASA-funded FFRDC, and industry laboratories.

RECRUITING AND RETENTION OF PERSONNEL

There is perhaps no more important endeavor for laboratory leadership than the recruitment and retention of top talent for both early career and leadership positions, and LDRD can play a vital role in enabling strategic hires. Recruiting top talent raises the level of innovative R&D across the board. For the NNSA laboratories in particular, LDRD provides a way to maintain a pool of talented individuals whose work is aligned with the core mission of the laboratories. This is particularly important for recruiting early career staff, although more senior staff recruiting is impacted as well. This finding is supported by evidence of the participation of early career staff and recently recruited staff in LDRD programs.

The majority of LDRD projects include early career researchers. Figure 7, for instance, shows that at LANL early career researchers lead many LDRD projects, and that the distribution of LDRD principal investigators peaks at an age 10 to 15 years younger than that of the laboratory's overall research staff. These younger principal investigators have the opportunity to lead larger projects than they would have otherwise, which is an important development experience for future R&D leaders. In addition, many early career researchers are contributors to LDRD projects. Figure 8 shows the percentage of LDRD projects at six laboratories where early career staff contributions represent at least 10 percent of staff effort for FY 2008 to FY 2013 (except for LANL, where the total for FY 2015 is presented).

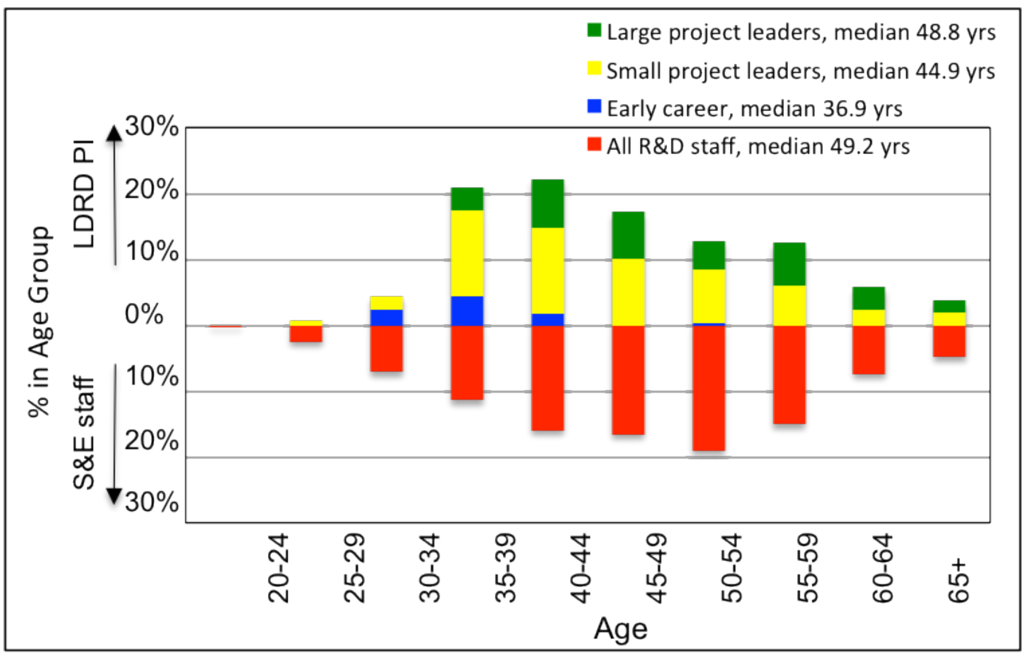

Figure 7. Demographics of LDRD principal investigators (top) and R&D population (bottom) at LANL in FY 2013.

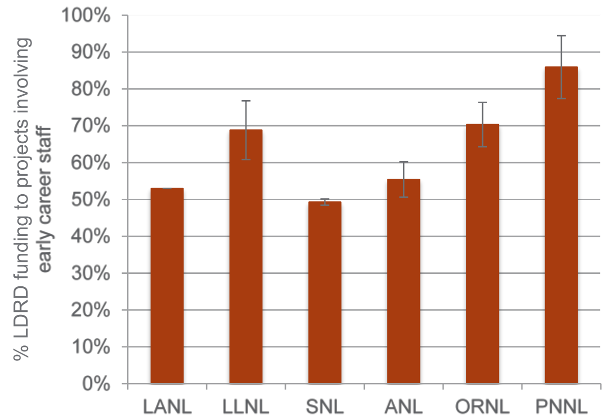

Figure 8. Percent of LDRD program funding to LDRD projects with early career contributors (>10% FTE). All budgets FY 2008–FY 2013 except for LANL (FY 2015).

Research Innovation and Capability Development

> ***"LDRD support has been responsible for some of the most important ideas coming from the laboratories."***

LDRD support has been responsible for some of the most important ideas coming from the laboratories. For instance, LDRD programs at SNL on synthetic aperture radar (SAR) permitted dramatic improvements in resolution, size and weight, image quality, and processing speed important for applications ranging from defense to environmental monitoring to urban development.[31] LDRD at ORNL supported the research on the creation of nanoposts in silica that demonstrated superhydrophobic coatings and surfaces that can be used to dramatically extend the lifetimes of marine coatings used by the U.S. Navy and by commercial shipping, as well as by systems used in municipal water supplies.[32] In addition, LDRD resources funded the initial proof of concept of unique superconducting bend magnets or "superbends," subsequently developed and installed in the Advanced Light Source at the LBNL. Ultimately, this capability was important in enabling Roger Kornberg to determine the structure of RNA Polymerase II, for which he received the 2006 Nobel Prize in Chemistry.[33]

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[31] As early as 1983, SNL was investing LDRD to design and test a SAR-based directional altimeter, with improvements in terrain mapping, strip image mapping, and real-time processing following shortly thereafter. These investments, over many years, led to higher-resolution static images from a miniaturized package (miniSAR) deployed on unmanned aerial vehicles, advanced imaging of moving targets, and real-time video radar. Obtained from: http://www.sandia.gov/research/laboratory_directed_research/ and http://www.sandia.gov/research/laboratory_directed_research/_assets/documents/LDRD_Impacts_Sandia_Nation.pdf

[32] The superhydrophobic coating using tailored nanoposts was discovered under an LDRD project at ORNL in 2004 via a biomimetic approach, and was quickly expanded through a subsequent LDRD project (2005-2006) to the creation of powders that could be used for coatings. These new materials are optically transparent, durable and synthesized using controllable processes. Obtained from: http://science.energy.gov/~/media/lp/pdf/laboratory-directed-research-and-development/impact/brochures/DOE_LDRD_Brochure_June-28_FINAL.pdf.

[33] These initial LDRD proof-of-principal studies justified construction and installation of several beamlines using actual "superbend" magnets. These new capabilities were an important component, along with other work at the Stanford Synchrotron Light Source, of Roger Kornberg's determination of the structure of RNA

Strategic Opportunities for Partnerships

LDRD has been instrumental in sponsoring cooperative studies and conferences within and among laboratories. Furthermore, by investing LDRD resources in foundational, leading-edge R&D and user facilities, laboratories can better support exploration of new ideas in partnerships with other agencies. Finally, LDRD allows laboratories to explore cooperative activities with industry, strengthening laboratory-industry and laboratory-university partnerships.

Communication Challenges

The value and impact of the LDRD program has not been effectively conveyed to Congress, industry, or the public. The current combination of local DOE oversight, internal and external reviews, and annual program reports to Congress do not come together as a compelling narrative about the nature of the overall program and its achievements. The result is insufficient appreciation of the strategic contributions that the LDRD program makes to the nation and to DOE's missions.

Recommendations

To improve the efficiency, performance, and understanding about the value of LDRD, The TF proposes the following:

Enhance Efficiency

Recommendation 4.1: The NLDC should prepare and share a best practices document for managing LDRD programs.

The NLDC should capture their distributed expertise and experience to improve the overall quality and impact of the LDRD program. These best practices would be particularly beneficial to the SC laboratories that have recently added LDRD programs, but would be useful across the complex. The NLDC should complete and distribute these best practices by the end of FY 2015.

Recommendation 4.2: The Secretary of Energy should set a common base for LDRD expenditures (the numerator) and laboratory expenditures (the denominator). It makes little difference if one uses Direct + Indirect cost or direct cost as the basis since the indirect cost portion will be roughly the same for all lab activities and LDRD activity. We prefer to use Total Direct Costs for the basis and we recommend 6%. Others may recommend more or less. We believe transparency in the method of calculation is important.

Polymerase II, and for which Kornberg received the 2006 Nobel Prize in Chemistry. Found at: http://science.energy.gov/lp/laboratory-directed-research-and-development/impact/2011/11-16-11-6/

The level of LDRD funding should be maintained with strong support from the DOE and capped at 6 percent.[34,35] This is comparable to many R&D institutions in the private and public sectors (e.g., DOD R&D laboratories such as Lincoln Laboratory). This level would ensure that the laboratories retain adequate capacity to develop the next generation(s) of capabilities—including recruiting, retention, and development of scientists and engineers—that address national science, energy, and security needs.

IMPROVE COMMUNICATION

Recommendation 4.3: Provide enhanced reporting by the offices of the Under Secretary for Science and Energy, the Under Secretary of Management and Performance, and the Under Secretary for Nuclear Security on the substance and value of LDRD.

The current mandated LDRD report to Congress is prepared by the Office of the Chief Financial Officer. This report focuses on the cost and legislative authorization of the LDRD program and includes the entire list of the names of all LDRD projects, but does not convey the substance or impact of the LDRD program.[36] The DOE should charge the NLDC to develop an informative summary of the benefits and structure of the LDRD program, with ultimate responsibility for reporting to Congress held by the offices of the Under Secretaries. Furthermore, the improved report should include a narrative of selected program impacts seeded via LDRD investment that extend back into previous years, including cumulative benefits where appropriate. (This is in contrast to the current report, which is limited to results obtained in the current FY.) If a new Office of Laboratory Policy Implementation is established to provide oversight of all of the DOE National Laboratories per Recommendation 1.2, the report should be prepared by the new office on the basis of information provided by the offices of the Under Secretaries.

Recommendation 4.4: The NLDC should pilot an independent peer review of the LDRD program impacts and process of four laboratories, evaluating up to ten years of funded projects.

Best practices in the scientific community include peer review, and the TF believes the LDRD program at any given laboratory could benefit from a comprehensive and rigorous peer review of process and impact. Such a peer review could serve as a model for future assessment and continuous improvement.[37]

[34] "Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories", C. Shank, C.K.N. Patel, J.F Ahearne, W.W. Burke, et al. 2013. http://www.nap.edu/catalog.php?record_id=13367.

[35] "Laboratory Directed Research and Development (LDRD) At Lawrence Livermore National Laboratory", J.F. Holzrichter. 2011. Found at http://www.johnholzrichter.com/lib/literature/IR-D_Livermore_092011.pdf.

[36] The annual LDRD report to Congress is coordinated by the Office of the Chief Financial Officer and is focused on financial reporting, with token reporting of publication totals, patent and invention disclosure totals, and number of postdoctoral researchers supported. The FY 2014 report can be found here: http://energy.gov/cfo/downloads/fy-2014-ldrd-report. A second document provides project titles and funding levels for all projects; the FY 2014 list can be found here: http://energy.gov/sites/prod/files/2014/12/f19/DOELDRDProjectListFY2014_0.pdf.

[37] "Laboratory Directed Research and Development (LDRD) At Lawrence Livermore National Laboratory", J.F. Holzrichter. 2011. Found at http://www.johnholzrichter.com/lib/literature/IR-D_Livermore_092011.pdf.

Encourage Creativity

Recommendation 4.5: The Under Secretary for Science and Energy and the NNSA Administrator should pilot an approach with up to four laboratories, in which the laboratories define project scientific areas, but are not required to obtain approval of specific tasks.

This approach would encourage the laboratories to attack grand challenge problems and would foster more high-risk, high-payoff projects while decreasing the complexity of project approval. The laboratories should be encouraged to "think big" and develop LDRD programs that tackle complex, important science and technology challenges. This innovative approach would be effective for recruiting new talent to the laboratories.

Enhance Collaboration

The following recommendation underscores the TF's support for programs such as LDRD that encourage creativity and cooperation. The DOE National Laboratories should explore, develop, and adopt new approaches that serve this broader purpose. One such new idea is presented below; however, additional work is needed to define it better.

Recommendation 4.6: The NLDC should establish an Energy Science Study Group (ESSG) modeled on the Defense Science Study Group (DSSG) to develop laboratory leadership talent with broader capability to address and solve key DOE mission challenges.

In 1986 the DOD established the DSSG as a program of education and study to introduce outstanding science and engineering professors to U.S. security challenges and encourage them to apply their talents to these issues.[38] The TF recommends the NLDC consider adopting two DSSG model programs:

The first model program would be focused on the development of early career DOE National Laboratory scientists and engineers. Analogously to the DSSG, an ESSG would invite promising scientists and engineers from the laboratories to form teams collaborating to address and solve key challenges within the DOE mission space. When appropriate, the ESSG teams could expand to include individuals from the private sector, non-profits, and universities to broaden their examination of key technical and socio-economic issues. The ESSG experience would promote innovation and nurture technical leadership for early career investigators from across the laboratory complex. The ESSG would also help to improve cross-laboratory communication and collaboration, thereby increasing productivity and reducing duplication.

The second model program would establish multi-institutional teams composed of individuals from academia, non-profits, the private sector, and the laboratories to address significant problems in DOE mission areas. This model would expand the range of experts familiar with DOE problems and opportunities, increase recruiting operations, and broaden the range of engagement of laboratory scientist and engineers, thus enhancing their leadership potential.

In both cases, laboratory directors should be free to support ESSG related activities should they wish to do so.

[38] Paul Alivisatos, Director of LBNL, drew the TF's attention to the possibilities of the DSSG.

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References

Andes, S., M. Muro, M. Stepp. 2014. *Going Local: Connecting the National Labs to their Regions for Innovation and Growth*. Brookings, Center for Clean Energy Innovation, and The Information Technology & Innovation Foundation. Accessed February 27, 2015 at http://www.brookings.edu/~/media/research/files/reports/2014/09/10%20national%20labs/bmpp_doe_brief.pdf.

Augustine NR, N Lane. 2014. *Restoring the Foundation: The Vital Role of Research in Preserving the American Dream*. American Academy of Arts & Sciences, Cambridge Massachusetts. Accessed February 27, 2015 at https://www.amacad.org/content/Research/researchproject.aspx?d=1276.

Blake F, WF Brinkman, J Gansler, D Klein, FH Habicht, and J Tuck. 2003. *Blue Ribbon Commission Use of Competitive Procedures at the Department of Energy Laboratories*. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://www.breckenridgeinstitute.com/2003-SEAB-S-BLUE-RIBBON-COMM-RPT.pdf

Breul JD, DA Ink, A Burman, CM Kinghorn Jr., J Lachance, PW Marshall, HM Messner, DJ Spero. 2009. *Department of Energy: Managing at the Speed of Light Improving Mission-Support Performance*. National Academy of Public Administration, Washington, D.C. Accessed February 27, 2015 at http://www.napawash.org/wp-content/uploads/2013/01/DOE-FINAL-REPORT-1-2-13.pdf.

Breul JD, DA Ink, A Burman, PW Marshall, VJ Tschinkel, and TO Hunter. 2013. *Positioning DOE's Labs for the Future: A Review of DOE's Management and Oversight of the National Laboratories*. National Academy of Public Administration, Washington, D.C. Accessed February 27, 2015 at http://www.napawash.org/wp-content/uploads/2013/01/DOE-FINAL-REPORT-1-2-13.pdf.

Burke S and C Parthemore. 2008. *A Strategy for American Power: Energy, Climate and National Security*. Center for a New American Security. Accessed at http://www.cnas.org/files/documents/publications/Burke_EnergyClimateNatlSecurity_June08.pdf.

The Center for Measuring University Performance. 2015. Part II: MUP Research Universities. Accessed March 15, 2015 at http://mup.asu.edu/MUP-TARU-Part-II-MUP-Research-Universities.html.

DOE – U.S. Department of Energy. 2007. *Discussion of the Origin, Characteristics, and Significance of the Department of Energy's Management and Operating (M&O) Form of Contract*. Acquisition Guide – Chapter 17.6. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/17.6_Origin,_Characteristics,_and_Significance_of_the_DOE%27s_Management_and_Operating_0.pdf

DOE – U.S. Department of Energy. 2009. *Audit Report: Cooperative Research and Development Agreements at the Department of Energy's Office of Science Laboratories*. DOE/IG-0826. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/igprod/documents/IG-0826.pdf.

DOE – U.S. Department of Energy. 2009. *Audit Report: Work for Others Performed by the Department of Energy for the Department of Defense*. DOE/IG-0829. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/igprod/documents/IG-0829%281%29.pdf.

DOE – U.S. Department of Energy. 2009. *U.S. Department of Energy Policy Regarding the Competition of Contracts to Manage and Operate its National Laboratories*. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://science.energy.gov/~/media/lp/pdf/management-and-operating-contracts/DOE_Policy_Extension_or_Competition_of_Contracts_for_National_Labs_2009-12-22.pdf.

DOE – U.S. Department of Energy Order 413.2b. 2011. Administrative Change to DOE O 413.2b, Laboratory Directed Research and Development. U.S. Department of Energy, Washington, D.C. https://www.directives.doe.gov/directives-documents/400-series/0413.2-BOrder-b-admchg1/@@download/file

DOE – U.S. Department of Energy. 2011. *50 Breakthrough by America's National Labs*. Accessed on February 27, 2015 at http://science.energy.gov/~/media/_/pdf/news/in-focus/2011/50_Breakthroughs.pdf.

DOE – U.S. Department of Energy. 2011. *Special Report: Management Challenges at the Department of Energy*. DOE/IG-0858. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/IG-0858.pdf.

DOE – U.S. Department of Energy. 2013. *Audit Report: Cooperative Research and Development Agreements at National Nuclear Security Administration Laboratories*. OAS-M-13-02. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/OAS-M-13-02.pdf.

DOE – U.S. Department of Energy. 2014. *Audit Report: The Department's Management of Scientific User Facilities*. OAS-L-14-02. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/2014/02/f7/OAS-L-14-02.pdf.

DOE – U.S. Department of Energy. 2014. *Audit Report: Fiscal Year 2012 Work Performed Under the Work for Others Program at Los Alamos National Laboratory*. OAS-M-14-03. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/2014/03/f12/OAS-M-14-03.pdf

DOE – U.S. Department of Energy. 2014. *Audit Report: Technology Transfer and Commercialization Efforts at the Department of Energy's National Laboratories*. OAS-M-14-02. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/2014/02/f8/OAS-M-14-02.pdf.

DOE – U.S. Department of Energy. 2014. *Fiscal Year 2013 Report To Congress on Laboratory Directed Research and Development (LDRD) at the DOE National Laboratories*. U.S. Department of Energy, Washington, DC. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/2014/01/f6/2013%20LDRD%20Report%20December%202013_1.pdf.

DOE – U.S. Department of Energy. 2014. *Laboratory Directed Research and Development: Legislative History*. Accessed on March 2, 2015 at http://science.energy.gov/lp/laboratory-directed-research-and-development/legislative-history/

DOE – U.S. Department of Energy. 2014. *Request for Proposals (RFP) No. De-Sol-0006266 for the Selection of a Management and Operating Contractor for the Brookhaven National Laboratory (BNL)*. U.S. Department of Energy, Washington D.C. Accessed February 27, 2015 at http://bnlcompetition.science.energy.gov/pdf/Executive_Summary.pdf

DOE – U.S. Department of Energy. 2014. *U.S. Department of Energy Strategic Plan 2014–2018*. DOE/CF-0067. Accessed February 27, 2015 at http://energy.gov/sites/prod/files/2014/04/f14/2014_dept_energy_strategic_plan.pdf.

DOE – U.S. Department of Energy. 2015. *Discussion of the Origin, Characteristics, and Significance of the Department of Energy's Management and Operating (M&O) Form of Contract.* Accessed on March 2, 2015 at http://energy.gov/sites/prod/files/17.6_Origin%2C_Characteristics%2C_and_Significance_of_the_DOE%27s_Management_and_Operating_0.pdf

DOE – U.S. Department of Energy. 2015. *The DOE Laboratory System*. Accessed on March 2, 2015 at http://science.energy.gov/laboratories/.

Executive Office of the President. 2012. Transformation and Opportunity: The Future of the U.S. Research Enterprise. President's Council of Advisors on Science and Technology, Washington, D.C. Accessed February 27, 2015 at http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_future_research_enterprise_20121130.pdf.

Galvin R. 1995. *Alternative Futures for the Department of Energy National Laboratories (The Galvin Report)*. Prepared by the Secretary of Energy Advisory Board, Task Force on Alternative Futures for the Department of Energy National Laboratories, Department of Energy, Washington, D.C. Accessed February 27, 2015 at http://www2.lbl.gov/LBL-PID/Galvin-Report/Galvin-Report.html.

GAO – U.S. Government Accountability Office. 2002. *Contract Reform: DOE Has Made Progress, but Actions Needed to Ensure Initiatives Have Improved Results*. GAO-02-798. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/240/235299.pdf.

GAO – U.S. Government Accountability Office. 2003. *GAO Highlights—Contract Reform: DOE's Policies and Practices in Competing Research Laboratory Contracts*. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/120/110150.pdf

GAO – U.S. Government Accountability Office. 2004. *Information on DOE's Laboratory-Directed R&D Program*. GAO-04-489. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/250/242213.pdf.

GAO – U.S. Government Accountability Office. 2008. *Federal Research: Opportunities Exist to Improve the Management and Oversight of Federally Funded Research and Development Centers*. GAO-09-15. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/290/282697.pdf.

GAO – U.S. Government Accountability Office. 2009. *Technology Transfer: Clearer Priorities and Greater Use of Innovative Approaches Could Increase the Effectiveness of Technology Transfer at Department of Energy Laboratories*. GAO-09-548. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/300/290963.pdf.

GAO – U.S. Government Accountability Office. 2012. *Department of Energy: Additional Opportunities Exist to Streamline Support Functions at NNSA and Office of Science Sites*. GAO-12-255. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/590/588123.pdf.

GAO – U.S. Government Accountability Office. 2012. *Nuclear Safety: DOE Needs to Determine the Costs and Benefits of Its Safety Reform Effort*. GAO-12-347. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/600/590256.pdf.

GAO – U.S. Government Accountability Office. 2013. *National Laboratories: DOE Needs to Improve Oversight of Work Performed for Non-DOE Entities*. GAO-14-78. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/660/658585.pdf.

GAO – U.S. Government Accountability Office. 2014. *Federally Funded Research Centers: Agency Reviews of Employee Compensation and Center Performance*. GAO-14-593. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/670/665284.pdf.

Hemminger J. 2010. *Science for Energy Technology: Strengthening the Link between Basic Research and Industry*. Prepared by the BESAC Subcommittee on Science for Energy Technology. Accessed February 27, 2015 at http://science.energy.gov/~/media/bes/pdf/reports/files/setf_rpt.pdf.

Holzrichter, J. 2011. *Laboratory Directed Research and Development (LDRD) At Lawrence Livermore National Laboratory*. LLNL-AR-503171. Lawrence Livermore National Laboratory, Livermore, California. Accessed February 27, 2015 at http://www.johnholzrichter.com/lib/literature/IR-D_Livermore_092011.pdf.

Howieson, S. V., B. J. Sergi, and S. Shipp. 2013. *Department of Energy Agreements for Commercializing Technology*. P-5006. Institute for the Defense Analyses, Washington, D.C. Accessed February 27, 2015 at https://www.ida.org/~/media/Corporate/Files/Publications/STPIPubs/ida-p-5006.ashx.

Howieson, S. V., E. M. Sedenberg, B. J. Sergi, and S. Shipp. 2013. *Department of Energy Technology Maturation Programs*. P-5013. Institute for the Defense Analyses, Washington, D.C. Accessed February 27, 2015 at https://www.ida.org/~/media/Corporate/Files/Publications/STPIPubs/ida-p-5013.ashx.

Hruby JM, DK Manley, RE Stoltz, EK Webb, and JB Woodard. 2011. *The Evolution of Federally Funded Research & Development Centers*. Federation of American Scientists Public Interest Report, Spring Issue. Accessed February 27, 2015 at http://fas.org/pubs/pir/2011spring/FFRDCs.pdf.

Hughes ME, SV Howieson, G Walejko, N Gupta, S Jonas, AT Brenner, D Holmes, E Shyu, and S Shipp. 2011. *Technology Transfer and Commercialization Landscape of the Federal Laboratories*. NS P-4728. Institute for the Defense Analyses, Washington, D.C. Accessed February 27, 2015 at https://www.ida.org/~/media/Corporate/Files/Publications/STPIPubs/ida-nsp-4728.ashx.

Institute of Medicine, National Academy of Sciences, and National Academy of Engineering. 2007. *Rising Above the Gathering Storm: Energizing and Employing America for a Brighter Economic Future*. LBNL – Lawrence Berkeley National Laboratory. 2009. *Guidelines on Laboratory-Directed Research and Development (LDRD)*. Accessed February 27, 2015 at http://www2.lbl.gov/DIR/assets/docs/LDRD_Guidelines_10-09-c.pdf.The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/download.php?record_id=11463#.

National Academy of Sciences, National Academy of Engineering, and Institute of Medicine. 2013. *Trends in the Innovation Ecosystem: Can Past Successes Help Inform Future Strategies? Summary of Two Workshops*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog/18509/trends-in-the-innovation-ecosystem-can-past-successes-help-inform

National Research Council. 2004. *Facilitating Interdisciplinary Research*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog.php?record_id=11153.

National Research Council. 2004. *Intelligent Sustainment and Renewal of Department of Energy Facilities and Infrastructure*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/openbook.php?record_id=11173.

National Research Council. 2004. *Maintaining High Scientific Quality at Los Alamos and Lawrence Livermore National Laboratories*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog.php?record_id=11009.

National Research Council. 2005. *National Laboratories and Universities: Building New Ways to Work Together -- Report of a Workshop*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog.php?record_id=11190.

National Research Council. 2007. *Innovation Policies for the 21st Century: Report of a Symposium*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog/11852/innovation-policies-for-the-21st-century-report-of-a-symposium.

National Research Council. 2010. *Rising Above the Gathering Storm, Revisited: Rapidly Approaching Category 5*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/download.php?record_id=12999#.

National Research Council. 2012. *Rising to the Challenge: U.S. Innovation Policy for the Global Economy*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog/13386/rising-to-the-challenge-us-innovation-policy-for-the-global.

National Research Council. 2013. *Managing for High-Quality Science and Engineering at the NNSA National Security Laboratories*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog.php?record_id=13367.

National Research Council. 2013. *The Quality of Science and Engineering at the NNSA National Security Laboratories*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/download.php?record_id=18440#.

National Research Council. 2014. *Furthering America's Research Enterprise*. The National Academies Press, Washington, D.C. Accessed February 27, 2015 at http://www.nap.edu/catalog/18804/furthering-americas-research-enterprise.

Nazarro RM. 2003. *Contract Reform: DOE's Policies and Practices in Competing Research Laboratory Contracts*. GAO-03-932T. U.S. Government Accountability Office, Washington, D.C. Accessed February 27, 2015 at http://www.gao.gov/assets/120/110148.pdf.

Perry WJ, JR Schlesinger, H Cartland, F Ikle, J Foster, K Payne, J Glenn, B Tarter, M Halperin, E Williams, L Hamilton, and J Woolsey. 2009. Am*erica's Strategic Posture: The Final Report of the Congressional Commission on the Strategic Posture of the United States*. United States Institute of Peace Press, Washington, D.C. Accessed February 27, 2015 at http://www.usip.org/sites/default/files/America%27s_Strategic_Posture_Auth_Ed.pdf.

Pool S and J Erickson. 2012. *The High Return on Investment for Publicly Funded Research*. Center for American Progress, Science Progress. Accessed February 27, 2015 at https://cdn.americanprogress.org/wp-content/uploads/2012/12/InnovationResearchInvestments-1.pdf

Stepp M, S Pool, N Loris, and J Spencer. 2013. *Turning the Page: Reimagining the National Labs in the 21st Century Innovation Economy*. Information Technology and Innovation Foundation, Center for American Progress, and the Heritage Foundation. Accessed February 27, 2015 at http://scienceprogress.org/wp-content/uploads/2013/06/2013-turning-the-page-national-labs.pdf.

Townsend FF, D Kerrick, E Turpen. 2009. *Leveraging Science for Security. A Strategy for the Nuclear Weapons Laboratories in the 21st Century*. Stimson Center, Washington, D.C. Accessed February 27, 2015 at http://www.stimson.org/images/uploads/research-pdfs/Leveraging_Science_for_Security_FINAL.pdf

U.S. Congress, House. 2003. Energy and Water Development Appropriations Bill, 2004. Report 108-212, 108th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://www.gpo.gov/fdsys/pkg/CRPT-108hrpt212/html/CRPT-108hrpt212.htm.

U.S. Congress, House. 2004. Energy and Water Development Appropriations Bill, 2005. Report 108-554, 108th Congress, 2nd Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://www.gpo.gov/fdsys/pkg/CRPT-108hrpt554/pdf/CRPT-108hrpt554.pdf.

U.S. Congress, Senate. 2005. Energy and Water Appropriations Bill, 2006. Report 109-84, 109th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://www.gpo.gov/fdsys/pkg/CRPT-109srpt84/pdf/CRPT-109srpt84.pdf.

U.S. Congress, House. 2005. Energy and Water Appropriations Bill, 2006. Report 109-86, 109th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://science.energy.gov/~/media/budget/pdf/sc-congressional-appropriations/fy-2006/house-report/FY06_HRpt_109_86.pdf

U.S. Congress, House. 2009. Energy and Water Appropriations Bill, 2010, Report of the Committee on Appropriations Together with Additional Views (To Accompany H.R. 3183). Report 111-203, 111th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://www.gpo.gov/fdsys/pkg/CRPT-111hrpt203/pdf/CRPT-111hrpt203.pdf.

U.S. Congress, Senate. 2009. Energy and Water Appropriations Bill, 2010. Report 111-45, 111th Congress, 1st Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at http://www.gpo.gov/fdsys/pkg/CRPT-111srpt45/pdf/CRPT-111srpt45.pdf.

U.S. Congress, House. 2014. Energy and Water Development Appropriations Bill, 2015. Report 113-486, 113th Congress, 2nd Session, U.S. Government Printing Office, Washington, D.C. Accessed February 27, 2015 at https://beta.congress.gov/113/crpt/hrpt486/CRPT-113hrpt486.pdf.

Valdivia, WD. 2013. University Start-Ups: Critical for Improving Technology Transfer. Center for Technology Innovation at Brookings, Washington, D.C. Accessed March 15, 2015 at http://www.brookings.edu/~/media/research/files/papers/2013/11/start-ups-tech-transfer-valdivia/valdivia_tech-transfer_v29_no-embargo.pdf.

Warden, J, ed. 2011. *Nuclear Scholars Initiative: A Collection of Papers from the 2011 Nuclear Scholars Initiative*. Center for Strategic and International Studies, Washington, D.C. Accessed February 27, 2015 at http://csis.org/files/publication/111123_Jansson_NuclearScholar_web.pdf

Appendix A

The Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories

(found at http://energy.gov/seab/secretary-energy-advisory-board-seab-task-force-doe-national-laboratories)

The Secretary of Energy
Washington, D.C. 20585

June 16, 2014

MEMORANDUM FOR THE CO-CHAIRS
SECRETARY OF ENERGY ADVISORY BOARD

FROM: ERNEST J. MONIZ

SUBJECT: Establishing a Task Force on DOE National Laboratories

I request that you form a Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories (Labs) to provide advice, guidance, and recommendations on important issues related to improving the health and management of the labs. One of my priorities is to strengthen the relationship between the Department and the National labs and enhance the role of the labs in providing innovative solutions to our mission challenges in basic research, energy, nuclear security, and environmental remediation. I have undertaken a number of actions to reinforce an enterprise-wide view of the National lab system, including:

- Integrating basic research and applied energy programs under a single Under Secretary for Science and Energy who will better coordinate lab R&D activities;
- Initiating a dialog between Departmental and Lab senior leadership through the National Laboratory Policy Council;
- Establishing a Laboratory Operations Board to improve the effectiveness and efficiency of the labs and of the relationships among labs, DOE, and contractors; and
- Incorporating the lab leadership into DOE strategic planning, including launching research initiatives that cut across DOE programs and that may benefit from coordinated lab activity.

The SEAB National Laboratory Task Force has two broad purposes:

First: The Task Force should review past studies, Congressional reports and direction, and Departmental deliberations to identify key areas that have been raised concerning laboratory management and operations.

The Task Force should select a few specific issues for study, where the Secretary of Energy has the authority to make changes, which will improve laboratory performance and efficiency.

Examples of issues for initial Task Force attention are:

1. Clarifying and/or modifying the character of the M&O contracting system to encourage greater efficiency, mission performance, and morale at the labs utilizing a range of contract vehicles with an emphasis on public service to commercial terms.
2. Clarifying the authority and responsibilities for various laboratory functions among the lab management, Headquarters' program offices, DOE site and field offices, and contractors;
3. Managing Work for Others (Strategic Partnership Programs) in a way that efficiently provides other government agencies needed access to DOE laboratories;
4. Recommending appropriate policies and practices to effectively transfer DOE laboratory technology to the private sector while maintaining a mission focus; and
5. Increasing the effectiveness and setting the level of Laboratory Directed R&D (LDRD) programs for all DOE laboratories.

Second: The Task Force should remain informed about the deliberations of several studies underway at the DOE laboratories, including the Congressionally-mandated, *Commission on the Effectiveness of the DOE National Energy Laboratories*. I am interested in learning SEAB's views about:

1. The findings and recommendations of these studies;
2. Actions that the Department should take to implement such recommendations. (If SEAB believes no action should be taken on a finding or recommendation, it should give an explanation for its view); and
3. A recommended implementation plan for each recommended action.

The Office of the Under Secretary for Science and Energy will support the Task Force's work as needed.

Designated Federal Official: Karen Gibson, Director, Office of Secretarial Boards and Councils

Schedule: The Task Force will submit quarterly reports to SEAB of its progress and submit a final report by December 2015.

Appendix B

The Secretary of Energy Advisory Board (SEAB) Task Force on DOE National Laboratories Membership

- John Deutch, Massachusetts Institute of Technology, Chair*
- Steven Koonin, New York University*
- J. Michael McQuade, United Technologies Corporation*
- Arun Majumdar, Stanford University*
- Carmichael Roberts, Northbridge Venture Partners*
- Martha Schlicher, Monsanto*
- Ram Shenoy, Conoco Phillips*
- Michael Anastasio, Los Alamos and Lawrence Livermore National Laboratories (retired)
- Jennifer Chayes, Microsoft
- James Decker, Decker, Garman, Sullivan LLC
- John Gordon, General USAF (retired)
- Eric Isaacs, University of Chicago
- William Madia, Stanford University
- Robert McGrath, Georgia Institute of Technology
- Peter Ogden, Center for American Progress
- Joan Woodard, Sandia National Laboratories (retired)

*denotes SEAB Member

Resource:

- Daniel Gaspar, Pacific Northwest National Laboratory

Designated Federal Official:

- Karen Gibson, Director, Office of Secretarial Boards and Councils

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Appendix C

List of Contacts Providing Input to the Task Force

Name	Role and Organization
Alexander, Kathleen	Assistant Deputy Administrator, NNSA
Alivisatos, Paul	Director, Lawrence Berkeley National Laboratory
Anderson, Loren	Senior Manager, Technical Affairs and Special Projects, Marcellus Shale Coalition
Arvizu, Dan	Director, National Renewable Energy Laboratory
Baier, Gretchen	Associate R&D Director of External Technology, Dow
Benton, Jeremy	Commercialization Manager, Y-12
Berg, Thomas	Director, Y-12 National Security Complex
Bloom, Paul	Vice President, Process and Chemical Research, Archer Daniel Midland Company
Bosco, Paul	Director, Acquisition and Project Management, DOE
Budil, Kimberly	Vice President for Laboratory Management, University of California
Cantwell, Elizabeth	Director, Mission Development, Lawrence Livermore National Laboratory
Carlson, Curtis	Vice Chairman for Innovation and former CEO, SRI International
Cejka, Cheryl	Director, Technology Development and Outreach, Pacific Northwest National Laboratory
Chalk, Steven	Principal Deputy Assistant Secretary, Energy Efficiency and Renewable Energy, DOE
Conger, Martin	Chief Financial Officer and Associate Director for Business Systems, Pacific Northwest National Laboratory
Cook, Donald	Deputy Administrator for Defense Programs, NNSA
Cotton, Chip	Program Manager, Energy Research and Development, General Electric Global Research
Covey, Debra	Associate Laboratory Director, Ames National Laboratory
D'Agostino, Thomas	Former Administrator, NNSA
Danielson, David	Assistant Secretary, Energy Efficiency and Renewable Energy, DOE
Dehmer, Patricia	Director (Acting), Office of Science, DOE
Elachi, Charles	Director, Jet Propulsion Laboratory
Evans, Eric	Director, Lincoln Laboratories
Farris, William	Associate Laboratory Director, Innovation, Partnering and Outreach, National Renewable Energy Laboratory
Ferraro, Patrick	Deputy Director, Acquisition and Project Management, DOE
Fetcenko, Michael	Vice President and Managing Director, BASF Battery Materials-Ovonic
Fjeldsted, John	Director, Mass Spectrometry Research and Development, Agilent Technologies
Fleener, R. Thomas	Executive Vice President, Chief Financial Officer and Treasurer, MRIGlobal
Francis, David	Senior Vice President, Metal Improvement Company, Inc
Gentry, Lucille	Program Manager, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Gibbs, Doon	Director, Brookhaven National Laboratory
Gioconda, Thomas	Former Acting Deputy Administrator for Defense Programs, NNSA, and Deputy Director, Lawrence Livermore National Laboratory
Goldstein, William	Director, Lawrence Livermore National Laboratory
Gonzales, Manny	Manager, Chevron Energy Technology Company
Graham, Tammy	Manager, Technology Transfer Operations, Y-12

Name	Role and Organization
Grossenbacher, John	Director, Idaho National Laboratory
Hartney, Mark	Director, Office of Strategic Planning, SLAC National Accelerator Laboratory
Hazel, Brian	Staff Materials Engineer, Pratt and Whitney
Hennessy, Mark	Vice President, Business Development, Data Centric Systems, IBM T.J. Watson Research Center
Hoffman, Ron	CaRon Energy Strategies
Hommert, Paul	Director, Sandia National Laboratories
Howanitz, John	General Manager, Nuclear Security & Operations, Bechtel Nuclear, Security & Environmental
Hurd, Merna	Associate Deputy Director for Strategic Operations, Lawrence Livermore National Laboratory
Johnson, Duane	Chief Research Officer, Ames National Laboratory
Kao, Chi-Chang	Director, SLAC National Accelerator Laboratory
Kennedy, Stewart	President, Dry Surface Technologies
Kithil, Philip	Founder, Chairman and Chief Executive Officer, Atmocean
Klara, Scott	Director (Acting), National Energy Technology Laboratory
Kluse, Michael	Director, Pacific Northwest National Laboratory
Knotek, Michael	Deputy Under Secretary for Science and Energy, DOE
Kuhn, Garry	Senior Program Advisor, NNSA
Kumar, Sujeet	Co-Founder and Chief Technology Officer, Envia Systems
Labarge, John	Senior Program Analyst, Laboratory Policy and Evaluation, Office of Science, DOE
Levy, Donald	Vice President for Research and National Laboratories, University of Chicago
Littlewood, Peter	Director, Argonne National Laboratory
Lockyer, Nigel	Director, Fermi National Accelerator Laboratory
MacDougal, James	Senior Manager, Contract Development and Technology Transfer, Air Products
Markovitz, Alison	Director, National Laboratory Operations Board, DOE
Mason, Thom	Director, Oak Ridge National Laboratory
McBranch, Duncan	Chief Technology Officer, Los Alamos National Laboratory
McCarthy, William	Senior Patent Agent, RainDance Technologies, Inc
McMasters, Steven	Director, Technology Deployment, Idaho National Laboratory
McMillan, Charles	Director, Los Alamos National Laboratory
Meisner, Robert	Director, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Meixler, Lewis	Head, Office of Technology Transfer, Patents and Publications, Princeton Plasma Physics Laboratory
Mertz, Landon	Chief Executive Officer, Cerion Advanced Materials
Michalske, Terry	Director, Savannah RNL
Mieher, Walter	Engineer, KLA-Tencor
Montgomery, Hugh	Director, Thomas Jefferson National Accelerator Facility
Morris, Thomas	Vice President, Quality, Hadron Technologies, Inc.
Morrow, Karen	President and Chief Financial Officer, Hadron Technologies, Inc.
Morrow, Stan	Chief Technology Officer, Hadron Technologies, Inc.
Murokh, Alex	Chief Technology Officer, Radiabeam
O’Riley, Mark	Office of the General Counsel, Government and Regulatory Affairs, IBM T.J. Watson Research Center
Peirce, William	Government Collaboration, General Motors
Pesiri, David	Division Leader, Richard P. Feynman Center for Innovation, Los Alamos National Laboratory
Prager, Steward	Director, Princeton Plasma Physics Laboratory
Raines, Robert	Associate Administrator, Acquisition and Supply Management, NNSA
Rankin, Richard	Director, Industrial Partnerships, Lawrence Livermore National Laboratory

Name	Role and Organization
Rasar, Kimberly	Assistant Deputy Under Secretary for Science and Energy, DOE
Reis, Victor	Senior Advisor, DOE
Rosenfield, Michael	Vice President, Data Centric Systems, IBM T.J. Watson Research Center
Ruth, Ronald	Founder and Chairman, Lyncean Technologies, Inc.
Scarcello, Joseph	Chief Financial Officer and Manager, Business Operations, Thomas Jefferson National Accelerator Facility
Schwartz, Adam	Director, Ames National Laboratory
Sexton, James	Program Manager, IBM T.J. Watson Research Center
Shank, Charles	Former Director, Lawrence Berkeley National Laboratory
Shinoff, Josh	Director, Life Sciences Business Development, Bio-Rad Laboratories, Inc.
Snyder, Roger	Manager, Pacific Northwest Site Office, Office of Science, DOE
Stearrett, Barbara	Deputy Director, Acquisition and Supply Management, NNSA
Steen, Eric	Chief Science Officer and Founder, Lygos
Straubel, JB	Founder and Chief Technical Officer, Tesla Motors
Strevel, Nicholas	Manager, First Solar
Sullivan, Kelly	Director, Institutional Science and Technology Investments, Pacific Northwest National Laboratory
Summers, Eric	Vice President and Chief Scientist, ETREMA Products, Inc.
Suski, Gregory	Acting Deputy Director for Science and Technology, Lawrence Livermore National Laboratory
Townsend, Ron	Executive Vice President for Laboratory Operations, Battelle
Valentino, Daniel	Vice President, Global Technology and Innovation, LANDAUER, Inc.
Wade, Douglas	Deputy Director, Advanced Simulation and Computing and Institutional Research and Development, NNSA
Wall, John	Vice President - Chief Technical Officer, Cummins Inc.
Williams, Ellen	Senior Advisor, DOE
Winslow, Matt	Executive Vice President, Business Development, Cerion Advanced Materials
Wong, Jetta	Director, National Laboratory Impact Initiative, Energy Efficiency and Renewable Energy, DOE
Yetter, Christopher	Chief of Staff, Lawrence Berkeley National Laboratory
Zaidi, Ali	Associate Director for Natural Resources, Energy and Science, Office of Management and Budget
Zyuzin, Alex	Director of Research and Business Development, Advanced Cyclotron Systems, Inc.

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Appendix D

Contract, Contractor and Budget Summary for all 17 DOE National Laboratories

National Laboratory	Contractor	Incumbency,[a] Award, and End Dates			Award Term[b]	Partners	FY 2013 Budget, Other Cost,[c] and Fee, all $M			Fee Type[d]
Ames	Iowa State U.	1947	2006	2016	8/7	none	$45	$0	$0.84	$0.5M/$0.3M
Argonne	UChicago Argonne LLC	2006	2006	2016	8/7	Northwestern U. Parsons	$765	[e]	$5.3	Fixed
Brookhaven	Brookhaven Science Associates, LLC	2004	2015	2020	0/15	Battelle, SUNY-Stony Brook	$563	[e]	$7.4	Fixed
Fermilab	Fermi Research Alliance LLC	2007	2007	2016	8/7	U. Chicago, URA, Inc.	$376	$0	$3.9	Var.
Lawrence Berkeley	Regents of the U. Of California	1931	2005	2015	10/5	U. California	$743	$0	$4.5	Var.
Oak Ridge National	UT-Battelle LLC	1999	1999	2020	None	U. Tennessee, Battelle	$1,251	$0	$11.2	Var.
Pacific Northwest	Battelle Memorial Institute	1965	2002	2017	None	none	$967	$3.5	$11.9	Var.
Princeton Plasma Physics	Trustees of Princeton U.	1961	2009	2018	No addl. term	none	$78	$1.6	$1.9	Var.
SLAC National Accelerator Laboratory	Stanford	1962	2012	2017	None	none	$362	$0	$4.9	Var.
Thomas Jefferson Nat. Accel. Fac.	Jefferson Science Associates LLC	2006	2006	2016	7/7	SURA, Inc., Applied Techno-logies LLC	$142	[e]	$3.1	Var.
Idaho	Battelle Energy Alliance LLC	2005	2004	2019	None	EPRI, B&W	$1,129	[e]	$16.0	Var.
Nat. Energy Technology	N/A	N/A	N/A	N/A	N/A	N/A	$655	N/A	N/A	N/A
National Renewable Energy	Alliance for Sustainable Energy	2008	2008	2015	One 40 mo. period	Battelle, Mid-west Research Inst.	$347	[e]	$5.4	Var.
Savannah River	Savannah River Nuclear Solutions LLC	2008	2008	2016	Option to 7/31/ 2018	Newport News Nuclear, Fluor, Honeywell	$209	[e]	$5.9	Var.
Lawrence Livermore	Lawrence Livermore National Security, LLC	2007	2007	2018	4/9	Bechtel, U. California, B&W, URS Corp. Battelle	$1,449	[e]	$39.5	30%/70%
Los Alamos	Los Alamos National Security LLC	2006	2005	2018	5/8	Bechtel, U. California, B&W, URS Corp.	$2,066	[e]	$57.2	30%/70%
Sandia	Sandia Corp.	1993	2003	2016	None	Lockheed Martin	$2,503	$2.8	$28.1	$18M/$9.8M

(a) Incumbency refers to the date when current contractor began managing the laboratory.
(b) Award term refers to additional contract years awarded for excellent contract performance. The two numbers are the number of years earned, and the number of additional years that are available.
(c) Primary source of Other Cost is Home Office cost, i.e., allowable cost paid to LLC or other M&O contractor for services such as, e.g., benefits administration, negotiated as part of the contract. PNNL has the largest amount of Home Office cost; most laboratories have none. Except for PNNL, the budget shown is the maximum allowed by the contract; actual costs may be lower.
(d) Where two numbers (either fee amounts or percentages) are shown, the first number is the fixed portion of the fee, and the second number is the variable component of the fee. For example, $0.5M/$0.3M indicates $0.5M fee is fixed, and the variable fee is $0.3M.
(e) data not obtained by TF.

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Appendix E

Laboratory Policy Council Charter

Department of Energy
Washington, DC 20585

U.S. Department of Energy
National Laboratory Policy Council Charter

Objectives and Scope of Activities

The Department of Energy (DOE) National Laboratories are engaged in a broad program of scientific research and technological innovation supporting the Department's mission responsibilities in energy, nuclear security, science and environmental management.

The National Laboratory Policy Council will provide a forum for the National Laboratories to provide strategic advice and assistance to the Secretary in the Department's policy and program planning processes and for the Department to provide strategic guidance on National Laboratory activities in support of Departmental missions.

The scope of the Council shall include, but not be limited to, discussion of policies and strategies for:

- Advancing new research directions;
- Building human capacity;
- Supplying frontier research facilities for the U.S. research community;
- Supporting technology transfer;
- Improving communication with the public and other stakeholders;
- Enhancing the role of the national laboratories in addressing national priorities, such as nuclear security; and
- Providing strategic direction to the National Laboratory Operations Board.

The Council membership may raise additional issues for discussion, subject to approval by the Chair.

Membership

The National Laboratory Policy Council will include the following members:

- Secretary of Energy (Chair)
- Deputy Secretary
- Under Secretary for Management and Performance
- Under Secretary for Nuclear Security
- Under Secretary for Science and Energy
- Associate Deputy Secretary
- Director of the Office of Science
- Assistant Secretary for Energy Efficiency and Renewable Energy

- Assistant Secretary for Environmental Management
- Assistant Secretary for Nuclear Energy
- Assistant Secretary for Fossil Energy
- Deputy Administrator for Defense Programs
- Four National Laboratory Directors, as described below

The following Departmental offices will participate in activities of the Council as appropriate:

- Senior Advisors in the Office of the Secretary
- Assistant Secretary for Electricity Delivery and Energy Reliability
- Director of the Office of Energy Policy and Systems Analysis
- Director of the Advanced Research Projects Agency – Energy
- Chief Financial Officer
- General Counsel
- Assistant Secretary for Congressional and Intergovernmental Affairs
- Deputy Administrator for Defense Nuclear Nonproliferation
- Director of Intelligence and Counter Intelligence

The group of four Directors of the National Laboratories shall be nominated by the National Laboratory Directors Council and shall be able to represent activities across all DOE missions. The Chair may request broader participation, depending upon the topic or activity.

Frequency of Meetings

The Council will meet three times a year or as required by the Chair.

Operations

The Office of Secretarial Boards and Councils will provide a designee to serve as Executive Director to the Council. With guidance from the Office of the Secretary, the Office of Secretarial Boards and Councils will be responsible for ensuring that issues brought before the Council are properly analyzed and recommendations are formed for Federal employee decision and communication as appropriate.

The Council may seek advice from senior representatives from other elements of the U.S. Government and from experts outside the U.S. Government, in a manner consistent with applicable law. Any members of the Council will be employed by either the Federal government or a DOE management and operating contractor.

Effective Date: OCT 24 2013

Appendix F

Questions Posed to Industry Representatives Interviewed by the TF

1. In the context of broad engagement with the NLs, what value do you think the Lab can provide you?
2. What are the most effective ways to create this value (joint technology development; facility use; IP development and licensing; personnel transfer)?
3. Are the current mechanisms (CRADA, WFOs, ACT; IP Licensing) adequate?
4. What are the key barriers in effective engagement with the national laboratories?
5. How do (or should) you measure the value (follow-on funding; number of company personnel engaged and supported; technical know-how generated; IP generated and licensed/used)?
6. How could incentives be better aligned (internally in the Lab, in DOE and in the company) to make engagement with the national laboratories significantly more productive and valuable?

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Appendix G

Datasets Analyzed by the Task Force

G.1 Total budgets for all 17 NLs from FY 2008 to FY 2013, including DOE appropriations, federal WFOs and non-federal WFOs.

G.2 CRADA Funds-In, i.e., funding provided by industry to the laboratory as part of a CRADA agreement and Non-federal WFO funds for each Laboratory for FY 2008-FY 2013.

G.3 Patents and income-bearing licenses for each year from FY 2009-FY 2013 for each DOE National Laboratory.

G.4 Total royalties and royalties scaled by laboratory budget over the years FY 2008-FY 2013, and percentage of royalty revenue used to engage with industry.

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Appendix H

LDRD Projects and Funding for Each DOE National Laboratory for FY 2014

Excerpted from the annual LDRD report found at http://energy.gov/cfo/downloads/fy-2014-ldrd-report.

Table H.1. FY 2014 Overall Laboratory Costs and LDRD Costs at DOE National Laboratories

DOE National Laboratory	Number of LDRD Projects	LDRD Certified Costs ($M)	Total Laboratory Certified Cost Base ($M)	LDRD as a Percentage of Certified Cost Base
Ames Laboratory	9	1.0	**53.0**	1.89
Argonne National Laboratory	107	29.2	**753.6**	3.87
Brookhaven National Laboratory	40	9.6	**566.1**	1.70
Fermi National Accelerator Laboratory	7	0.2	**324.1**	0.06
Idaho National Laboratory	69	17.0	**827.7**	2.05
Lawrence Berkeley National Laboratory	83	23.6	**751.7**	3.14
Lawrence Livermore National Laboratory	147	78.2	**1,411.7**	5.54
Los Alamos National Laboratory	290	118.5	**2,068.0**	5.73
National Renewable National Laboratory	57	10.3	**356.3**	2.89
Oak Ridge National Laboratory	174	36.3	**1,231.8**	2.95
Pacific Northwest National Laboratory	182	38.9	**982.2**	3.96
Princeton Plasma Physics Laboratory	15	2.0	**102.0**	1.96
Sandia National Laboratories	419	151.3	**2,686.3**	5.63
Savannah River National Laboratory	40	6.2	**188.4**	3.29
SLAC National Accelerator Laboratory	20	4.4	**283.7**	1.55
Thomas Jefferson National Accelerator Facility	3	0.2	**107.9**	0.19
Total	**1,662**	**526.9**	**12,694.5**	**4.15**

Departmental Response:

Assessment of the Report of the SEAB Task Force on National Laboratories

Introduction

The Department of Energy (DOE) and its network of national laboratories (labs) are responsible for advancing the national, economic, energy, and nuclear security of the U.S.; promoting innovative and transformative scientific and technological solutions in support of those missions; sponsoring basic research in the physical sciences; and ensuring environmental cleanup of the nation's nuclear weapons complex. To tackle large-scale challenges and opportunities, DOE designed the national labs as trusted partners, managed and operated in the public interest by university and industry scientist leaders. The Federal Government develops research and development programs for the labs by, setting goals and allocating resources. The national labs provide the expert people, facilities, and management systems to carry out those programs. The national laboratory system is a vital national asset. However, over the years, questions have been raised about the management and performance of this system and the relationship between DOE and its laboratories. Congress and others have commissioned many studies analyzing the purpose, organization, performance, and cost of the DOE national laboratory system.

SEAB Report of the Task Force on National Laboratories

In June 2014, Energy Secretary Ernest Moniz charged the Secretary of Energy Advisory Board (SEAB) to provide advice, guidance, and recommendations on important issues related to improving the health and management of the labs. SEAB formed a task force to review past studies, Congressional reports and direction, and Departmental deliberations to identify key areas that have been raised concerning laboratory management and operations and select a few specific issues for study in areas where the Secretary of Energy has the authority to make changes that will improve laboratory performance and efficiency. The Secretary also requested the task force to remain informed about the deliberations of several studies underway on the DOE laboratories and provide views on the findings and recommendations of these studies and the actions that the Department should take to implement such recommendations.

On June 17, 2015, the SEAB approved the Interim Report of the Task Force.

DOE Assessment and Response to Recommendations

The interim report of the Secretary of Energy Advisory Board (SEAB) National Laboratory Task Force identifies the constraints on and evaluates the effectiveness of laboratory operations that impact the performance and efficiency of the DOE national laboratories and proposes a series of new mechanisms and procedures to enhance the performance of the DOE national laboratory system through targeted "experiments" in three key areas: (1) the management and operation (M&O) contracting system; (2) technology transfer as a means for creating value for the private sector; and (3) Laboratory Directed Research and Development (LDRD).

This brief assessment provides DOE's initial response to the report's recommendations.

Framework

Recommendation 1.1: Clarify the roles and responsibilities for mission execution at the laboratories. The Secretary of Energy should lead the Laboratory Policy Council in clarifying roles and responsibilities and direct the Under Secretary for Management and Performance to lead the Laboratory Operations Board in implementing these changes.

Response: DOE is taking steps to clarify the roles and responsibilities of the headquarters, program, field, and laboratory organizations. In general, program management responsibility and strategic direction reside at DOE Headquarters, whereas field offices provide day-to-day implementation and are advocates for mission work at the site. As part of this effort, each DOE program will review its field authorities and structure and formalize a field manager training and professional development program that provides for effective workforce planning and instills an understanding of "mission support" as the primary site office role.

NNSA, in particular, will execute plans to improve its governance and oversight of field operations at its laboratories, sites, and plants, and clarify roles and responsibilities. This approach will clarify the oversight roles of headquarters and field office personnel, placing emphasis on new rigorous and dependable Contractor Assurance Systems (CAS) and leveraging best practices from the Office of Science, including enhancing peer review and corporate parent involvement as appropriate for each site. In addition, to manage and eliminate duplication in field oversight, NNSA's field offices will use a Site Integrated Assessment Plan (SIAP) to identify their annual oversight requirements.

With respect to the oversight environment, CAS will continue to serve as a system for the contractor to manage performance consistent with contract requirements. A working group led by the Laboratory Operations Board has been reviewing how the various offices operate CAS at the laboratories under their purview and is developing a Departmental Policy document to articulate high-level CAS principles, to help further more uniform application across the complex. NNSA also is in the process of updating its CAS process to more closely mirror the Office of Science model.

In addition, core elements of the DOE/Lab relationship will be articulated in the forthcoming inaugural Annual State of the Labs report to Congress.

Recommendation 1.2: The Under Secretary for Management and Performance should lead a process to establish a structure and process that replicates the Office of Science (SC) Office of Laboratory Policy for the National Nuclear Security Administration (NNSA) and the Energy laboratories.

Response: The Department recognizes the need raised by SEAB for rigorous, comprehensive planning across DOE, including with individual laboratories. The Secretary has initiated efforts to bring more consistency to the management and oversight of the DOE laboratories. These efforts are being implemented through the line structure.

DOE has already begun to make improvements and develop a consistent annual laboratory planning approach to track and assess laboratory planning and evaluation. In this effort, DOE has established a Laboratory Planning Working Group, convened by the Under Secretary for Science and Energy, with participation from NNSA and the Office of Environmental Management, to share lessons and ideas for implementing consistent laboratory planning processes. Both NNSA and the applied energy offices are incorporating core elements from the Office of Science's lab planning process.

Specifically, NNSA is working to improve its strategic planning process and partnership efforts by establishing a laboratory strategic planning function in the NNSA Office of Policy within the Office of the Administrator. NNSA will work with each of the Lab Directors and NNSA field office managers to establish this new process, which will include an annual high-level strategic discussion at which each Laboratory Director presents his/her long-term strategic vision, to include the complex factors and competing objectives that each national laboratory balances, while continuing to assure national security mission success. The discussion will also include longer-term issues that the Director considers vital to the mission success of the laboratory.

The Office of the Under Secretary for Science and Energy has developed coordinated and uniform guidance for the Science and applied energy program national labs to submit an Annual Laboratory Plan (ALP). The guidance builds off of the Science process and provides for an enhanced focus on the applied energy programs, technology transitions, and collaborations. The guidance and schedule will parallel that previously used in the Office of Science, and builds upon the original set of core capabilities to integrate those applicable to the applied energy programs. The written plans will be due in the spring and presented by the lab leadership to not only their respective stewarding programs – Fossil Energy (FE), Nuclear Energy (NE), Energy Efficiency and Renewable Energy (EERE), and Science (SC) – but also to the leadership of the other stewarding offices, as well as the Office of Under Secretary for Science and Energy and its programs, the Office of Electricity Delivery and Energy Reliability (OE), NNSA, the Office of Environmental Management (EM), the Office of Indian Energy (IE), and the Office of Technology Transitions (OTT). The FY 2016 ALPs will inform the FY 2017 Performance Evaluation and Measurement Plans (PEMP), infrastructure plans, and 10-Year Site Plans, and the FY 2018 budget request. The annual laboratory plans will also inform the activities of the Office of the Under Secretary for Science and Energy initiatives such as the tech teams, the National Laboratories' Big Ideas Summit, the resulting crosscut proposals, and the budget request.

The Office of Environmental Management (EM) will establish an entity that is responsible for the stewardship of the Savannah River National Laboratory. This entity within EM will manage the Department's process for annual laboratory planning and evaluation, and will serve as a focal point for other key laboratory stewardship activities such as Strategic Partnership Projects (SPP) and LDRD. EM may directly implement (i.e., participate in) the laboratory planning and evaluation process described above for the Under Secretary for Science and Energy.

Finally, a Laboratory Performance Management Working Group was chartered in 2014 by the Under Secretary for Science and Energy to better align the processes used by the program offices to annually evaluate the laboratories' performance, using the Office of Science process as a model. This group developed several recommendations that are being implemented by DOE, through the Under Secretaries, in FY 2016. The recommendations provide for: consistent annual laboratory performance plans across all laboratories with common hierarchy; standard nomenclature and definitions of terms; the identification and evaluation of a laboratory's leadership role in cross-cutting initiatives with inter-laboratory collaboration (e.g., Grid Modernization); and performance feedback from all major sponsors (both DOE and non-DOE) of work at a laboratory. Each Under Secretary will merge this effort with the laboratory planning activities to enhance the annual laboratory planning approach and will ensure both efforts are institutionalized for FY 2016 and beyond.

Management and Operations

Recommendation 2.1: The SC Director should complete, expeditiously, the study currently underway to evaluate options for changes to the contracting model.

Response: The Department agrees with this recommendation. The Office of Science study of contract modifications at a single program lab is complete and has resulted in 18 concrete actions. While the study initially looked at actions to affect only one lab, the Working Group consensus was that many of the final recommendations could be applicable across the DOE enterprise. As a result, six contract experiments are proposed, including four of the five most commonly reported issues, and 12 actions will be more widely applied across the enterprise. The working group recommended that Fermi National Lab conduct the experiment beginning spring 2016.

Recommendation 2.2: The Under Secretary for Management and Performance should authorize a number of experiments to move control authority for certain operational procedures to the laboratory management. Specific recommendations:

2.2.1 Compensation Management: The current compensation approval process is eight times longer than industry norms, and requires excessive data submission. After parameters are received from DOE in late July, laboratories must conduct market surveys and analyses and review affordability, which takes up to one month. This is followed by a white paper presentation and DOE review and approval, which can take a minimum of five weeks. Finally, M&O contractor review and approval takes one week. In total, the current review process can take ten weeks or more, and its variability impacts the laboratories' ability to effectively plan for compensation reviews.

The Task Force recommends an experiment in which intent and constraints are discussed and agreed upon with the DOE during the first week, and DOE review and approval time is reduced to one week. This will limit the compensation process timeline to six weeks, while still ensuring that total compensation meets DOE strategic intent and constraints.

Response: DOE agrees that the Compensation Increase Plan (CIP) approval process needs improvement and has taken action by issuing Departmental policy on January 15, 2016 that requires Contracting Officers to modify existing contracts to significantly streamline DOE's existing oversight process. To accelerate the process, DOE has established pre-authorized thresholds. Specifically, in the absence of Departmental policy to the contrary (e.g., Secretarial pay freeze), contractors will not be required to submit CIP approval packages for merit fund increases that do not exceed World at Work projections nor will they be required to submit packages for promotion/adjustments that do not exceed thresholds established by Program Offices. In these instances, contractors will notify the Contracting Officer that they will not exceed established thresholds and will provide summary level information on their increases. No subsequent approval will be needed. Contractors proposing to exceed the pre-authorized amounts will submit a proposal with supporting documentation as required by the Program Office for Contracting Officer (CO) approval. The CO will issue a decision within four weeks, which will reduce the current response time cited by SEAB by nearly half.

2.2.2 Labor Negotiations: Currently, the process for labor negotiations is structured around approval parameters for bargaining on discrete elements (e.g., general wages and benefits). These parameters are determined through market surveys and analyses, as well as affordability reviews that are submitted to DOE for approval. Obtaining detailed point-by-point parameters from DOE can take months.

The Task Force recommends an experiment in which the process shifts to a "not-to-exceed total compensation" budget. The strategic intent and constraints would be discussed and agreed upon with DOE, so that DOE can provide authorization for a total cost ceiling. Such a change would ensure system-level controls are in place, while allowing the laboratories to decrease strike probability, improve the alignment of the contracts and broader strategic intent, and reduce bargaining costs. This process should be limited to a six-week timeframe (not including negotiating time).

Response: DOE will revise the model H-Clause, "Labor Relations," to clarify that specific, advance approval will not be required unless (1) the contractor-proposed parameters exceed a specified aggregate ("NTE") amount or exceed separate NTE amounts identified for specified categories of wages, salaries and benefits, (2) working conditions have not been normalized to current industry standards, or (3) the changes are contrary to Departmental policy or written instructions. Advance written notification to the Contracting Office is required for all changes for which approval is not required. In so doing, DOE can streamline the approval process and ensure Contractors have appropriate flexibility in the course of negotiations, while ensuring that DOE manages in compliance with DEAR 970.2201-1, "Basic Labor Policies", which charges DOE with assuring the "judicious expenditure of public funds" through reviewing the alignment of wages, salaries and benefits with private industry and institutions of higher education.

2.2.3 Benefits: Currently, DOE utilizes individual reviews for lower-risk laboratory transactions, which is time consuming and can be a net drain on resources. The Task Force proposes that DOE authorize laboratories to manage benefits below a preset cost threshold. The proposed process will provide the laboratories with improved agility and increase focus on the overall total rewards design while maintaining market-reference and affordability. This process will reduce review and approval time by DOE from a one-month minimum to one week. After a period of 12 months, the program should be reviewed to determine its efficacy at containing benefits costs while still achieving competitive benefits levels and reduced transaction costs.

Response: DOE agrees that the current process should be streamlined. DOE's Departmental Policy issued on January 15, 2016 revised its process to eliminate prior approval of new or revised benefit plan changes with the exception of changes that result in increased costs or that are contrary to Departmental policy or written instructions. Laboratories will be required to submit advance written notification with summary level data to the Contracting Officer for all proposed changes that are not required to be submitted for approval. As a result, contractors should save time in preparing approval packages for lower-risk benefits and the cost of coordinating with their Benefit Value consultant on each change to obtain an impact assessment on the Benefit Value index.

2.2.4 Annual Pension Funding: The current pension contribution process inhibits laboratories from making pension contributions utilizing a risk-based approach. The current process operates under existing constraints and peer-determined caps. Any pension contributions in excess of the actuarially determined Minimum Required Contribution must be submitted to DOE for approval. This process can take two to three months. In addition, the timing of DOE approval could result in mid-year changes to labor rates.

As an experiment, laboratories should discuss and agree on the strategic intent and constraints with DOE in advance of defining an annual pension management plan. The proposed process could help enable long-term strategic pension management and ensure pension plans meet agreed DOE minimum long-term strategic standards.

Response: DOE agrees that the timing of its process for reviewing pension funding plans should be addressed. DOE's January 15, 2016 Departmental Policy changed its process so that contractors anticipating the need for pension funding above the Minimum Required Contribution may submit a request to DOE in the form of a business case (2-3 pages) justifying the additional funds, ideally at the beginning of the fiscal year. DOE has issued guidance requiring programs to provide contractors pre-approval, if appropriate, within 30 days of receipt of the business case to allow contractors to determine labor rates. Final approval of funding would be communicated by the HCA when discount rates are finalized and it is known whether there are any budget issues with the proposed contribution amount. The Contractor would still participate in the Pension Management Plan process.

2.2.5 Conference Management Approvals: The current process for conference participation approval creates lengthy delays and barriers. Conference expenses expected to exceed $ 100K across all laboratories are routed through DOE for approval, which can take weeks or months. Once approval is secured, laboratories inform conference attendees of whether they are authorized to attend the conference, long after their names are submitted to the conference approval system.

This process hurts morale and hinders the ability of laboratory staff to network with their peers and build their knowledge base. It also increases the costs as later approvals result in higher conference attendance fees (missed early registration pricing) and higher travel costs.

Instead the Task Force proposes piloting a new arrangement for two years in which laboratories and DOE agree to an annual ceiling for conference attendance and spending, and then allow the laboratory to make its own decisions on attendance on a conference by conference.

Response: The Secretary recently approved a significant change to the conference management process that will reduce the workload and approval time for conferences. The most recent guidance eliminates the requirement for DOE contractors to report and seek approval from DOE headquarters for non-DOE/contractor-sponsored conferences. Contractors will still report and seek approval for estimated conference expenses for DOE and contractor-sponsored conferences (when contractor-sponsored conferences exceed $100,000 in costs), but with less detail than the current system requires. The Department is modifying laboratory contracts to include an H-clause that requires laboratories to locally track conference expenses and requires the laboratory director to approve participation in non-DOE/contractor conferences where expenses exceed $100,000.

2.2.6 Outside Legal Counsel: The current process for engaging outside legal counsel requires substantial resources to negotiate low-risk items without commensurate value. Approval process variability can result in increased supplier payments and limit the number of suppliers willing to provide counsel to the laboratories.

The Task Force recommends directing field offices to streamline billing and for laboratories to provide annual billing submission to DOE, based on agreed upon strategic intent constraints with DOE. By eliminating the current process of field office reviews and Q&A interactions with the laboratories to secure approval, the process can be shortened by up to two months. The future process would support Title 10 of the Code of Federal Regulations (CFR) Part 719 requirements while implementing a streamlined, risk-based approach.

Response: DOE engaged in a notice-and-comment rulemaking in 2011-2013, which included consideration of comments from many DOE M&O contractors, and resulted in the publication of a revised regulation governing contractor legal management requirements for the retention of outside counsel by contractors. The revised regulation was effective July 2, 2013, and was designed to provide effective monitoring and control of legal costs through a workable process. The Department is willing to engage further with the labs to understand and consider any specific proposed changes to streamline the approval process, or to address any potential inconsistencies that are causing issues at particular sites, consistent with the Department's oversight responsibilities with respect to contractor litigation and legal costs. One avenue for this engagement would be calls between GC and the lab counsels.

2.2.7 Large Request for Quotations (RFQ) and Contract Awards: The current review process for large RFQ and contract awards, defined here as >$1M, requires three rounds of duplicative reviews (i.e., field office contracting officer, Acquisition Project Management, and Head of Contracting Authority). Further, the reviews often include contradictory guidance/direction from the various reviewers. Consequently, high-dollar procurements are delayed, on average, by six to eight months.

Instead, the Task Force proposes utilizing a one-week discussion period with DOE to agree upon the strategic intent and constraints, followed by a single federal review once high-dollar RFQs are developed. The proposed process would reduce reviews to one contracting officer and could reduce review time to as little as two weeks.

Response: DOE intends to implement a contract experiment at a single program laboratory to enhance communication and reduce process time. As part of the agency subcontract approval process and to assist the contractor with understanding DOE's needs, the Federal Contracting Officer (CO) will engage with the Contractor Integrated Project Team (IPT) early in the subcontract planning process to enhance communication, and to increase early identification and resolution of issues. Early communication and resolution of issues with the Contractor and Federal Contracting Officer (CO) will streamline the DOE subcontract consent process. This experiment is intended to improve efficiency of subcontract procurement actions and to lower the overall costs to DOE for subcontract procurements.

Acquisitions (subcontracts) with a total estimated value in excess of $25 million are considered large. Large value acquisitions are reviewed by the Site Office Federal Contracting Officer (CO) and an Independent Review Board (IRB), and then are sent to the Head of the Contracting Authority (HCA) for review and approval. If the acquisition is larger than $50 million then it must be offered to the Office of Acquisition Management (MA-62) for further review and approval. It should be noted that MA-62 can elect to waive their review and typically does for Office of Science M&O subcontracts. By engaging a Federal CO in the Contractor Integrated Project Team early it will be possible to shorten review times for RFQ's and subcontract awards, in large part due to an improvement in the quality of acquisition products. One of the primary causes of delays in the approval process is poorly prepared or inadequate documents that require significant re-work. For large RFQ's and contract awards the goal would be to review and approve the submitted documents within 30 business days of receipt. If an additional review/approval is required from MA-62 then the goal would be 45 business days.

The CO will not engage in activities that would could lead to making the subcontract procurement a purchase "by DOE" or that could create privity of contract between DOE and the subcontractor, such as preparing the subcontract solicitation, receiving and/or evaluating proposals, conducting discussions, selecting a prospective awardee or conducting responsibility determinations.

Laboratory Value to Private Sector, Including Technology Transfer

Recommendation 3.1: The Secretary of Energy should provide a statement to the DOE enterprise, including DOE staff and the laboratories, that laboratory technology transfer activities intended to create value for industry are part of the mission for DOE National Laboratories. Such a statement should be accompanied by any necessary implementation instructions.

Response: DOE agrees with this recommendation and notes that in addition to developing a current Department-wide policy statement on technology transfer activities, the new Office of Technology Transitions will also develop the statutorily required Technology Transfer Execution Plan, which will help set the strategic vision and implementation instructions for the Department. The policy statement and Plan will be drafted in the third quarter of fiscal year 2016. Additionally, technology transfer was included in the Department's inaugural Science and Energy Plan which describes the Department's science and energy functions, and the essential role that each plays across the Department and throughout the technology development lifecycle. With these documents DOE will build on prior Secretarial Policy Statements on Technology Transfer (most recently in 2011) and DEAR Clause 970.5227-3 (in all National Laboratory M&O contracts) to reinforce that technology transfer is a mission of the Department and all of its National Laboratories and facilities.

Recommendation 3.2: The DOE should organize its technology transfer activities using a decentralized approach where industry and laboratory participants interact directly to structure programs. As an experiment, the DOE could consider flexibility in such agreements to facilitate rapid laboratory-industry engagements.

Response: DOE implements a mix of decentralized and centralized approaches to technology transfer and notes that national laboratories currently have and employ the flexibility to interact directly with industry and negotiate agreements, including Strategic Partnership Projects (formerly known as Work For Others), Cooperative Research And Development Agreements (CRADAs), and intellectual property licensing. DOE headquarters encourages industry to contact the national laboratories directly regarding these opportunities, such as through the Energy Innovation Portal for licensable laboratory patents and new laboratory user facilities database on the Office of Technology Transitions web page. Recognizing some of the constraints of existing mechanisms, DOE has over the last few years worked to provide more flexibility through the Agreement for Commercializing Technology (ACT) pilot discussed in the report. DOE is planning to assess if the flexibilities of the ACT mechanism can be further extended to include federally funded entities. DOE believes the pilot needs additional time to be implemented to determine if it can effectively alleviate some of the issues identified in the report. The evaluation of the pilot will take place at the end of the pilot in 2017.

DOE supports industry and laboratory interactions that are decentralized especially since each laboratory is unique and should develop unique partnerships that support the missions of the Department and its surrounding community and industry needs. Some technology transfer related approaches that laboratories have implemented include the New Mexico Small Businesses Assistance program at Los Alamos National Laboratory and Sandia National Laboratories which focuses on the needs of small businesses in the state of New Mexico. The Center for Advanced Energy Studies is another example where five regional universities and Idaho National Laboratory developed a consortium that is committed to conducting cutting edge energy research, educating the next generation of scientists and engineers, and partnering with industry to advance competitiveness. Other laboratories have similar programs where industry and laboratory participants interact directly to structure programs and activities. In addition to these existing programs, DOE's national laboratory impact pilot programs in the Office of Energy Efficiency and Renewable Energy are also structured to empower the laboratories to directly build relationships and agreements with industry, including Small Business Vouchers, Lab-Corps, and Technologists-in-Residence.

To complement the existing contracting mechanisms and laboratory led activities that are implemented in the field, DOE's new Office of Technology Transitions will implement the Technology Commercialization Fund created by the Energy Policy Act of 2005 in the second quarter of fiscal year 2016. This will be a centralized approach focused on increasing engagement between national laboratories and private sector partners around laboratory developed energy technologies.

Recommendation 3.3: The DOE should create fast-track CRADA and non-federal WFO contracting and approval processes supported at the laboratory level by a dedicated laboratory/DOE team of legal and procurement experts with a leader authorized to shepherd each agreement to completion, and pilot this process at three laboratories. This recommendation should be implemented by the Under Secretary for Science and Energy and the Administrator of the NNSA.

Response: DOE agrees in principle that speed of contracting with the private sector is important, however, it notes that there are fundamental differences in the manner by which the various DOE program offices partner with the private sector. DOE will build off prior benchmarking efforts, including the "Agreement Execution Process Study: CRADAs and NF-WFO Agreements and the Speed of Business" (PNNL Report- 20163, February 2011), and work with the labs to evaluate data on actual average agreement negotiation and approval times for CRADA and non-federal SPP approvals in order to gauge whether/ how much additional action is warranted. DOE notes that it released "Guidance for Fast-track Cooperative Research and Development Agreement (CRADA) Programs at DOE Facilities" in June of 2012. DOE will take steps to understand how the fast-track CRADA has been implemented and if it has made an impact on reducing the time it takes to get approval. A review of the average agreement times and the fast-track CRADA guidance will be an activity of the Technology Transfer Execution Plan and will be implemented starting in the fourth quarter of fiscal year 2016.

DOE agrees that there may be other opportunities to accelerate approval of partnering mechanisms, including the dedicated team model implemented by ARPA-E. Future contracting experiments conducted by the Department will be developed with these recommendations in mind.

Recommendation 3.4: Each DOE National Laboratory should adopt a personnel pathway that permits a limited number of staff to take entrepreneurial leave for a designated period with the assurance of appropriate resources upon return to restart a research program.

Response: The National Lab Directors Council agrees that Entrepreneurial Leave Policies (ELPs) have value in improving the success of technology transfer at DOE National Laboratories. The breadth and depth of ELPs at the National Laboratories differ. In general, an ELP allows National Laboratory employees to take a leave of absence or separation in order to start or join an entrepreneurial company. In some cases, the individual program may reduce some of the job security risks facing employees considering entrepreneurship by guaranteeing a job at the National Laboratory if returning within well-defined constraints. Other programs may require a separation with only partial certainty of returning to a job.

The NLDC notes that development and approval of an ELP policy involves significant effort and may require contractual and employee benefit modifications. Furthermore, the implementation and operation of an ELP program will require the laboratories to develop processes that address potential loss of funding, hiring replacement talent, and resources needed to successfully on-board returning employee. That being said, nearly one half of the national laboratories either have in place or are planning to develop ELPs within the next year. In Q2 FY16, all laboratories will document the status of their ELPs (active, actively developing, or no plans to develop). In reporting their current status, laboratories will share best practices they have developed as well as identify specific barriers limiting their ability to fully implement an ELP program. By Q4 FY16, NLDC will propose a set of actions that DOE should consider in order to facilitate use of best practices across the laboratory complex and help minimize barriers to the laboratories' adoption of successful ELPs.

Recommendation 3.5: Each DOE national laboratory should track its impact on industry.

Response: DOE agrees that each national laboratory should track its impact on industry and should identify quantitative and qualitative metrics to better measure the efficacy of its engagement with industry. DOE's Office of Technology Transitions (OTT) together with the national laboratories are taking steps in the identification and further refinement of metrics and the collection and analysis of data for that purpose. OTT and the laboratories are currently analyzing the existing portfolio of industrial agreements to understand the nature and extent of these laboratory-industry engagements. OTT and the DOE laboratory Technology Transfer Working Group are working to build on FY14 efforts to construct a process methodology that enables real-time cross-sectional and longitudinal analyses of such data and reporting of results in the FY15 data collection request. However, DOE is being cautious to develop metrics and data collection and reporting activities, including continued collection of standard metrics across all labs, that incentivize the desired actions and empower the labs to report industry activities that are unique over the long term and make efficient use of DOE HQ, field offices, and the laboratory resources. Specifically, the OTT is giving additional consideration to how core platform technologies developed by the labs, such as high performance computing, have had long term societal impacts. DOE is also currently evaluating methods of gathering qualitative examples of successful lab-industry engagements.

DOE agrees in part with the recommendation that each lab should consider benchmarking against other successful partnerships at peer institutions, if and only if, a fair and appropriate "peer institution" is identified and metrics clearly specified. The DOE missions served by each laboratory define the capabilities of that laboratory and have direct impact on the partnerships that result. For example, a science or applied lab/facility (i.e. NREL or ANL) benchmarking against other successful partnerships at another science or applied lab (i.e. PNNL or ORNL) may be a worthwhile exercise, but an NNSA lab/facility (i.e. Y-12) benchmarking against other successful partnerships at a science or applied lab (i.e. ANL) may not. In Q4 FY16, the laboratories will pilot an inter-laboratory benchmarking study using readily available laboratory data (as determined by the participating laboratories). The study will use selected impact metrics and will focus on the mission specific performance of peer laboratories (i.e. NNSA, SC, or Applied/EM laboratories).

Laboratory Directed Research and Development

Recommendation 4.1: The NLDC should prepare and share a best practices document for managing LDRD programs.

The NLDC should capture their distributed expertise and experience to improve the overall quality and impact of the LDRD program. These best practices would be particularly beneficial to the SC laboratories that have recently added LDRD programs, but would be useful across the complex. The NLDC should complete and distribute these best practices by the end of FY 2015.

Response: The Department agrees with the Task Force as to the value of sharing best practices. The LDRD program provides the laboratories with the opportunity and flexibility to establish and maintain an environment that encourages and supports creativity and innovation, and contributes to their long-term viability. LDRD allows DOE's laboratories to position themselves to advance the national security mission and respond to the Nations' future research needs.

DOE is working to promulgate best practices on LDRD throughout DOE. DOE will establish a best practices process in FY 2016 to help the National Laboratories improve the flow of outcomes from LDRD to missions. A working group, led by NNSA and coordinated between the three Under Secretary offices, will develop an electronic forum to document and share best practices, and enhance reporting on the substance and value of the LDRD program. In FY 2016, DOE will issue a LDRD Highlights document; NNSA will also share the individual annual lab reports with Congress and provide an annual briefing for stakeholders on the benefits realized due to LDRD investments.

Best practices may help Labs improve their efficiency and effectiveness in:

- Facilitating the flow of outcomes from LDRD to missions
- Capturing the best ideas of a lab in a proposal and review process
- Aligning to strategic missions
- Analyzing LDRD program outcomes
- Maximizing the productivity of LDRD projects
- Engaging staff
- Enhancing communication within the lab
- Interfacing with field offices and HQ

Recommendation 4.2: The Secretary of Energy should set a common base for LDRD expenditures (the numerator) and laboratory expenditures (the denominator). It makes little difference if one uses Direct + Indirect cost or direct cost as the basis since the indirect cost portion will be roughly the same for all lab activities and LDRD activity. We prefer to use Total Direct Costs for the basis and we recommend 6%. Others may recommend more or less. We believe transparency in the method of calculation is important.

Response: We agree that transparency in the calculation is important. We have recently modified the DOE Order to provide that transparency as well as to reflect current Congressional direction. The percentage level of LDRD is set by Congress and is currently capped at 6 percent (burdened). The FY 2016 National Defense Authorization Act set a minimum rate of 5 percent and a maximum of 7 percent for LDRD based on national security activities at the national security laboratories, a level more consistent with historic NNSA levels. The NDAA also requires that the Secretary and the Under Secretary for Nuclear Security brief Congress on the LDRD benefits, ongoing reviews of LDRD, costs and accounting practices associated with LDRD, and how LDRD projects support the mission of NNSA.

Recommendation 4.3: Provide enhanced reporting by the offices of the Under Secretary for Science and Energy, the Under Secretary of Management and Performance, and the Under Secretary for Nuclear Security on the substance and value of LDRD.

Response: During the FY 2015 Annual SC LDRD Program Review it was agreed to update the LDRD Highlights, last published in 2011, to better communicate the scientific success and impact of DOE LDRD programs. The LDRD Highlights document will demonstrate the substance and value of LDRD and will have input and review from all the appropriate DOE HQ offices, including the three Under Secretary offices. SLAC National Accelerator Laboratory and Idaho National Laboratory will lead a team of contractor staff to collect, edit, and consolidate some of the most notable success stories from recent LDRD projects. These success stories will focus on scientific breakthroughs, recruiting and retaining a world-class scientific workforce, and proof of concept for new technologies. The target date for completion of the Highlights document is September 30, 2016.

Recommendation 4.4: The NLDC should pilot an independent peer review of the LDRD program impacts and process of four laboratories, evaluating up to ten years of funded projects.

Response: The Department agrees with the recommendation and will contract with an outside organization to conduct the peer review. This should be a strategic review with a focus on LDRD processes and high-level outcomes at the four selected laboratories. Each of the four laboratories would prepare and present a summary of their LDRD goals, selection and review processes, LDRD program alignment with the Lab strategy, and outcomes and impacts in terms of the program goals and criteria.

The effort could include reviewing:

- The LDRD processes of the four selected laboratories to identify best practices that can be shared across the Lab system. This includes selection criteria, metrics, proposal reviews, project progress reviews and performance management, and post project evaluations.
- Return-on-investment to DOE and the Laboratory through LDRD, as demonstrated by new strategic research directions enabled by LDRD investments, new strategic capabilities that position the laboratory to respond to emerging mission needs, growth of targeted research areas and capabilities, and strategic staffing additions that contribute to the scientific and technical strength of the Lab.

- An integrated assessment of the LDRD programs at the four Laboratories focusing on common principles as well as the diversity of the programs, and how this diversity supports DOE as well as the unique mission and strategic environment of each Lab.

The peer review team should take into consideration the many independent peer reviews that have been already conducted by the Laboratories for their LDRD proposals, projects, and programs, and the data provided by the Laboratories should incorporate this body of work, as appropriate.

The four selected Laboratories should represent a cross section of the DOE Labs including a Science, Energy, and NNSA Laboratory, and an at-large Laboratory chosen to reflect the diversity in the Lab system. The at-large Laboratory should be chosen to underscore the breadth of LDRD program and its role in supporting the various DOE missions. Laboratories selected for this review should have a history with LDRD that is long enough to analyze long-term outcomes from a well-established program.

The target date for the Department to fully develop the object and goals of the independent peer review and select candidate organizations to conduct the review is April 29, 2016.

Recommendation 4.5: The Under Secretary for Science and Energy and the NNSA Administrator should pilot an approach with up to four laboratories, in which the laboratories define project scientific areas, but are not required to obtain approval of specific tasks.

This approach would encourage the laboratories to attack grand challenge problems and would foster more high-risk, high-payoff projects while decreasing the complexity of project approval. The laboratories should be encouraged to "think big" and develop LDRD programs that tackle complex, important science and technology challenges. This innovative approach would be effective for recruiting new talent to the laboratories.

Response: The current review of each proposed LDRD project by DOE adds value without adding significant time or resources to the approval process. It guarantees regular, formal engagement between the laboratories and Federal officials, and makes it possible to assure Congressional stakeholders that the LDRD program undergoes Federal oversight to ensure mission relevance and compliance with LDRD Order. Further, discussions with the laboratories indicate that the DOE review is not burdensome and support it being continued.

Recommendation 4.6: The NLDC should establish an Energy Science Study Group (ESSG) modeled on the Defense Science Study Group to develop laboratory leadership talent with broader capability to address and solve key DOE mission challenges.

Response: The NLDC supports the recommendation for an Energy Science Leadership Group and submitted a draft proposal for such a program to the Lab Policy Council for consideration. A planning group is actively framing a pilot for the program with the aim of identifying a first cohort made up of academics and early career lab scientists to pilot the program in the spring 2016.

Significant Audit Reports

Department of Energy programs are responsible for responding to Inspector General (IG) and Government Accountability Office (GAO) audit reports, including identifying and implementing corrective actions to address audit recommendations. The Office of the Chief Financial Officer coordinates the corporate audit resolution and follow-up program for the Department and maintains the Departmental Audit Report Tracking System (DARTS) to monitor and report on the status of audits. Provided below is a listing of significant audits currently reported in DARTS. Significant audits have been subjectively selected based on impact, sensitivity and/or relation to key programs or initiatives of interest.

Office of Inspector General Final Reports
Fiscal Year 2016

Report Title / (Report Number)	Report Date
Office of Science's Bioenergy Research Centers (OAI-M-16-01)	10/22/2015
Audit Coverage of Cost Allowability for Lawrence Livermore National Security, LLC, During Fiscal Year 2013 Under Department of Energy Contract No. DE-AC52-07NA27344 (OAI-V-16-01)	10/27/2015
Small Business Subcontracting Goals at the East Tennessee Technology Park (OAI-L-16-01)	10/29/2015
Federal Energy Regulatory Commission's Unclassified Cybersecurity Program – 2015 (OAI-L-16-02)	10/30/2015
The Department of Energy's Unclassified Cybersecurity Program - 2015 (DOE-OIG-16-01)	11/3/2015
The Department of Energy's Cybersecurity Risk Management Framework (DOE-OIG-16-02)	11/4/2015
Audit Coverage of Cost Allowability for DM Petroleum Operations Company, During October 1, 2011, Through March 31, 2014, Under Department of Energy Contract No. DE-AC96-03PO092207 (OAI-V-16-02)	11/10/2015
Department of Energy's Fiscal Year 2015 Consolidated Financial Statements (OAI-FS-16-01)	11/16/2015
SPECIAL REPORT: Management Challenges at the Department of Energy – Fiscal Year 2016 (OIG-SR-16-01)	11/16/2015
The Energy Information Administration's Information Technology Program (DOE-OIG-16-04)	11/17/2015
Procurement of Parts and Materials for the Waste Treatment and Immobilization Plant at the Hanford Site (DOE-OIG-16-03)	11/17/2015
Federal Energy Regulatory Commission's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-02)	11/18/2015
Energy Savings Performance Contract Biomass Project at Oak Ridge National Laboratory (OAI-L-16-03)	11/25/2015
Department of Energy Nuclear Waste Fund's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-03)	12/1/2015

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Report Title / (Report Number)	Report Date
Energy Savings Performance Contract Review Board (OAI-L-16-04)	12/4/2015
Issues Management at the Los Alamos Field Office (OAI-M-16-02)	12/7/2015
Lithium Operations at the Y-12 National Security Complex (OAI-L-16-05)	12/15/2015
The Office of Fossil Energy's Regional Carbon Sequestration Partnerships Initiative (OAI-M-16-03)	12/18/2015
The National Nuclear Security Administration's Network Vision Initiative (DOE-OIG-16-05)	12/18/2015
Worker Safety and Health at the Y-12 National Security Complex (OAI-L-16-06)	12/22/2015
Information Technology Management Letter on the Audit of the Department of Energy's Consolidated Balance Sheet for Fiscal Year 2015 (OAI-FS-16-05)	1/7/2016
Management Letter on the Federal Energy Regulatory Commission's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-04)	1/7/2016
Bonneville Power Administration's Real Property Services (OAI-M-16-04)	1/8/2016
Management Letter on the Audit of the Department of Energy's Consolidated Financial Statements for Fiscal Year 2015 (OAI-FS-16-06)	1/15/2016
Audit Coverage of Cost Allowability for Brookhaven Science Associates LLC During Fiscal Years 2012 and 2013 Under Department of Energy Contract No. DE-AC02-98CH10886 (OAI-V-16-03)	1/19/2016
Fiscal Year 2014 Work Performed Under the Work for Others Program at the Pacific Northwest National Laboratory (OAI-M-16-05)	1/20/2016
Corrective Action Program at the Waste Treatment and Immobilization Plant (OAI-M-16-06)	2/1/2016
Follow-up Audit of the Department of Energy's Management of Contractor Fines, Penalties and Legal Costs (DOE-OIG-16-06)	2/5/2016

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Report Title / (Report Number)	Report Date
Audit Coverage of Cost Allowability for Babcock & Wilcox Technical Services Pantex LLC During Fiscal Year 2013 Through June 30, 2014, Under Department of Energy Contract No. DE-AC54-00AL66620 (OAI-V-16-04)	2/12/2016
SPECIAL REPORT: Allegations Regarding the Sandia National Laboratories Mixed Waste Landfill (OAI-SR-16-01)	2/18/2016
Security Clearance Vetting at the Portsmouth Site (OAI-L-16-07)	2/19/2016
Issues Management at the Los Alamos National Laboratory (DOE-OIG-16-07)	2/25/2016
The Department of Energy's Audit Resolution and Follow-up Process (DOE-OIG-16-08)	3/1/2016
Audit Coverage of Cost Allowability for UChicago Argonne LLC During Fiscal Years 2010 Through 2013 Under Department of Energy Contract No. DE-AC02-06CH11357 (OAI-V-16-05)	3/9/2016
Audit Coverage of Cost Allowability for Sustainable Energy LLC During Fiscal Years 2012 and 2013 Under Department of Energy Contract No. DE-AC36-08GO28308 (OAI-V-16-06)	3/11/2016
Procurement Administration and Human Reliability Program Revocations Within the Office of Secure Transportation (OAI-M-16-07)	3/21/2016
Review of Electrical Safety Management at the Department of Energy (OAI-L-16-08)	3/24/2016
Management of Start-up of the Sodium-Baring Waste Treatment Facility (DOE-OIG-16-09)	3/30/2016
Management of the Solar Energy Technologies Office's Technology to Market Program (OAI-M-16-08)	3/31/2016
Management and Oversight of Information Technology Contracts at the Department of Energy's Hanford Site (DOE-OIG-16-10)	4/1/2016
Followup on Western Area Power Administration's Critical Asset Protection (DOE-OIG-16-11)	4/4/2016

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Report Title / (Report Number)	Report Date
The Department of Energy's Office of Headquarters Procurement Services Contract Awards Made to Alaska Native Corporations (OAI-M-16-09)	4/6/2016
Western Federal Power System's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-07)	4/6/2016
Audit Coverage of Cost Allowability for National Security Technologies, LLC During Fiscal Years 2012 through 2014 Under Department of Energy Contract No. DE-AC52-06NA25946. (OAI-V-16-07)	4/12/2016
The Department of Energy’s Improper Payment Reporting in the Fiscal Year 2015 Agency Financial Report (OAI-FS-16-08)	4/21/2016
The Department of Energy’s Continued Support of the Texas Clean Energy Project Under the Clean Coal Power Initiative (OIG-SR-16-02)	4/26/2016
The Department of Energy's Energy Information Technology Services Federal Support Costs (DOE-OIG-16-12)	5/2/2016
Review of Management and Accountability of Sealed Radioactive Sources Maintained at Department Sites (OAI-L-16-09)	5/6/2016
Management Letter on the Western Federal Power System's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-09)	5/6/2016
Atmospheric Radiation Measurement Climate Research Facility (OAI-M-16-10)	5/16/2016
Followup on National Nuclear Security Administration's Ability to Meet the Aircraft Requirements of the Joint Technical Operations Team (OAI-L-16-10)	5/18/2016
The Department of Energy's Small Modular Reactor Licensing and Technical Support Program (OAI-M-16-11)	5/25/2016
Audit Coverage of Cost Allowability for Iowa State University During Fiscal Years 2013 and 2014 Under Department of Energy Contract No. DE-AC02-07CH11358 (OAI-V-16-08)	6/6/2016
Audit Coverage of Cost Allowability for URS | CH2M Oak Ridge LLC During Fiscal Years 2011, 2012, and 2013 Under Department of Energy Contract No. DE-SC0004645 (OAI-V-16-09)	6/10/2016

Office of Inspector General Final Reports
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Report Title / (Report Number)	Report Date
Implementation of the Department of Energy's CyberOne Initiative (OAI-L-16-11)	6/17/2016
Management of Infrastructure at the Pantex Plant (OAI-M-16-12)	6/23/2016
Audit Coverage of Cost Allowability for University of California During Fiscal Years 2013 and 2014 Under Department of Energy Contract No. DE-AC02-05CH11231 (OAI-V-16-10)	6/28/2016
Followup on the Office of Science's Management of the Isotope Program (OAI-L-16-12)	7/1/2016
Lawrence Livermore National Laboratory's Laser Inertial Fusion Energy Endeavor (OAI-M-16-13)	7/7/2016
Enriched Uranium Operations at the Y-12 National Security Complex (DOE-OIG-16-13)	7/14/2016
Battelle's Pacific Northwest National Laboratory Procurement Activities (OAI-M-16-14)	7/27/2016
Audit Coverage of Cost Allowability for UT-Battelle LLC During Fiscal Year 2014 Under Department of Energy Contract No. DE-AC05-00OR22725 (OAI-V-16-11)	7/29/2016
Technetium-99 Incident at Los Alamos National Laboratory (OAI-L-16-13)	8/2/2016
Summary Report: Department of Energy’s Implementation of Selected Controls as Defined in the Cybersecurity Act of 2015 (DOE-OIG-16-14)	8/4/2016
Management of Selected Department of Energy Contractors' Health and Post-Retirement Benefits (OAI-M-16-15)	8/4/2016
Assessment Report on the Audit Coverage of Cost Allowability for Nuclear Waste Partnership, LLC, During Fiscal Years 2013 and 2014 Under Department of Energy Contract No. DE-EM0001971 (OAI-V-16-12)	8/16/2016
Follow-up Audit on Sandia National Laboratories' Nuclear Weapons Safety Program (OAI-M-16-16)	8/17/2016
National Nuclear Security Administration's Management of the B61-12 Life Extension Program (DOE-OIG-16-15)	8/18/2016

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Southwestern Federal Power System's Fiscal Year 2015 Financial Statement Audit (OAI-FS-16-10)	8/29/2016
Audit Coverage of Cost Allowability for Honeywell Federal Manufacturing & Technologies LLC During Fiscal Years 2012 Through 2014 Under Department of Energy Contract No. DE-NA0000622 (OAI-V-16-13)	9/21/2016
H-Canyon Processing at the Savannah River Site (OAI-L-16-14)	9/26/2016
Followup Audit on Chronic Beryllium Disease Prevention Program at Oak Ridge Sites (OAI-L-16-15)	9/28/2016
Followup Audit of the Department's Continuity of Operations Planning (DOE-OIG-16-16)	9/29/2016
Disposition of Excess Government Weapons, Explosives, and Protective Force Equipment at Lawrence Livermore National Laboratory and Hanford Site (OAI-L-16-16)	9/29/2016

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Department of Energy: Transactions Involving USEC Inc. Since 1998 (GAO-15-730)	10/13/2015
Federal Supply Chains: Opportunities to Improve the Management of Climate-Related Risks (GAO-16-32)	10/27/2015
NUCLEAR NONPROLIFERATION: NNSA's Proliferation Threat Assessment Process Could Be Improved (GAO-16-118)	10/30/2015
2013 Sequestration and Shutdown: Selected Agencies Generally Managed Unobligated Balances in Reviewed Accounts, but Balances Exceeded Target Levels in Two Accounts (GAO-16-26)	10/30/2015
Information Security: Federal Agencies Need to Better Protect Sensitive Data (GAO-16-194T)	11/17/2015
Federal Real Property: Additional Authorities and Accountability Would Enhance the Implementation of the Federal Buildings Personnel Training Act of 2010 (GAO-16-39)	11/19/2015
Information Security: DHS Needs to Enhance Capabilities, Improve Planning, and Support Greater Adoption of Its National Cybersecurity Protection System (GAO-16-43SU)	11/19/2015
Critical Infrastructure Protection: Sector-Specific Agencies Need to Better Measure Cybersecurity Progress (GAO-16-79)	11/19/2015
BIOSURVEILANCE: DHS Should Not Pursue BioWatch Upgrades until Systems Capabilities Are Established (GAO-16-99)	11/23/2015
Maritime Transportation: Implications of Using U.S. Liquefied Natural Gas Carriers for Exports (GAO-16-104)	12/3/2015
EMERGENCY PREPAREDNESS: Opportunities Exist to Strengthen Interagency Assessments and Accountability for Closing Capability Gaps (GAO-15-20)	12/9/2015
Nuclear Weapons Sustainment: Improvements Made to Budget Estimates Report, but Opportunities Remain to Further Enhance Transparency (GAO-16-23)	12/10/2015
DEFENSE TRANSPORTATION: DOD Needs to Improve the Evaluation of Safety and Performance Information for Carriers Transporting Security-Sensitive Materials (GAO-16-82)	12/10/2015

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WOMEN IN STEM RESEARCH: Better Data and Information Sharing Could Improve Oversight of Federal Grant-making and Title IX Compliance (GAO-16-14)	12/14/2015
Critical Infrastructure Protection: Measures Needed to Assess Agencies' Promotion of the Cybersecurity Framework (GAO-16-152)	12/17/2015
Federal Acquisitions: Use of 'Other Transaction' Agreements Limited and Mostly for Research and Development Activities (GAO-16-209)	1/7/2016
DOD Efforts to Develop Net Zero Installations (GAO-16-153R)	1/12/2016
USAID Venture Capital Approach Relies on Evidence of Results but Could Strengthen Collaboration among Similar Programs (GAO-16-142)	1/20/2016
INFORMATION QUALITY ACT: Actions Needed to Improve Transparency and Reporting of Correction Requests (GAO-16-110)	1/20/2016
FEDERAL RESEARCH OPPORTUNITIES: DOE, DOD, and HHS Need Better Guidance for Participant Activities (GAO-16-128)	1/20/2016
INFORMATION SECURITY: DHS Needs to Enhance Capabilities, Improve Planning, and Support Greater Adoption of Its National Cybersecurity Protection System (GAO-16-294)	1/28/2016
INNOVATIVE MANUFACTURING: Commerce Should Target Program Outreach to Address Capital Access Gaps (GAO-16-271)	2/4/2016
Nuclear Weapons: NNSA Has a New Approach to Managing the B61-12 Life Extension, but a Constrained Schedule and Other Risks Remain (GAO-16-218)	2/4/2016
RARE EARTH MATERIALS: Developing a Comprehensive Approach Could Help DOD Better Manage National Security Risks in the Supply Chain (GAO-16-161)	2/11/2016
Counterfeit Parts: DOD Needs to Improve Reporting and Oversight to Reduce Supply Chain Risk (GAO-16-236)	2/16/2016
Nuclear Nonproliferation: Preliminary Observations on IAEA's Role in Verifying the Iran Agreement (GAO-16-417)	2/23/2016

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Department of Energy: Observations on Efforts by NNSA and the Office of Environmental Management to Manage and Oversee the Nuclear Security Enterprise (GAO-16-422T)	2/23/2016
Credit Reform: Current Method to Estimate Credit Subsidy Costs Is More Appropriate for Budget Estimates than a Fair Value Approach (GAO-16-41)	2/29/2016
Data Center Consolidation: Agencies Making Progress, but Planned Savings Goals Need to Be Established (GAO-16-323)	3/3/2016
TESTIMONY: DOE Loan Programs: Information on Implementation of GAO Recommendations and Program Costs (GAO-16-150T)	3/3/2016
Modernizing the Nuclear Security Enterprise: NNSA's Budget Estimates Increased but May Not Align with All Anticipated Costs (GAO-16-290)	3/4/2016
Federal Research: Information on DOE’s Laboratory-Directed Research and Development (LDRD) Program (GAO-16-486R)	4/8/2016
2016 ANNUAL REPORT: Additional Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits (GAO-16-375SP)	4/13/2016
GOVERNMENT EFFICIENCY AND EFFECTIVENESS: Opportunities to Reduce Fragmentation, Overlap, and Duplication and Achieve Other Financial Benefits (Testimony) (GAO-16-579T)	4/13/2016
HIGH-CONTAINMENT LABORATORIES: Comprehensive and Up-to-Date Policies and Stronger Oversight Mechanism Needed to Improve Safety (GAO-16-305)	4/19/2016
Critical Infrastructure Protection: Federal Agencies Have Taken Actions to Address Electromagnetic Risks, but Opportunities Exist to Further Assess Risks and Strengthen Collaboration (GAO-16-243)	4/25/2016
Municipal Freshwater Scarcity: Improving Distribution System Efficiency and Tapping Nontraditional Water Sources (GAO-16-474)	4/29/2016
Nuclear Security: Status of the National Nuclear Security Administration’s Effort to Develop a Security Infrastructure Plan (GAO-16-447R)	5/13/2016

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CRITICAL INFRASTRUCTURE PROTECTION: Federal Efforts to Address Electromagnetic Risks (GAO-16-641T)	5/17/2016
Managing for Results: OMB Improved Implementation of Cross-Agency Priority Goals, But Could Be More Transparent About Efforts to Measure Progress (GAO-16-509)	5/20/2016
INFORMATION TECHNOLOGY: Federal Agencies Need to Address Aging Legacy Systems (GAO-16-468)	5/25/2016
Small Business Research Programs: Agencies Have Improved Compliance with Spending and Reporting Requirements, but Challenges Remain (GAO-16-492)	5/26/2016
IT DASHBOARD: Agencies Need to Fully Consider Risks When Rating Their Major Investments (GAO-16-494)	6/2/2016
Managing for Results: Agencies Need to Fully Identify and Report Major Management Challenges and Actions to Resolve them in their Agency Performance Plans (GAO-16-510)	6/8/2016
DIGITAL SERVICE PROGRAMS: Assessing Results and Coordinating with Chief Information Officers Can Improve Delivery of Federal Projects (GAO-16-733T)	6/10/2016
Combating Nuclear Smuggling: NNSA's Detection and Deterrence Program Is Addressing Challenges but Should Improve Its Program Plan (GAO-16-460)	6/17/2016
Government Purchase Cards: Opportunities Exist to Leverage Buying Power (GAO-16-526)	6/20/2016
INFORMATION SECURITY: Agencies Need to Improve Controls over Selected High-Impact Systems (GAO-16-501)	6/21/2016
DEFENSE CIVIL SUPPORT: DOD Has Made Progress Incorporating the Homeland Response Force into the Chemical, Biological, Radiological, and Nuclear Response Enterprise (GAO-16-599)	6/28/2016
U.S.-China Cooperation: Bilateral Clean Energy Programs Show Some Results but Should Enhance Their Performance Monitoring (GAO-16-669)	7/5/2016

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FEDERAL REAL PROPERTY: Actions Needed to Enhance Information on and Coordination among Federal Entities with Leasing Authority (GAO-16-648)	7/6/2016
Tax Expenditures: Opportunities Exist to Use Budgeting and Agency Performance Processes to Increase Oversight (GAO-16-622)	7/7/2016
Improper Payments: CFO Act Agencies Need to Improve Efforts to Address Compliance Issues (GAO-16-554)	7/11/2016
Department of Energy: Whistleblower Protections Need Strengthening (GAO-16-618)	7/14/2016
IRAN NUCLEAR AGREEMENT: The International Atomic Energy Agency's Authorities, Resources, and Challenges (GAO-16-565)	7/14/2016
Federal Research Grants: Opportunities Remain for Agencies to Streamline Administrative Requirements (GAO-16-573)	7/22/2016
Nuclear Waste: Waste Isolation Pilot Plant Recovery Demonstrates Cost and Schedule Requirements Needed for Cleanup Operations (GAO-16-608)	8/4/2016
DOE PROJECT MANAGEMENT: NNSA Needs to Clarify Requirements for Its Plutonium Analysis Project at Los Alamos (GAO-16-585)	8/9/2016
NUCLEAR SUPPLY CHAIN: DOE Should Assess Circumstances for Using Enhanced Procurement Authority to Manage Risk (GAO-16-710)	8/11/2016
Federal Hiring: OPM Needs to Improve Management and Oversight of Hiring Authorities (GAO-16-521)	9/1/2016
Foreign Assistance: Actions Needed to Improve Transparency and Quality of Data on ForeignAssistance.gov (GAO-16-768)	9/7/2016
DOD Renewable Energy Projects: Improved Guidance Needed for Analyzing and Documenting Costs and Benefits (GAO-16-487)	9/8/2016
FREEDOM OF INFORMATION ACT: Litigation Costs For Justice and Agencies Could Not Be Fully Determined (GAO-16-667)	9/8/2016
Department of Energy: Actions Needed to Strengthen Acquisition Planning for Management and Operating Contracts (GAO-16-529)	9/8/2016

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Digital Service Programs: Assessing Results and Coordinating with Chief Information Officers Can Improve Delivery of Federal Projects (GAO-16-602)	9/14/2016
NUCLEAR WEAPONS: NNSA Should Evaluate the Role of the Enhance Surveillance Program in Assessing the Condition of the U.S. Nuclear Stockpile (GAO-16-549)	9/14/2016
FEDERAL CHIEF INFORMATION SECURITY OFFICERS: Opportunities Exist to Improve Roles and Address Challenges to Authority (GAO-16-686)	9/15/2016
High-Containment Laboratories: Improved Oversight of Dangerous Pathogens Needed to Mitigate Risk (GAO-16-642)	9/21/2016
FEDERAL DISASTER ASSISTANCE: Federal Departments and Agencies Obligated at Least $278.6 Billion during Fiscal Years 2005 through 2014 (GAO-16-797)	9/22/2016
TESTIMONY: Federal Real Property: Efforts Made, but Challenges Remain in Reducing Unneeded Facilities (GAO-16-869T)	9/23/2016
Information Technology: Agencies Need to Improve Their Application Inventories to Achieve Additional Savings (GAO-16-511)	9/29/2016
OFFICE OF PERSONNEL MANAGEMENT: Actions Are Needed to Help Ensure the Completeness of Political Conversion Data and Adherence to Policy (GAO-16-859)	9/30/2016

DOE STATUTORY AUTHORITIES

This memorandum outlines the various statutory authorities, functions, and responsibilities that are vested in the Secretary of Energy. This memorandum begins with a discussion of the structural organization of the Department, and proceeds with a discussion of programmatic authorities and emergency powers.

STRUCTURAL ORGANIZATION

The Department of Energy Organization Act (DOE Act) establishes the position of Secretary of Energy and details the core functions and responsibilities of the Secretary. The DOE Act transferred various functions and responsibilities from other agencies to the Secretary and provided certain generic authorities such as the authority to promulgate regulations, to enter into and administer contracts, leases, and cooperative agreements, to acquire real and personal property, to establish and maintain field offices, and to construct, operate, and maintain laboratories and research facilities.

The Act directly establishes certain subordinate positions—e.g., Deputy Secretary, Under Secretaries, General Counsel, eight Assistant Secretaries—and some subordinate offices—e.g., Energy Information Administration (EIA), Office of Science. The Secretary may establish, alter, and discontinue other organizational units. Almost all of the Secretary's authorities may be delegated, and in practice, most of the work of the Department is carried out in this fashion. Nevertheless, it bears emphasis that essentially all official actions of Department officials are carried out pursuant to delegated authority from the Secretary. As a result, with the exception of the Federal Energy Regulatory Commission (FERC) each subdivision and each subordinate is subject, directly or through an intermediary, to the oversight and control of the Secretary. This fundamental principle remains true even for the National Nuclear Security Administration (NNSA), which otherwise exercises a degree of autonomy from the rest of the Department.

PROGRAMMATIC AUTHORITIES

The Secretary's programmatic authorities fall into four basic categories: atomic energy, energy development, electricity and energy information.

Atomic Energy. The Atomic Energy Act of 1954 (AEA) provides the key authorities exercised by the Secretary with respect to nuclear energy, including the authority to conduct research and development in the field of nuclear processes, atomic energy, and the utilization of nuclear material for military purposes, medical purposes, and commercial purposes; to own, produce, and distribute nuclear material, including special nuclear material, source material, and byproduct material; and in the field of military use of nuclear technology, the authority to engage in the production of atomic weapons and to develop nuclear energy for naval propulsion; and to control the dissemination and declassification of Restricted Data in such a manner as to assure the common defense and security.

In addition to the AEA, some authorities derive from later statutes and major amendments to the AEA including the Price-Anderson Act, the Nuclear Nonproliferation Act of 1978, the Nuclear Waste Policy Act of 1982, the Low Level Radioactive Waste Policy Act, the Uranium Mill Tailings Radiation Control Act and the NNSA Act. Key among the authorities derived from these later statutes are, in the field of cleanup and waste management, the authority to provide for safe storage, processing, transportation, and disposal of hazardous waste resulting from nuclear materials production, weapons production and surveillance production, and naval nuclear propulsion programs; with respect to civilian radioactive waste, the authority to site, construct, and operate a repository for civilian spent nuclear fuel and high level waste, to accept and dispose of Greater Than Class C (GTCC) low-level waste, to convert and dispose of depleted uranium, to remediate and provide for the long-term care of uranium mining sites; and to indemnify contractors that operate DOE nuclear facilities for harm that may be caused by nuclear incidents; the authority to approve or deny the application of any individual seeking to engage in production of special nuclear material or the transfer of technology and assistance related to nuclear activities outside the United States; and the authority to provide technical assistance and expertise to other nations or international organizations in the field of nuclear technology.

Energy Development. Separate and distinct from the AEA authorities, the Secretary has authority under the Energy Reorganization Act, the DOE Act, the Federal Nonnuclear Energy Research and Development Act, and other statutes to conduct research and development activities respecting all energy sources, and covering the entire span of technology development, including basic research, and technology development (including the transfer of technology to private industry), demonstration, and commercialization. In the commercialization realm, the Secretary may issue and administer loan guarantees for innovative technologies and loans for advanced technology vehicle manufacturing. The Secretary may make the Department's research and development facilities available to other federal agencies, state and local governments, and private persons.

The Secretary has additional authority to improve energy efficiency and support research and development with respect to renewable energy under the Energy Policy and Conservation Act, the Energy Reorganization Act, the DOE Act, the Energy Conservation and Production Act, the Energy Policy Act of 2005 and the Energy Independence and Security Act of 2007. In particular, the Secretary is authorized to establish minimum energy efficiency standards for consumer appliances and industrial equipment and may enforce these minimum standards appropriately. The Secretary may also provide funds to states, local governments, and tribes to implement conservation projects for residential homes, commercial buildings, and vehicle fleets. Next, the Secretary is authorized to assess and promote energy efficiency in building codes. Further, the Secretary provides financial assistance and technical support for various types of renewable energy generation. Finally, the Secretary may support and guide federal agencies in making energy efficiency improvements in their operations.

Electricity. The Secretary's authorities in the electricity sphere derive from statutes including the Federal Power Act, the Energy Policy Act of 2005, the Bonneville Project Act, the Northwest Power Act, the Federal Columbia River Transmission System Act, the Reclamation Project Act, the Flood Control Act, and the DOE Organization Act.

The Secretary is authorized to market power from dams operated by the Bureau of Reclamation and the Army Corps of Engineers with preference to municipalities, public bodies, and cooperatives. The Secretary may construct, operate, and maintain transmission lines and facilities necessary to market electricity from these dams. The Department may accept third-party contributions and participate in public/private electric transmission projects through two of the Power Marketing Administrations. These functions are carried out by the Department's Power Marketing Administrations. Although the functions must be exercised through the Administrators of these organizations, the ultimate authority is exercised upon a delegation from the Secretary and is thus subject to the Secretary's oversight and control.

Finally, the Federal Power Act, the Natural Gas Act, the Interstate Commerce Act and the DOE Act authorize the FERC, an "independent regulatory commission" "within" the Department, to license hydroelectric projects on federal land or navigable waters and to regulate interstate transmission of electricity, sales of electricity at wholesale, interstate sales and transportation of natural gas, and rates for transportation of oil by pipeline. Unlike the other subdivisions described above, these functions are not carried out by delegation from the Secretary; instead, these authorities are vested in the Commission itself. The statute explicitly states that the employees of FERC shall not be responsible to or subject to the supervision or direction of any employee of any other part of the Department, including the Secretary. That said, the Secretary may delegate functions to the Commission.

Energy Information. Several statutes authorize the Secretary to collect and disseminate various types of information, including the Energy Reorganization Act, the DOE Act, the Federal Energy Administration Act, and the Energy Supply and Environmental Coordination Act.

The Secretary is authorized to collect, assemble, evaluate, analyze, and disseminate information from private persons related to energy supply, production, demand, and technology. As part of this information-gathering power, the Secretary may require persons engaged in any phase of energy supply or consumption to make information available by providing periodic reports, records, documents and other data. This work is accomplished through the Energy Information Administration (EIA), which is established by the DOE Act, and which requires the Secretary to delegate certain information gathering powers to the EIA Administrator on a nonexclusive basis. EIA has considerable autonomy to produce statistical information without interference from other offices or employees of the Department, but the Administrator's authority is subject to the Secretary's oversight and direction.

EMERGENCY POWERS

In the energy emergency domain, there is a range of authorities under which the Secretary can and does act. Statutes that govern DOE's emergency authorities include the Energy Policy and Conservation Act, the Natural Gas Act, the Federal Power Act, the Natural Gas Policy Act, the Defense Production Act, and the Fixing America's Surface Transportation (FAST) Act.

The Secretary's emergency authorities can be divided into categories: emergency preparedness and response authorities, including authorities that can be exercised independently by the

Secretary; authorities requiring a Presidential finding; and authorities that require consultation with other agencies.

With respect to emergency preparedness and response, the Department is the sector-specific agency for the energy sector, which is a presidential designation also codified in part in the FAST Act. As the sector-specific agency, DOE coordinates the sharing of information between energy entities and federal agencies regarding infrastructure situational awareness and physical and cyber security. In addition, the Secretary has authority to provide technical assistance and information to states, local governments, and other agencies, and the Secretary may deploy experts and responders whenever there is a risk of a possible incident to ensure that aid is available immediately.

The Secretary owns, operates, and manages three emergency petroleum stocks, the Strategic Petroleum Reserve, the Northeast Gasoline Supply Reserve, and the Northeast Home Heating Oil Reserve. In order to maintain the reserves, the Secretary may construct, own, and operate storage facilities, may acquire petroleum products, and may store those products in reserve. These reserves can then be made available in the event of a supply disruption.

In the event of an actual emergency, the Secretary has independent authority to order temporary electricity connections and the generation and transmission of electric energy, to make exchanges—as distinct from *sales*—of crude oil or petroleum products from the petroleum reserves, to assist entities to procure the necessary energy materials and services to maintain supply during an emergency or to restore their systems, to control nuclear material, and to deploy experts and responders to provide technical expertise and assistance. Emergency authorities requiring a presidential finding include grid security emergency orders to protect or restore the reliability of critical electric infrastructure, sales of crude oil or petroleum products from the petroleum reserves, allocation of energy materials, services, and facilities in the civilian market, allocation and certain purchases of natural gas, and fuel switching by electric power plants or major fuel-burning installations. The Secretary also has a consultative role for Jones Act waivers and a concurrence role for fuel waivers under the Clean Air Act.

The Department of Energy (DOE) promulgates regulations essential to achieving its critical mission and to implementing major initiatives. Among other things, the Energy Policy and Conservation Act (EPCA) requires DOE to set appliance efficiency standards at levels that achieve the maximum improvement in energy efficiency that is technologically feasible and economically justified for both consumer products and commercial equipment. These rulemakings are expected to save American consumers billions of dollars in energy costs. As demonstrated by the listing below, DOE has a demanding rulemaking schedule for the appliance program. In addition, DOE has rulemaking proceedings that cover a wide range of additional subjects including: (1) Federal buildings; (2) health, safety and security; (3) procurement and financial assistance;(4) loan guarantees; (5) electricity transmission and the grid; (6) the environment; and (7) nuclear issues, such as ensuring the safe and secure operation of DOE nuclear facilities.

The listing below shows those rulemakings that are projected to have action taken by January 20, 2017 as well as those rules with projected action dates after January 20, 2017. All final actions that DOE has published since January, 2014 through October 1, 2016 are also included.

Department of Energy Rulemakings Documents Published Since January 2014 (through September 28, 2016)		
Name	**Current Stage**	**Action Date**
Inflation Adjustment of Civil Monetary Penalties	Final Rule 16	01/02/14
Energy Conservation Program: Test Procedures for Residential Furnace Fans	Final Rule 499	01/03/14
Energy Conservation Program: Compliance Date for the Dehumidifier Test Procedure	Final Rule 7366	02/07/14
Energy Conservation Program: Energy Conservation Standards for Metal Halide Lamp Fixtures	Final Rule 7745	02/10/14
Energy Conservation Program: Energy Conservation Standards for External Power Supplies	Final Rule 7845	02/10/14
Alternative Fuel Transportation Program; Alternative Fueled Vehicle Credit Program Modification and Other Amendments	Final Rule 15881	03/21/14
Energy Conservation Program: Energy Conservation Standards for Commercial Refrigeration Equipment	Final Rule 17725	03/28/14
Energy Conservation Program: Energy Conservation Standards for Certain Consumer Products	Final Rule 20091	04/11/14
Energy Conservation Program: Test Procedure for Commercial Refrigeration Equipment	Final Rule 22277	04/21/14
Energy Conservation Program: Test Procedures for Refrigerators, Refrigerator-Freezers, and Freezers	Final Rule 22319	04/21/14
Revision of Department of Energy's Freedom of Information Act (FOIA) Regulations	Final Rule 22855	04/25/14
Energy Conservation Program: Certification of Commercial Heating, Ventilation, and Air-Conditioning (HVAC), Water Heating (WH), and Refrigeration (CRE) Equipment	Final Rule 25486	05/05/14

Amendments and Correction to Petitions for Waiver and Interim Waiver for Consumer Products and Commercial and Industrial Equipment	Final Rule 26591	05/09/14
Energy Conservation for Certain Industrial Equipment: Alternative Efficiency Determination Methods and Test Procedures for Walk-In Coolers and Walk-In Freezers	Final Rule 27387	05/13/14
Energy Conservation Program: Energy Conservation Standards for Commercial and Industrial Electric Motors	Final Rule 30933	05/29/14
Energy Conservation Program: Energy Conservation Standards for Walk-In Coolers and Freezers	Final Rule 32049	06/03/14
Energy Conservation Program for Consumer Products: Test Procedures for Residential Furnaces Fans; Correction	Final Rule 37937	07/03/14
Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnace Fans	Final Rule 38129	07/03/14
Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Test Procedures for Residential and Commercial Water Heaters	Final Rule 40541	07/11/14
Energy Conservation Program for Consumer Products: Test Procedures for Refrigerators, Refrigerator-Freezers, and Freezers; Correction	Final Rule 41417	07/16/14
Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Furnaces; Energy Conservation Standards for Residential Direct Heating Equipment	Final Rule 43927	07/29/14
Acquisition Regulation: Access to and Ownership of Records	Final Rule 56279	09/19/14
Energy Conservation Program for Certain Commercial and Industrial Equipment: Energy Conservation Standards for Walk-in Coolers and Freezers; Air-Conditioning, Heating, & Refrigeration Institute Petition for Reconsideration	Final Rule 59090	10/01/14
Green Building Certification Systems for Federal Buildings	Final Rule 61563	10/14/14
Procedures for Changes in Control Affecting Applications and Authorizations To Import or Export Natural Gas	Final Rule 65541	11/05/14

Energy Conservation Program: Test Procedures for Commercial Clothes Washers	Final Rule 71624	12/03/14
Energy Conservation Program: Energy Conservation Standards for Commercial Clothes Washers	Final Rule 74491	12/15/14
Federal Awarding Agency Regulatory Implementation of Office of Management and Budget's Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards	Final Rule 75867	12/19/14
Energy Conservation Program: Alternative Efficiency Determination Methods and Compliance for Commercial HVAC, Refrigeration, and Water Heating Equipment	Final Rule 144	01/05/15
Energy Conservation Program for Consumer Products: Test Procedures for Direct Heating Equipment and Pool Heaters	Final Rule 791	01/06/15
Energy Conservation Program: Energy Conservation Standards for Commercial Clothes Washers	Final Rule 1583	01/13/15
Energy Conservation Program: Energy Conservation Standards for General Service Fluorescent Lamps and Incandescent Reflector Lamps	Final Rule 4041	01/26/15
Energy Conservation Program: Energy Conservation Standards for Automatic Commercial Ice Makers	Final Rule 4645	01/28/15
Technical Amendments: Transfer of Office Functions	Final Rule 5005	01/30/15
Energy Conservation Program: Test Procedures for Fluorescent Lamp Ballasts	Final Rule 5896	02/04/15
Assistance to Foreign Atomic Energy Activities	Final Rule 9359	02/23/15
Energy Conservation Program: Energy Conservation Standards for Walk-in Coolers and Freezers	Final Rule 9591	02/24/15
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards and Test Procedures for Commercial Heating, Air-Conditioning, and Water-Heating Equipment; Correction	Final Rule 11857	03/05/15
Energy Conservation Program: Energy Conservation Standards for Walk-In Coolers and Freezers; Correction	Final Rule 12078	03/06/15

Acquisition Regulation: Technical and Administrative Changes to Department of Energy Acquisition Regulation	Final Rule 15517	03/24/15
Authority of DOE Protective Force Officers That Are Federal Employees To Make Arrests Without a Warrant for Certain Crimes	Final Rule 23689	04/29/15
Energy Conservation Program: Clarification for Energy Conservation Standards and Test Procedures for Fluorescent Lamp Ballasts	Final Rule 31971	06/05/15
Energy Conservation Program: Test Procedures for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps	Final Rule 37136	06/30/15
Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Test Procedures for Residential and Commercial Water Heaters; Correction	Final Rule 37953	07/02/15
Energy Conservation Program: Test Procedures for Conventional Ovens	Final Rule 37954	07/02/15
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards and Test Procedures for Commercial Heating, Air-Conditioning, and Water-Heating Equipment	Final Rule 42613	07/17/15
Energy Conservation Program: Energy Conservation Standards for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps	Final Rule 43161	07/21/15
Energy Conservation Program: Test Procedure for Refrigerated Bottled or Canned Beverage Vending Machines	Final Rule 45757	07/31/15
Energy Conservation Program: Test Procedures for Dehumidifiers	Final Rule 45801	07/31/15
Energy Conservation Program: Test Procedures for Clothes Washers	Final Rule 46729	08/05/15
Energy Conservation Program for Consumer Products: Definitions and Standards for Grid-Enabled Water Heaters	Final Rule 48004	08/11/15 08/21/15
Energy Conservation Program for Consumer Products: Test Procedures for Clothes Washers; Correction	Final Rule 50757	

Energy Conservation Program for Consumer Products: Definitions and Standards for Grid-Enabled Water Heaters	Final Rule 50757	08/21/15
Energy Conservation Program: Test Procedures for External Power Supplies	Final Rule 51424	08/25/15
Administrative Requirements for Grants and Cooperative Agreements	Final Rule 53235	09/03/15
Energy Conservation Program: Energy Conservation Standards for Packaged Terminal Air Conditioners and Packaged Terminal Heat Pumps; Correction	Final Rule 56894	09/21/15
Medical, Physical Readiness, Training, and Access Authorization Standards for Protective Force Personnel	Final Rule 57080	09/22/15
Energy Conservation Program: Energy Conservation Standards for Single Package Vertical Air Conditioners and Single Package Vertical Heat Pumps	Final Rule 57437	09/23/15
Uniform Administrative Requirements, Cost Principles and Audit Requirements for Federal Awards	Final Rule 57509	09/24/15
Energy Conservation Program for Consumer Products: Test Procedures for Clothes Washers; Correcting Amendments	Final Rule 62441	10/16/15
Acquisition Regulations: Export Control	Final Rule 64361	10/23/15
Energy Efficiency Standards for New Federal Commercial and Multi-Family High-Rise Residential Buildings' Baseline Standards Update	Final Rule 68749	11/06/15
Worker Safety and Health Program; Technical Amendments	Final Rule 69564	11/10/15
Energy Conservation Program: Energy Conservation Standards for Walk-In Coolers and Freezer	Final Rule 69837	11/12/15
Energy Conservation Program: Energy Conservation Standards for High-Intensity Discharge Lamps	Final Rule 76355	12/09/15
Energy Conservation Program: Test Procedures for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment	Final Rule FR 79655	12/23/15

Energy Conservation Program: Test Procedures for Ceiling Fan Light Kits	Final Rule 80209	12/24/15
Energy Conservation Program: Test Procedures for Commercial Prerinse Spray Valves	Final Rule 81441	12/30/15
Energy Conservation Program: Energy Conservation Standards for Ceiling Fan Light Kits	Final Rule FR 579	01/06/16
Energy Conservation Program: Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines	Final Rule 1027	01/08/16
Energy Conservation Program: Energy Conservation Standards for Residential Boilers	Final Rule 2319	01/15/16
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces	Final Rule 2419	01/15/16
Energy Conservation Program for Consumer Products: Test Procedures for Residential Furnaces and Boilers	Final Rule 2627	01/15/16
Energy Conservation Program: Test Procedure for Pumps	Final Rule 4085	01/25/16
Energy Conservation Program: Energy Conservation Standards for Pumps	Final Rule 4367	01/26/16
Energy Conservation Program for Consumer Products: Energy Conservation Standards for Residential Boilers; Correction	Final Rule 4574	01/27/16
Energy Conservation Program: Energy Conservation Standards for Commercial Prerinse Spray Valves	Final Rule 4747	01/27/16
Energy Conservation Program: Energy Conservation Standards for Standby Mode and Off Mode for Microwave Ovens; Correction	Final Rule 7965	02/17/16
Energy Conservation Program: Test Procedure for Pumps; Correction	Final Rule 15426	03/23/16
Energy Conservation Program: Test Procedures for Commercial Clothes Washers; Correction	Final Rule 20528	04/08/16
Energy Conservation Program for Consumer Products and Certain Commercial and Industrial Equipment: Determination of Portable Air Conditioners as a Covered Consumer Product	Final Rule 22514	04/18/16

Energy Conservation Program: Energy Conservation Standards for Refrigerated Bottled or Canned Beverage Vending Machines; Correction	Final Rule 24009	04/25/16
Energy Conservation Program: Clarification of Test Procedures for Fluorescent Lamps Ballasts	Final Rule 25595	04/29/16
Energy Conservation Program: Establishment of Procedures for Requests for Correction of Errors in Rules	Final Rule 26998	05/05/16
Energy Conservation Program: Exempt External Power Supplies Under the EPS Service Parts Act of 2014	Final Rule 30157	05/16/16
Energy Conservation Program: Test Procedure for Battery Chargers	Final Rule 31827	05/20/16
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air Conditioning and Heating Equipment and Commercial Warm Air Furnaces	Final Rule 32628	05/24/16
Energy Conservation Program: Test Procedures for Portable Air Conditioners	FR 35241	06/01/16
Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps	Final Rule 36991	06/08/16
Energy Conservation Program: Energy Conservation Standards for Battery Chargers	Final Rule 38265	06/13/16
Energy Conservation Program: Energy Conservation Standards for Dehumidifiers	Final Rule 38337	06/13/16
Inflation Adjustment of Civil Monetary Penalties	Final Rule 41790	06/28/16
Energy Conservation Program: Test Procedure for Battery Chargers	Final Rule 42235	06/29/16
Energy Conservation Program: Test Procedures for Integrated light-emitting Diode Lamps	Final Rule 43403	07/01/16
Energy Conservation Program: Enforcement of Regional Standards for Central Air Conditioners	Final Rule 45387	07/14/16
Energy Conservation Program: Final Coverage Determination; Test Procedures for Miscellaneous Refrigeration Products	Final Rule 46767	07/18/16

Energy Conservation Program: Test Procedures for Ceiling Fans	Final Rule 48619	07/25/16
Energy Conservation Program for Consumer Products: Final Coverage Determination; Test Procedures for Miscellaneous Refrigeration Products; Correction	Final Rule 49868	07/29/16
Energy Conservation Program for Certain Industrial Equipment: Energy Conservation Standards for Small, Large, and Very Large Air-Cooled Commercial Package Air-Conditioning and Heating Equipment and Commercial Warm Air Furnaces; Correction	Final Rule 53907	08/15/16
Energy Conservation Program: Test Procedures for Ceiling Fans; Correction	Final Rule 54721	08/17/16
Energy Conservation Program: Test Procedures for Central Air Conditioners and Heat Pumps; Correction	Final Rule 55111	08/18/16
Energy Conservation Program: Energy Conservation Standards for Dehumidifiers	Final Rule 56471	08/22/16
Energy Conservation Program: Notice of Partial Grant and Partial Denial of Petitions To Amend the Error Correction Rule	Final Rule 57745	08/24/16
Energy Conservation Program: Test Procedure for Compact Fluorescent Lamps	Final Rule 59385	08/29/16
Notice of Revised Procedures Affecting Applications and Authorizations for the In-Transit Movement of Natural Gas	Final Rule 59436	08/30/16

Department of Energy Rulemakings with Action Expected between November 1, 2016 and January 20, 2017 (Based on Fall 2016 Government-wide Agenda of Federal Regulatory and De-Regulatory Actions)

Notes: (1) The term "NPRM" means Notice of Proposed Rulemaking; (2) The term SNPRM means Supplemental Notice of Proposed Rulemaking; (3) The term DFR means Direct Final Rule; (4) The term RFI means Request for Information.

Category	**Name**	**Current Stage**	**Action Date**
Energy Efficiency Appliance Rulemakings	Energy Conservation Standards for Miscellaneous Refrigeration Products (1904-AC51)	Final Rule	11/00/2016
	Energy Conservation Standards for Commercial and Industrial Air Compressors (1904-AC83)	Final Rule	11/00/2016
	Energy Conservation Standards for Ceiling Fans (1904-AD28)	Final Rule	11/00/2016
	Energy Conservation Standards for Central Air Conditioners and Heat Pumps (1904-AD37)	Direct Final Rule	11/00/2016
	Energy Conservation Program for Consumer Products: Definitions for Residential Water Heaters (1904-AD48)	Final Rule	11/00/2016
	Energy Conservation Standards for Pool Heaters (1904-AD49)	NPRM	11/00/2016
	Test Procedures for Commercial and Industrial Air Compressors (1904-AD43)	Final Rule	11/00/2016
	Test Procedure for Commercial Water Heating Equipment (1904-AD18)	Final Rule	11/00/2016
	Test Procedure for Commercial Packaged Boilers (1904-AD16)	Final Rule	11/00/2016
	Certification, Compliance, and Enforcement for Electric Motors and Small Electric Motors (1904-AD25)	Final Rule	11/00/2016

	Proposed Determination to Treat Non-Compressor Residential Refrigeration Products as Covered Products (1904-AC66)	Final Determination	11/00/2016
	Energy Conservation Standards for Fans and Blowers (1904-AC55)	NPRM	11/00/2016
	Test Procedures for Traffic Signal Modules and Pedestrian Modules (1904-AC73)	NPRM	11/00/2016
	Certification, Compliance, and Enforcement for Consumer Products and Commercial and Industrial Equipment (1904-AD26)	NPRM	11/00/2016
	Energy Conservation Standards for Small Electric Motors and Other Electric Motors (1904-AD29)	RFI	11/00/2016
	Energy Conservation Standards for Fluorescent Lamp Ballasts (1904-AD51)	Preliminary Analysis	11/00/2016
	Energy Conservation Standards for Dedicated-Purpose Pool Pumps (1904-AD52)	DFR	12/00/2016
	Energy Conservation Standards for Walk-In Coolers and Walk-In Freezers (1904-AD59)	Final Rule	12/00/2016
	Energy Conservation Standards for Residential Non-Weatherized Gas Furnaces and Mobile Home Gas Furnaces (1904-AD20)	Final Rule	12/00/2016
	Energy Conservation Standards for Commercial Packaged Boilers (1904-AD01)	Final Rule	12/00/2016
	Energy Conservation Standards for Portable Air Conditioners (1904-AD02)	Final Rule	12/00/2016

	Energy Conservation Standards for General Service Lamps (1904-AD09)	Final Rule	12/00/2016
	Energy Conservation Standards for Commercial Water Heating Equipment (1904-AD34)	Final Rule	12/00/2016
	Energy Conservation Standards for Uninterruptible Power Supplies (1904-AD69)	Final Rule	12/00/2016
	Test Procedure for Dedicated Purpose Pool Pumps (1904-AD66)	Final Rule	12/00/2016
	Test Procedure for Cooking Products (1904-AD60)	Final Rule	12/00/2016
	Test Procedure for General Service Lamps (1904-AD64)	Final Rule	12/00/2016
	Test Procedure for Battery Chargers that are Uninterruptible Power Supplies (1904-AD69)	Final Rule	12/00/2016
	Test Procedure for Consumer and Certain Commercial Water Heaters (1904-AC91)	Final Rule	12/00/2016
	Test Procedures for Central Air Conditioners and Heat Pumps (1904-AD71)	Final Rule	12/00/2016
	Test Procedures for Walk-In Cooler and Freezer Refrigeration Systems) 1904-AD72)	Final Rule	12/00/2016
	Energy Conservation Program’s Certification and Enforcement-Import Data Collection (1990-AA44)	Final Rule	12/00/2016

	Energy Conservation Standards for Computers (1904-AD04)	NPRM	12/00/2016
	Test Procedure for Residential Clothes Dryers (1904-AD46)	NPRM	12/00/2016
	Energy Conservation Standards for Residential Conventional Cooking Products (1904-AD15)	SNPRM	12/00/2016
Other Energy Efficiency Rulemakings	Fossil Fuel-Generated Energy Consumption Reduction for New Federal Buildings and Major Renovations of Federal Buildings (1904-AB96)	Final Rule	11/00/2016
	Energy Efficiency Standards for Manufactured Housing (1904-AC11)	Final Rule	11/00/2016
	Energy Efficiency Design Standards for New Federal Low-Rise Residential Buildings (1904-AD56)	Final Rule	11/00/2016
	Sustainable Design Standards for New Federal Buildings and Major Renovations (1904-AD62)	Final Rule	11/00/2016
Health, Safety, and Security Rulemakings	Criteria and Procedures for Determining Eligibility for Access to Classified Matter or Special Nuclear Material (1992-AA36)	Final Rule	11/00/2016
	Safeguarding of Restricted Data by Access Permittees (1992-AA46)	NPRM	11/00/2016
	Occupational Radiation Protection (1992-AA51)	NPRM	11/00/2016

	Workplace Substance Abuse Programs at DOE Sites (1992-AA53)	NPRM	12/00/2016
	Human Reliability Program (1992-AA44)	Final Rule	01/00/2017
Procurement and Financial Assistance Rulemakings	Non-displacement of Qualified Workers Under Service Contracts and Other Changes to the Contractor Purchasing System Clause (1990-AC03)	Final Rule	12/00/2016
Other	Loan Guarantees for Projects That Employ Innovative Technologies (1901-AB28)	NPRM	11/00/2016
	Access to and Ownership of Records (1991-AC11)	NPRM	11/00/2016
	Export of Electricity and Permitting of Electricity Transmission Facilities at International Boundaries Administrative Procedures (1901-AB35)	NPRM	11/00/2016
	Convention on Supplementary Compensation for Nuclear Damage Contingent Cost Allocation (1990-AA39)	Final Rule	12/00/2016
	Grid Security Emergency Orders: Procedures for Issuance	Final Rule	12/00/2016
	Compliance with Floodplain and Wetland Environmental Review Requirements (1990-AA45)	NPRM	12/00/2016
	Nuclear Classification and Declassification (1992-AA49)	NPRM	12/00/2016

Rulemakings with Action After January 20, 2017 (Based on Fall, 2016 Government-wide Agenda of Federal Regulatory and De-Regulatory Actions)

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Category	**Name**	**Current Stage**	**Action Date**
Energy Efficiency Appliance Rulemakings	Test Procedures for Room Air Conditioners (1904-AD47)	NPRM	3/00/2017
	Test Procedures for Illuminated Exit Signs (1904-AC72)	NPRM	3/00/2017
	Test Procedure for Fluorescent Lamp Ballasts (1904-AD67)	NPRM	3/00/2017
	Energy Conservation Standards for Distribution Transformers (1904-AB39)	Framework Document	4/00/2017
	Energy Conservation Standards for Residential Dishwashers (1904-AD24)	SNPRM	6/00/2017
	Test Procedure for Televisions (1904-AD70)	NPRM	6/00/2017
Other	Procedural Rules for DOE Nuclear Activities (1992-AA52)	Final Rule	03/00/2017
	Revision of Technology Investment Agreement Regulations (1990-AA40)	NPRM	06/00/2017

	DOE Financial Assistance Regulation: Conflict of Interest (1991-AC09)	NPRM	06/00/2017
	DOE Acquisition Regulation-Nuclear Hazards Indemnity (1991-AC10)	NPRM	06/00/2017
	Protection of Nuclear Materials and Facilities (1992-AA54)	NPRM	06/00/2017
	Safeguarding of Restricted Data and Formerly Restricted Data by Federal Employees and Contractors (1992-AA48)	Final Rule	06/00/2017
	Chronic Beryllium Disease Prevention Program (1992-AA39)	Final Rule	10/00/2017

QUADRENNIAL ENERGY REVIEW:
ENERGY TRANSMISSION, STORAGE, AND DISTRIBUTION INFRASTRUCTURE

April 2015

Summary

TRANSFORMING U.S. ENERGY INFRASTRUCTURES IN A TIME OF RAPID CHANGE:

THE FIRST INSTALLMENT OF THE QUADRENNIAL ENERGY REVIEW

SUMMARY FOR POLICYMAKERS

The U.S. energy landscape is changing. The United States has become the world's leading producer of oil and natural gas combined. The country is less dependent on foreign oil, as a percentage of national oil consumption, than it has been since 1971. Current cars can go farther on a gallon of gas than ever before. Between 2005 and 2014, U.S. consumption of motor gasoline fell 2.6 percent despite population growth of 7.6 percent and gross domestic product growth of 13.0 percent. Additionally, as a result of changes in economic structure and conditions, and policies to promote energy efficiency, U.S. electricity consumption was flat over that 10-year period and total energy use declined by 1.9 percent.[a]

The composition of the Nation's energy supply has also started to shift: petroleum consumption is flat and coal consumption is declining, while the use of natural gas and renewables is growing. In 2014, renewable energy sources accounted for half of new installed electric-generation capacity, and natural gas units made up most of the remainder. Electricity generation from wind grew 3.3-fold between 2008 and 2014, and electricity generation from solar energy grew more than 20-fold.

The focus of U.S. energy policy discussions has shifted from worries about rising oil imports and high gasoline prices to debates about how much and what kinds of U.S. energy should be exported, concerns about the safety of transporting large quantities of domestic crude oil by rail, and the overriding question of what changes in patterns of U.S. energy supply and demand will be needed—and how they can be achieved—for the United States to do its part in meeting the global climate change challenge.

[a] The figures in this and the succeeding paragraph are from: Energy Information Administration. "Monthly Energy Review." March 2015. www.eia.gov/totalenergy/data/monthly/pdf/mer.pdf. The population data are from: Census Bureau. "Population Estimates." www.census.gov/popest/. Accessed April 5, 2015.

In the "Climate Action Plan" unveiled by President Obama in June 2013, he directed his Administration to initiate an interagency Quadrennial Energy Review (QER) to help ensure, in this dramatically changing energy landscape, that Federal energy policy is appropriately matched to the Nation's economic, security, and climate goals. The approximately annual installments of the QER over the ensuing 4 years are to focus on different components of the Nation's energy system—resource extraction and processing, energy transport and storage infrastructure, electricity generation, energy end-use—providing findings and recommendations on how Federal energy policy can best complement and incentivize state, local, tribal, and private sector actions so as to meet ongoing and emerging challenges and take advantage of new opportunities.

This first installment of the QER addresses infrastructures for energy transmission, storage, and distribution (TS&D), broadly defined as *infrastructures that link energy supplies, carriers, or by-products to intermediate and end users*. This focus was chosen because the dramatic changes in the U.S. energy landscape have significant implications for TS&D infrastructure needs and choices. Well-informed and forward-looking decisions that lead to a more robust and resilient infrastructure can enable substantial new economic, consumer service, climate protection, and system reliability benefits. Good decisions on TS&D infrastructure can also provide flexibility in taking advantage of new opportunities to achieve our national energy objectives.

This summary follows the organization of the main report, starting with an introduction to TS&D infrastructure issues (corresponding to Chapter I, Introduction, in the main report) and continuing with sections on the following:

- Increasing the Resilience, Reliability, Safety, and Asset Security of TS&D Infrastructure (Chapter II)
- Modernizing the Electric Grid (Chapter III)
- Modernizing U.S. Energy Security Infrastructures in a Changing Global Marketplace (Chapter IV)
- Improving Shared Transport Infrastructures (Chapter V)
- Integrating North American Energy Markets (Chapter VI)
- Addressing Environmental Aspects of TS&D Infrastructure (Chapter VII)
- Enhancing Employment and Workforce Training (Chapter VIII)
- Siting and Permitting of TS&D Infrastructure (Chapter IX).

The main report's treatment of the QER analytical and stakeholder process (Chapter X, Analytical and Stakeholder Process) and its appendices on technical details of TS&D infrastructure for liquid fuels, natural gas, and electricity are not covered in the Summary for Policymakers.

Introduction to TS&D Infrastructure Issues

The United States has one of the most advanced energy systems in the world, supplying the reliable, affordable, and increasingly clean power and fuels that underpin every facet of the Nation's economy and way of life. The energy TS&D infrastructure that links the components of that system with each other and with users is increasingly complex and interdependent. It includes approximately 2.6 million miles of interstate and intrastate pipelines; more than 640,000 miles of high-voltage transmission lines; 414 natural gas storage facilities; 330 ports handling crude petroleum and refined petroleum products; and more than 140,000 miles of railways that handle crude petroleum, refined petroleum products, liquefied natural gas, and coal. The components of the Nation's TS&D infrastructure considered in this report are listed in Table SPM-1.

The requirements that this TS&D infrastructure must meet are extensive and demanding. It must handle a diverse and evolving mix of energy sources and energy products; link sources, processors, and users across immense distances; match demands that vary on multiple time scales; co-exist with competing uses of the same systems (e.g., ports and railways); and perform 24 hours a day, 365 days a year with high reliability, which in turn requires both low susceptibility to disruptions and the resilience to recover quickly from whatever disruptions nonetheless occur. The longevity and high capital costs of energy TS&D infrastructure, moreover, mean that decisions made about how to locate, expand, and otherwise modify this infrastructure today will be influencing—either enabling or constraining—the size and composition of the national energy system for decades to come.

Challenges of TS&D Infrastructure Management and Policy

Much of the TS&D infrastructure is owned and operated by the private sector, and a significant portion of the related legal, regulatory, and policy development and implementation occurs at state and local levels. At the same time, the Federal Government controls and operates substantial TS&D infrastructure assets of its own, including inland waterways, thousands of miles of transmission lines, and strategic oil and product reserves. Some of the infrastructure elements owned by others are federally regulated with respect to aspects of siting, safety, environment, and reliability. A number of emergency authorities bearing on TS&D infrastructure are also vested in the Federal Government.

A further complexity affecting the TS&D infrastructure management and policy is that these infrastructures often reach across state and even international boundaries, thus affecting large regions and making multi-state and sometimes multi-national coordination essential for modernization, reliability, resilience, and flexibility. In addition, the large capital costs, scale, and "natural monopoly" characteristics of much TS&D infrastructure tend to perpetuate the role of incumbent providers; these circumstances constrain innovation and add to the usual litany of market failures—public goods, externalities, information deficits, perverse incentives—generally understood to warrant intervention through government policy when the proposed remedy is expected to have sufficient net benefits to overcome predictable ancillary and unintended consequences.

Table SPM-1. Components of TS&D Infrastructure Considered in this Installment of the QER

Fuel/Energy Carrier	TS&D Infrastructure Element/System
Electricity	Transmission lines and substations
	Distribution lines and distributed generation
	Electricity storage
	Other electric grid-related infrastructure
Natural Gas	Natural gas gathering lines
	Transmission pipelines
	Natural gas storage facilities
	Processing facilities
	Distribution pipelines and systems
	LNG production/storage facilities (including export terminals)
Coal	Rail, truck, barge transport
	Export terminals
Crude Oil/ Petroleum Products	Crude oil pipelines
	Crude oil and products import and export terminals
	Rail, truck, barge transport
	Oil refineries
	Strategic Petroleum Reserve & Regional Petroleum Product Reserves
	CO_2 pipelines (including for enhanced oil recovery)
Biofuels	Transport of feedstock and derived products, biorefineries

Source: Chapter 1, Table 1-1.

Given the complexity of this policy landscape, it should be obvious that Federal policies to encourage and enable modernization and expansion of the Nation's TS&D infrastructure must be well coordinated with state, local, tribal, and (sometimes) international jurisdictions. Full consideration must be given to the interaction of policy at all levels of government with private sector incentives and capabilities and include attention to opportunities for well-designed, purpose-driven, public-private partnerships.

Current Trends Affecting TS&D Infrastructure Choices

A number of changes in the U.S. energy landscape over the last decade were previously mentioned—dramatic changes in the pattern of domestic coal, petroleum, and natural gas production; a drastically altered outlook for energy imports and exports; large increases in electricity generation from wind and sunlight; and an increased priority on moving rapidly to reduce greenhouse gas (GHG) emissions from the energy sector. All of these trends have significant implications for the Nation's TS&D infrastructure. So does another trend that has been building for decades, which is lack of timely investment in refurbishing, replacing, and modernizing components of that infrastructure that are simply old or obsolete. These trends are elaborated briefly in the subsections that follow.

Aging Infrastructure and Changing Requirements

More than a decade ago, a Department of Energy (DOE) report pronounced the U.S. electricity grid "aging, inefficient, congested, and incapable of meeting the future energy needs of the information economy without significant operational changes and substantial public-private capital investment over the next several decades."[1] Although significant improvements have been made to the grid since then, the basic conclusion of the need to modernize the grid remains salient. The Edison Electric Institute estimated in 2008 that by 2030 the U.S. electric utility industry would need to make a total infrastructure investment of $1.5 trillion to $2.0 trillion, of which transmission and distribution are expected to account for about $900.0 billion.[2]

Modernization of the grid has been made all the more urgent by the increasing and now pervasive dependence of modern life on a reliable supply of electricity. Without that, navigation; telecommunication; the financial system; healthcare; emergency response; and the Internet, as well as all that depends on it, become unreliable. Yet the threats to the grid—ranging from geomagnetic storms that can knock out crucial transformers; to terrorist attacks on transmission lines and substations; to more flooding, faster sea-level rise, and increasingly powerful storms from global climate change—have been growing even as society's dependence on the grid has increased.

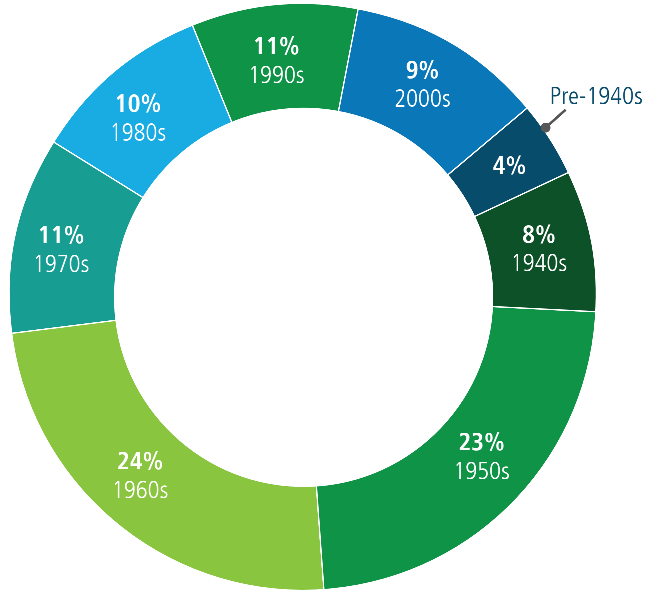
In addition, technology is altering expectations of what the grid should do. Once satisfied with a simple arrangement where utilities provided services and consumers bought power on fixed plans, individual consumers and companies increasingly want to control the production and delivery of their electricity, and enabling technology has become available to allow this. These trends, coupled with flat or declining electricity demand, could dramatically alter current utility business models, and they are already making it more important to appropriately value and use distributed generation, smart grid technologies, and storage.

Natural gas and oil TS&D infrastructures likewise face aging and obsolescence concerns. These infrastructures have not kept pace with changes in the volumes and geography of oil and gas production. The Nation's ports, waterways, and rail systems are congested, with the growing demands for handling energy commodities increasingly in competition with transport needs for food and other non-energy freight. Although improvements are being made, much of the relevant infrastructure—pipelines, rail systems, ports, and waterways alike—is long overdue for repairs and modernization.

One compelling example is the infrastructure for moving natural gas. Close to 50 percent of the Nation's gas transmission and gathering pipelines were constructed in the 1950s and 1960s—a build-out of the interstate pipeline network to respond to the thriving post-World War II economy (see Figure SPM-1). Analyses conducted for the QER suggest that natural gas interstate pipeline investment will range between $2.6 billion and $3.5 billion per year between 2015 and 2030, depending on the overall level of natural gas demand. The total cost of replacing cast iron and bare steel pipes in gas distribution systems is estimated to be $270 billion.[b]

[b] The American Gas Association reports that the total cost of replacing all cast iron pipe in the United States would be about $83 billion in 2011 dollars. American Gas Association. "Managing the Reduction of the Nation's Cast Iron Inventory." 2013. www.aga.org/managing-reduction-nation%E2%80%99s-cast-iron-inventory. Accessed January 16, 2015. According to Pipeline and Hazardous Materials Safety Administration data, cast iron pipes represent approximately 30 percent of the total leak-prone pipe in the United States. Therefore, assuming other pipe replacement has similar costs, the total cost for replacement of all leak-prone pipe is roughly $270 billion.

Figure SPM-1. Age by Decade of U.S. Gas Transmission and Gathering Pipelines



Source: Chapter 1, Figure 1-1.

The Nation's Strategic Petroleum Reserve (SPR) also requires attention. The design of the SPR and the infrastructure for utilizing it were determined in 1975, when domestic oil production was in decline, oil price and allocation controls separated the U.S. oil market from the rest of the world, there was no global commodity market for oil at all, and there were no hedging mechanisms to manage risk. The SPR requires updating in light of changed circumstances, including significant maintenance and upgrades to enhance its distribution capability.

Climate Change

Energy TS&D infrastructure has always been shaped not only by the mix of energy supply technologies and end-use patterns, but also by the characteristics of the environment where the infrastructure must operate, including, for example, terrain, vegetation, soil and seismic conditions, and climate. It has long been true, as well, that choices about TS&D infrastructure have had to take into account the need to limit that infrastructure's adverse impacts on the environment.

By far the most important environmental factor affecting TS&D infrastructure needs now and going forward is global climate change. Sea-level rise, thawing permafrost, and increases in weather extremes are already affecting TS&D infrastructure in many regions. The need to mitigate global climate change by reducing GHG emissions, moreover, is accelerating changes in the mix of energy supply options and end-use patterns, and over time, it is likely to become the dominant such influence. Reducing GHG emissions from TS&D infrastructure, including methane emissions from the transmission and distribution of natural gas, will be increasingly important in this context.

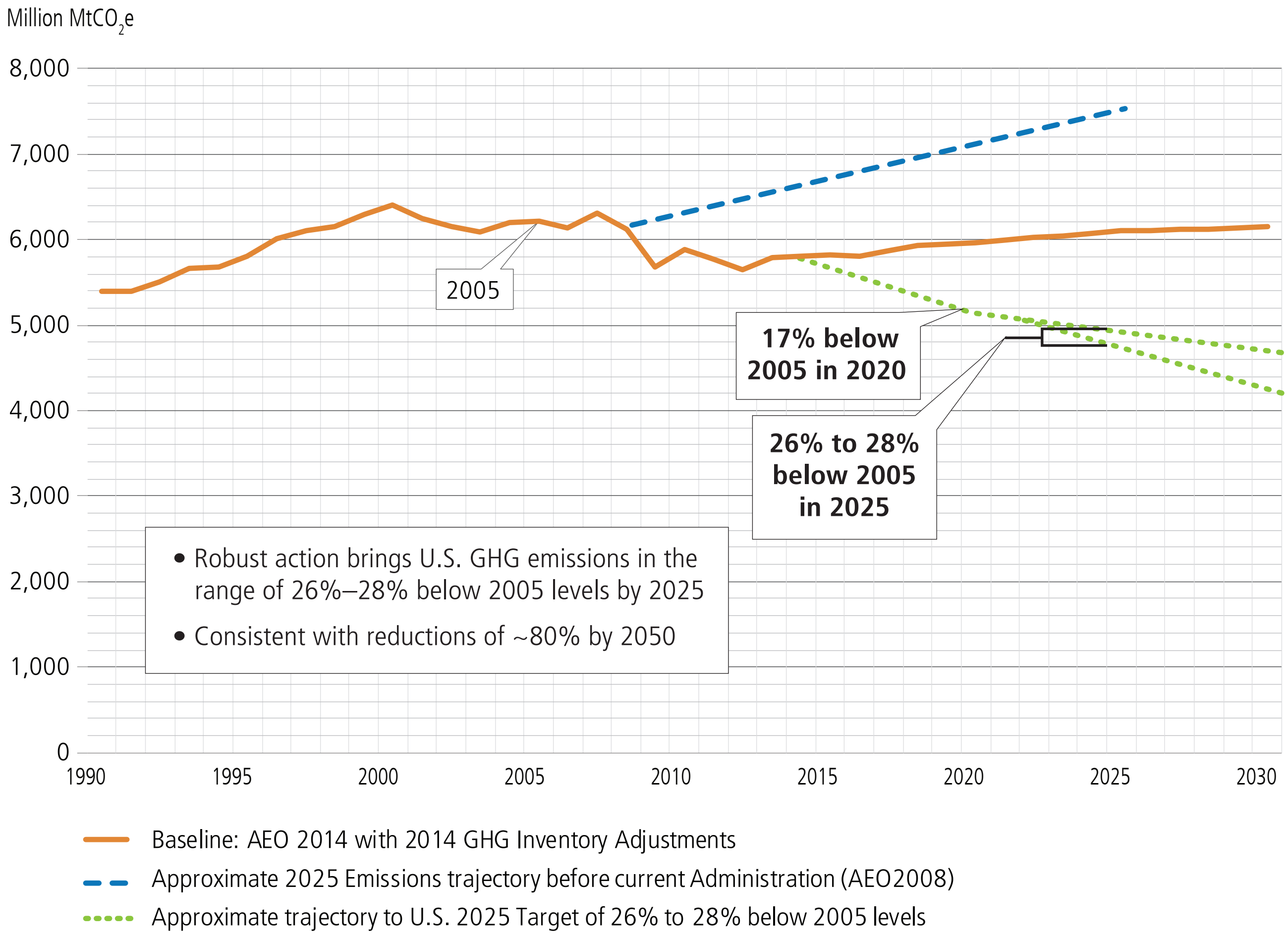
The key relevant conclusions from climate science—as embodied in the most recent reports of the Intergovernmental Panel on Climate Change, the National Academy of Sciences (jointly with the Royal Society of London), and the Third National Climate Assessment of the Global Change Research Program[3, 4, 5]—are that GHGs emitted by civilization's energy system are the dominant cause of changes in climate being observed across the globe; that the changes are not just in average conditions, but in extremes, are already causing harm to life, health, property, economies, and ecosystem processes; and that deep reductions in GHG emissions will be required if an unmanageable degree of global climate change is to be avoided.

Actions taken in the first term of the Obama Administration in response to the climate change challenge included major investments in a cleaner, more efficient U.S. energy future in the American Recovery and Reinvestment Act of 2009 and subsequent Presidential budgets; the promulgation of the first-ever joint fuel economy/GHG emission standards for light-duty vehicles and new, more stringent energy efficiency standards for commercial and residential appliances; and the announcement of a U.S. emissions reduction target in the range of 17 percent below the 2005 level by 2020. These steps were followed in the second term by the President's announcement, in June 2013, of a new "Climate Action Plan" with three pillars: reducing U.S. emissions of GHGs, increasing domestic preparedness for and resilience against the changes in climate that can no longer be avoided, and engaging internationally to encourage and assist other countries in taking similar steps.[6, 7]

Among the actions subsequently taken under the "Climate Action Plan," those with potential relevance for the future of TS&D infrastructure include a new Strategy for Reducing Methane Emissions nationwide; acceleration of permitting for new renewable energy projects on public lands and military installations; Executive Orders requiring that Federal departments and agencies—including those with responsibilities relating to TS&D infrastructure—take climate change into account in all of their policies and programs; and the announcement, in November 2014, of a post-2020 U.S. GHG emissions reduction target of 26 percent to 28 percent below the 2005 level by 2025.

The actions under the "Climate Action Plan" put the United States on a path to meet the Administration's 2020 and 2025 targets through several means, including the establishment of carbon emission standards for the power sector that will drive further shifts to low- and zero-carbon fuels, cleaner electricity generation technologies, and continuing improvements in end-use efficiency. Historic and projected U.S. emissions under these latest targets are shown in Figure SPM-2. While the Administration's 2020 and 2025 targets are ambitious, it is clear that continued reduction in GHG emissions will be needed beyond 2025 in the United States and globally. These reductions will continue to drive significant changes in TS&D infrastructure in the longer term.

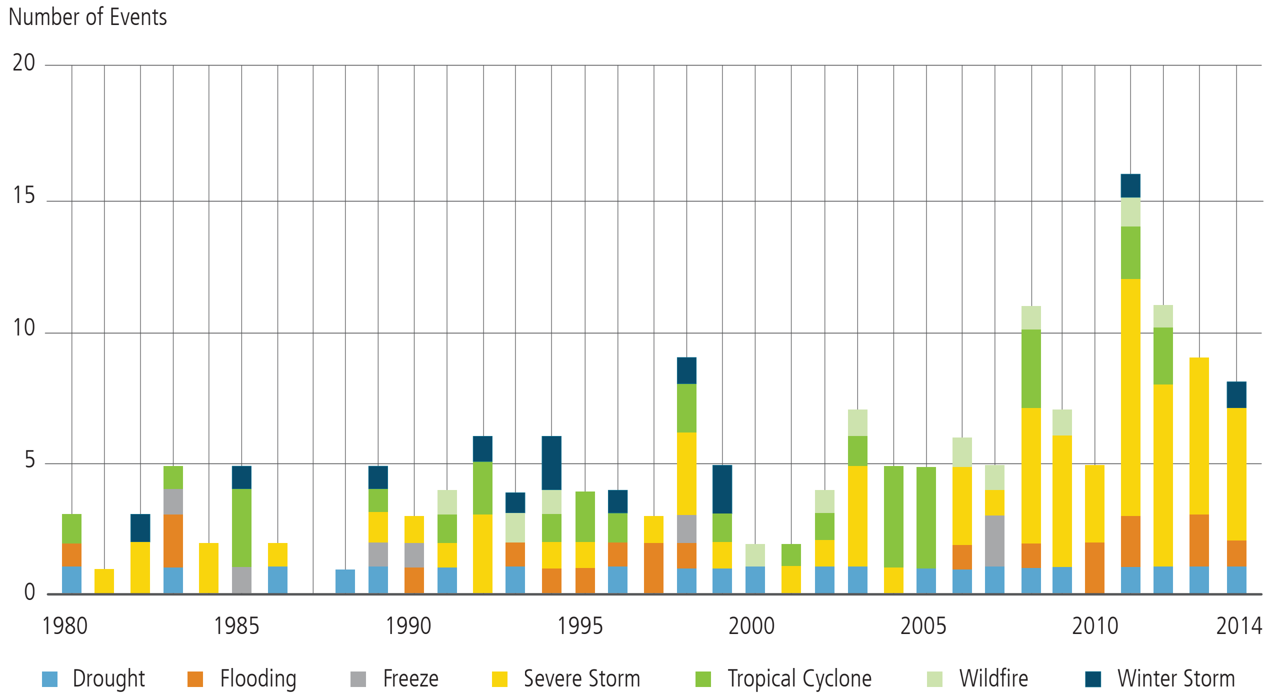
Figure SPM-2. Historic and Projected U.S. GHG Emissions under Obama Administration Targets



Source: Chapter 1, Figure 1-8.

Meanwhile, the ongoing impacts of global climate change have already been stressing energy TS&D infrastructure in a variety of ways. Extreme weather events with high societal costs have been increasing (see Figure SPM-3), a trend expected to intensify under continuing climate change. This means greater vulnerabilities for TS&D infrastructure from hurricanes, drought, extreme temperatures, wildfires, more intense precipitation events, and flooding. Climate change is also driving sea-level rise, which interacts with storm surge and heavy downpours to intensify coastal flooding, and it has been thawing large areas of permafrost in the far North, with impacts on pipelines, roads, and other energy-linked infrastructure.

Figure SPM-3. Billion-Dollar Disaster Event Types by Year



Source: Chapter 2, Figure 2-2.

Goals for TS&D Infrastructure Policy

This first installment of the QER analyzes how to leverage authorities, expertise, and resources to help modernize and transform the extensive, interlocking, capital-intensive networks constituting the national energy TS&D system so as to meet, in a complex jurisdictional environment, the evolving set of requirements and challenges just described. This report presents a set of findings and recommendations, organized around the high-level goals of energy security, economic competitiveness, and environmental responsibility, in the context of a set of analytically derived objectives that reflect an integrated assessment of the adequacy of existing TS&D infrastructures to meet these goals. These objectives include the following:

- Enhancing TS&D infrastructure resilience, reliability, safety, and asset security
- Modernizing the electric grid
- Modernizing the segments of TS&D infrastructure essential for collective energy security
- Improving the increasingly stressed TS&D infrastructures that are shared by energy and other goods and commodities.

These objectives are also informed and affected by an additional set of crosscutting needs and requirements, namely the following:

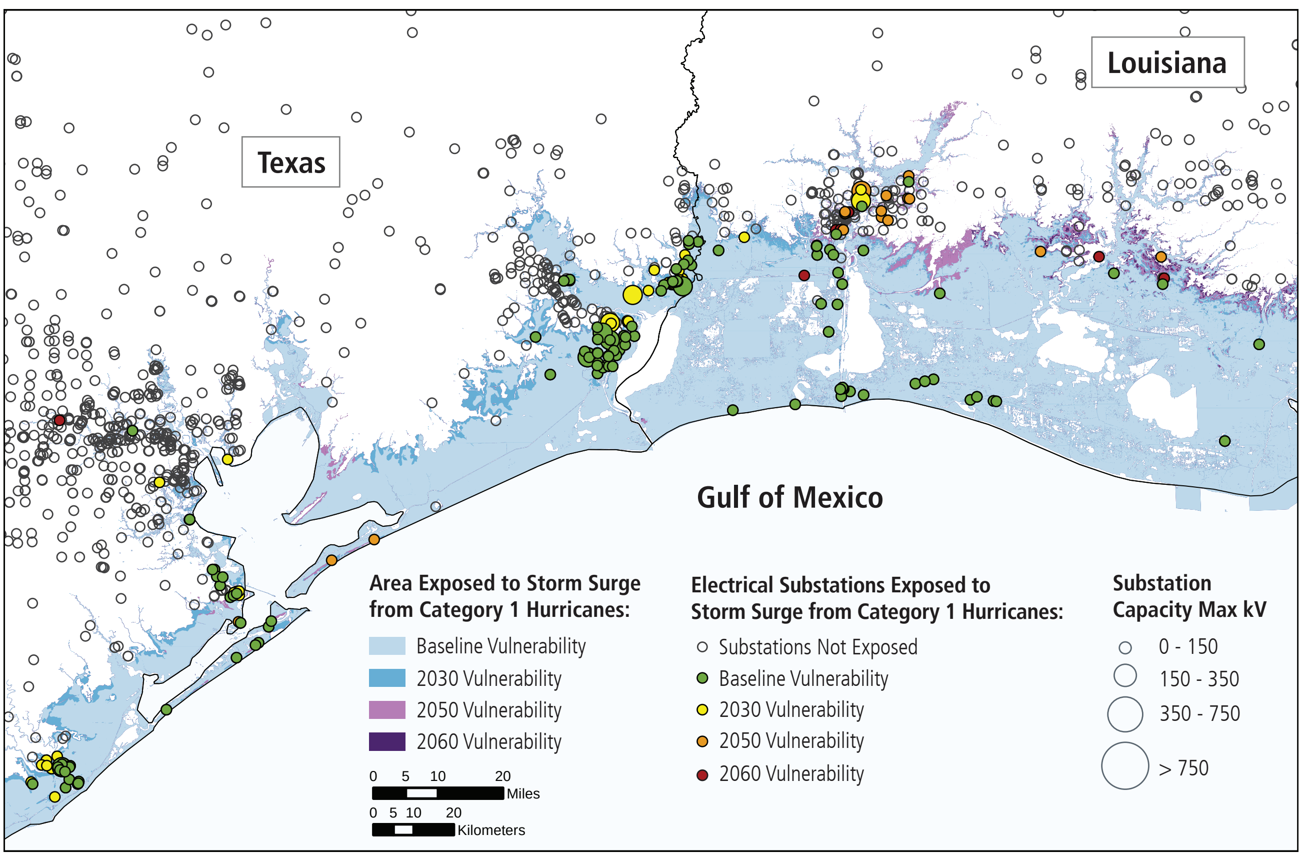
- Promoting environmental responsibility in developing, managing, and updating TS&D infrastructure, including reducing emissions from infrastructure that could contribute to climate change
- Developing and training the workforce needed for a 21st century energy infrastructure
- Expediting the siting of critical TS&D infrastructures to meet a range of energy needs and policy objectives
- Enhancing North American energy market integration.

Modernizing the Nation's TS&D infrastructures will also help enhance U.S. competitiveness in a global economy, and it will support jobs—approximately 1 million people were employed in energy transmission and distribution jobs in 2013, or almost 0.75 percent of U.S. civilian jobs; modernization will increase those numbers.

Increasing the Resilience, Reliability, Safety, and Asset Security of TS&D Infrastructure

Ensuring the resilience, reliability, safety, and security of TS&D infrastructure is a national priority and vital to American competitiveness, jobs, energy security, and a clean energy future. The imperative for TS&D infrastructure in the United States, going forward, is to maintain the high performance of existing systems; to continue to accommodate significant growth in domestic energy supplies; and to manage and adapt to new technologies, threats, and vulnerabilities in cost-effective ways. For example, severe weather is the leading source of electric grid disturbances in the United States. In fact, between 2003 and 2012, an estimated 679 widespread power outages occurred due to severe weather, costing the U.S. economy $18 billion to $33 billion each year between 2003 and 2013. This risk is growing; the number of Gulf Coast electricity substations exposed to inundation caused by storm surge from Category 1 storms is projected to increase from 255 to 337 by 2030 due to sea-level rise (see Figure SPM-4). TS&D infrastructures are becoming increasingly interconnected and interdependent, so disruptions from climate change, natural disasters, and cyber and physical incidents can have serious consequences beyond the specific TS&D infrastructure system that is directly affected.

Figure SPM-4. Gulf Coast Electricity Substation Facilities' Exposure to Storm Surge under Different Sea-Level Rise Scenarios



Source: Chapter 2, Figure 2-4.

Key Findings

Mitigating energy disruptions is fundamental to infrastructure resilience. Mitigating energy disruptions is particularly important because other critical infrastructures rely on energy services to operate, and these interdependencies are growing. Should disruptions occur, it is essential to have comprehensive and tested emergency response protocols to stabilize the system and begin recovery.

TS&D infrastructure is vulnerable to many natural phenomena. These include hurricanes, earthquakes, drought, wildfires, flooding, and extreme temperatures. Some extreme weather events have become more frequent and severe due to climate change, and this trend will continue. Sea-level rise resulting from climate change, coupled with coastal subsidence in the Mid-Atlantic and Gulf Coast regions, increases risks and damages to coastal infrastructure caused by storm surge.

Threats and vulnerabilities vary substantially by region. In many cases, a particular natural threat or infrastructure vulnerability will be region-specific (e.g., Gulf Coast hurricanes threatening refineries), limiting the utility of national, one-size-fits-all solutions for reliability and resilience. Regional solutions are essential.

Recovery from natural gas and liquid fuel system disruptions can be difficult. Although liquid fuels and natural gas disruptions are less likely than electricity disruptions, it is relatively more difficult to recover from disruptions to these systems than electric systems. Recovery from pipeline disruptions is particularly difficult because of the need to locate and repair underground breakages.

Cyber incidents and physical attacks are growing concerns. Cyber incidents have not yet caused significant disruptions in any of the three sectors, but the number and sophistication of threats are increasing, and information technology systems are becoming more integrated with energy infrastructure. There have been physical attacks; while some physical protection measures are in place throughout TS&D infrastructure systems, additional low-cost investments at sensitive facilities would greatly enhance resilience.

High-voltage transformers are critical to the grid. They represent one of its most vulnerable components. Despite expanded efforts by industry and Federal regulators, current programs to address the vulnerability may not be adequate to address the security and reliability concerns associated with simultaneous failures of multiple high-voltage transformers.

Assessment tools and frameworks need to be improved. Research has focused more on characterizing vulnerabilities and identifying mitigation options than on measuring the effects of best practices for response and recovery. In addition, assessment tools and frameworks tend to characterize the impacts of disruptions on system performance, but are less able to examine impacts on national or regional consequences like economic loss or loss of life.

Shifts in the natural gas sector are having mixed effects on resilience, reliability, safety, and asset security. The addition of onshore shale gas infrastructure benefits natural gas resilience by decreasing the percentage of infrastructure exposed to storms. The Energy Information Administration (EIA) reports that the Gulf Coast percentage of natural gas production went from 18 percent in 2005 to 6 percent in 2013. On the other hand, overall reliance on gas for electricity has gone up, creating a new interdependence and grid vulnerability. Furthermore, additional export infrastructure resulting from the natural gas boom would increase vulnerabilities to coastal threats, such as sea-level rise.

Dependencies and interdependencies are growing. Many components of liquid fuels and natural gas systems—including pumps, refineries, and about 5 percent of natural gas compressor stations—require electricity to operate. The interdependency of the electricity and gas systems is growing as more gas is used in power generation.

Aging, leak-prone natural gas distribution pipelines and associated infrastructures prompt safety and environmental concerns. Most safety incidents involving natural gas pipelines occur on natural gas distribution systems. These incidents tend to occur in densely populated areas.

Selected Recent Federal Government Actions

The Federal Government, the states, and the private sector all play crucial roles in ensuring that energy infrastructures are reliable, resilient, and secure. In 2013, President Obama released Presidential Policy Directive-21, *Critical Infrastructure Security and Resilience,* establishing national policy on critical infrastructure security and resilience and refining and clarifying the critical infrastructure-related functions, roles, and responsibilities across the Federal Government, as well as enhancing overall coordination and collaboration. The directive applies to all critical infrastructures, but calls out energy infrastructures as being *uniquely* critical due to the enabling functions they provide across all other critical infrastructures. Other recent Federal Government actions include the following:

- **Creating the Build America Investment Initiative.** The Administration has created this initiative—an interagency effort led by the Departments of Treasury and Transportation—to promote increased investment in U.S. infrastructure, particularly through public-private partnerships.
- **Enhancing grid resilience to geomagnetic storms.** In June 2014, the Federal Energy Regulatory Commission adopted a new reliability standard to mitigate the impacts of geomagnetic disturbances on the grid. In November 2014, the Administration established an interagency Space Weather Operations, Research, and Mitigation Task Force to develop a National Space Weather Strategy, to include mitigation of grid vulnerability.
- **Improving safety of natural gas transmission pipelines.** The Pipeline and Hazardous Materials Safety Administration of the Department of Transportation (DOT) is currently developing a proposed rule on integrity management for natural gas pipelines. In addition, the Federal Energy Regulatory Commission has issued a policy statement that will allow interstate natural gas pipelines to recover certain expenditures made to modernize pipeline system infrastructure in a manner that enhances system reliability, safety, and regulatory compliance.
- **Developing and operating regional refined petroleum product reserves.** DOE created the Northeast Gasoline Supply Reserve in 2014 and continues to manage the Northeast Home Heating Oil Reserve.
- **Enhancing emergency preparedness.** The National Petroleum Council, in response to a request from the Secretary of Energy, recently completed an Emergency Preparedness Study to help industry and government achieve a more rapid restoration of motor fuel supplies after a natural disaster.

Recommendations in Brief

To continue to drive progress toward addressing these TS&D infrastructure challenges, we recommend taking the following additional actions:

Develop comprehensive data, metrics, and an analytical framework for energy infrastructure resilience, reliability, safety, and asset security. DOE, in collaboration with the Department of Homeland Security and interested infrastructure stakeholders, should develop common analytical frameworks, tools, metrics, and data to assess the resilience, reliability, safety, and security of energy infrastructures.

Establish a competitive program to accelerate pipeline replacement and enhance maintenance programs for natural gas distribution systems. DOE should establish a program to provide financial assistance to states to incentivize cost-effective improvements in the safety and environmental performance of natural gas distribution systems through targeted funding to offset incremental costs to low-income households and funding for enhanced directed inspection and maintenance programs.

Support the updating and expansion of state energy assurance plans. DOE should undertake a multi-year program of support for state energy assurance plans, focusing on improving the capacity of states and localities to identify potential energy disruptions, quantify their impacts, share information, and develop and exercise comprehensive plans that respond to those disruptions and reduce the threat of future disruptions.

Establish a competitive grant program to promote innovative solutions to enhance energy infrastructure resilience, reliability, and security. DOE should establish a program to provide competitively awarded grants to states to demonstrate innovative approaches to TS&D infrastructure hardening and enhancing resilience and reliability. A major focus of the program would be the demonstration of new approaches to enhance regional grid resilience, implemented through the states by public and publicly regulated entities on a cost-shared basis.

Analyze the policies, technical specifications, and logistical and program structures needed to mitigate the risks associated with loss of transformers. As part of the Administration's ongoing efforts to develop a formal national strategy for strengthening the security and resilience of the entire electric grid for threats and hazards (planned for release in 2015), DOE should coordinate with the Department of Homeland Security and other Federal agencies, states, and industry on an initiative to mitigate the risks associated with the loss of transformers. Approaches for mitigating this risk should include the development of one or more transformer reserves through a staged process.

Analyze the need for additional or expanded regional product reserves. DOE should undertake updated cost-benefit analyses for all of the regions of the United States that have been identified as vulnerable to fuel supply disruptions to inform subsequent decisions on the possible need for additional regional product reserves.

Integrate the authorities of the President to release products from regional petroleum product reserves into a single, unified authority. Congress should amend the trigger for the release of fuel from the Northeast Home Heating Oil Reserve and from the Northeast Gasoline Supply Reserve so that they are aligned and properly suited to the purpose of a product reserve, as opposed to a crude oil reserve.

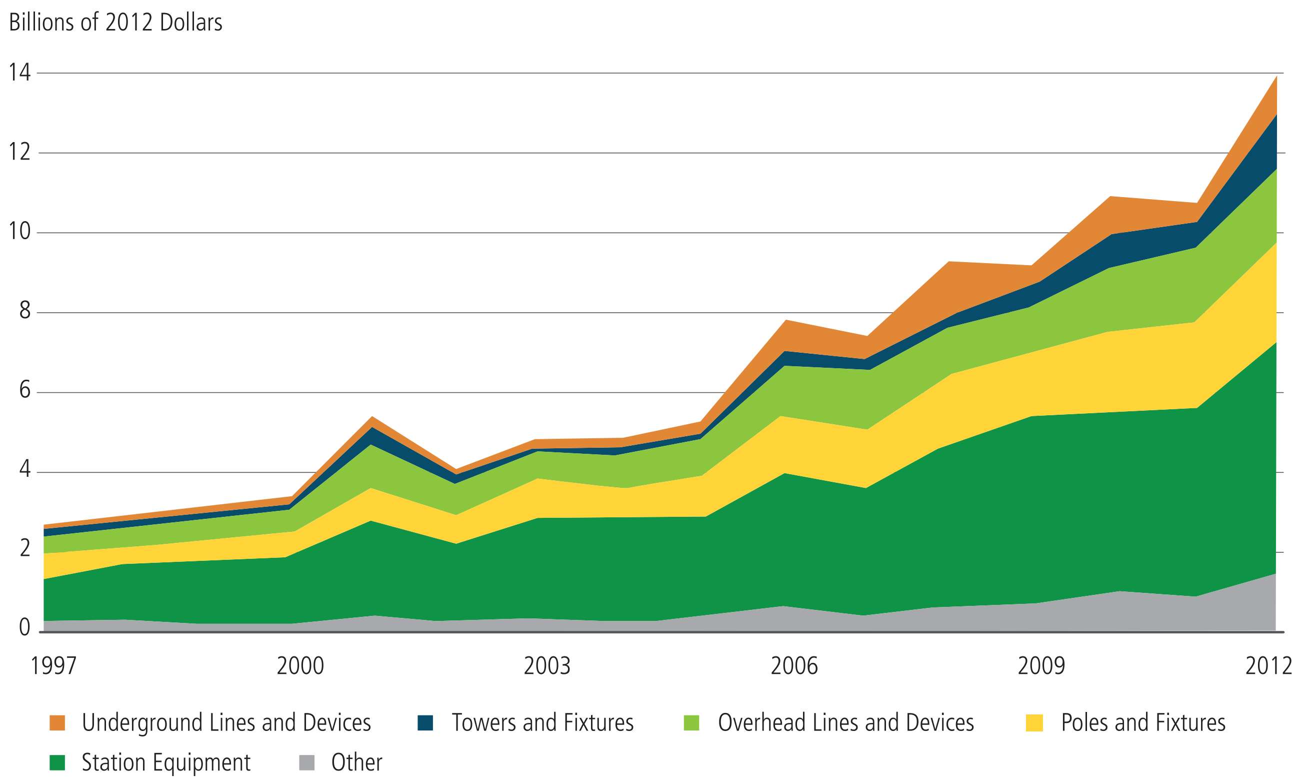
Modernizing the Electric Grid

Electricity is central to the well-being of the Nation. The United States has one of the world's most reliable, affordable, and increasingly clean electric systems, but the U.S. electric system is currently at a strategic inflection point—a time of significant change for a system that had had relatively stable rules of the road for nearly a century. The U.S. electricity sector is being challenged by a variety of new forces, including a changing generation mix; low load growth; increasing vulnerability to severe weather because of climate change; and growing interactions at the Federal, state, and local levels. Innovative technologies and services are being introduced to the system at an unprecedented rate—often increasing efficiency, improving reliability, and empowering customers, but also injecting uncertainty into grid operations, traditional regulatory structures, and utility business models. Modernizing the grid will require that these challenges be addressed.

Key Findings

Investments in transmission and distribution upgrades and expansions will grow. It is anticipated that in the next two decades, large transmission and distribution investments will be made to replace aging infrastructure; maintain reliability; enable market efficiencies; and aid in meeting policy objectives, such as GHG reduction and state renewable energy goals. Recent increases in investment in transmission infrastructure by investor-owned utilities are shown in Figure SPM-5.

Figure SPM-5. Investment in Transmission Infrastructure by Investor-Owned Utilities, 1997–2012



Source: Chapter 3, Figure 3-3.

Both long-distance transmission and distributed energy resources can enable lower-carbon electricity. The transmission network can enable connection to high-quality renewables and other lower-carbon resources far from load centers; distributed energy resources can provide local low-carbon power and efficiency.

The potential range of new transmission construction is within historic investment magnitudes. Under nearly all scenarios analyzed for the QER, circuit-miles of transmission added through 2030 are roughly equal to those needed under the base case, and while those base case transmission needs are significant, they do not appear to exceed historical yearly build rates.

Flexible grid system operations and demand response can enable renewables and reduce the need for new bulk-power-level infrastructure. End-use efficiency, demand response, storage, and distributed generation can reduce the expected costs of new transmission investment.

Investments in resilience have multiple benefits. Investments in energy efficiency, smart grid technologies, storage, and distributed generation can contribute to enhanced resiliency and reduced pollution, as well as provide operational flexibility for grid operators.

Innovative technologies have significant value for the electricity system. New technologies and data applications are enabling new services and customer choices. These hold the promise of improving consumer experience, promoting innovation, and increasing revenues beyond the sale of electric kilowatt-hours.

Enhancing the communication to customer devices that control demand or generate power will improve the efficiency and reliability of the electric grid. For example, open interoperability standards for customer devices and modified standards for inverters will improve the operation of the grid.

Appropriate valuation of new services and technologies and energy efficiency can provide options for the utility business model. Accurate characterization and valuation of services provided to the grid by new technologies can contribute to clearer price signals to consumers and infrastructure owners, ensuring affordability, sustainability, and reliability in a rapidly evolving electricity system.

Consistent measurement and evaluation of energy efficiency is essential for enhancing resilience and avoiding new transmission and distribution infrastructure. Efficiency programs have achieved significant energy savings, but using standard evaluation, measurement, and verification standards, like those recommended by DOE's Uniform Methods Project, is key to ensuring that all the benefits of efficiency are realized, including avoiding the expense of building new infrastructure.

States are the test beds for the evolution of the grid of the future. Innovative policies at the state level that reflect differences in resource mix and priorities can inform Federal approaches.

Different business models and utility structures rule out "one-size-fits-all" solutions to challenges. A range of entities finance, plan, and operate the grid. Policies to provide consumers with affordable and reliable electricity must take into account the variety of business models for investing, owning, and operating grid infrastructure.

Growing jurisdictional overlap impedes development of the grid of the future. Federal and state jurisdiction over electric services are increasingly interacting and overlapping.

Selected Recent Federal Government Actions

In addition to resilience-related activities aimed at the electric grid (e.g., large power transformer) discussed in the Chapter II (Increasing the Resilience, Reliability, Safety, and Asset Security of TS&D Infrastructure), the Administration has undertaken the following activities aimed at creating the electric grid of the future:

- **Promoting grid modernization.** DOE has made a comprehensive grid modernization proposal in the President's Fiscal Year (FY) 2016 Budget request. The crosscutting proposal supports strategic DOE investments in foundational technology development, enhanced security capabilities, and greater institutional support and stakeholder engagement, all of which are designed to provide the tools necessary for the evolution to the grid of the future. Specific elements include the following:

- A new State Energy Reliability and Assurance Grants program for grants to states, localities, regions, and tribal entities for electricity TS&D reliability planning.
- A program directed at research and development (R&D) on transformer protection from geomagnetic fields.
- Increases directed at improved controls, sensors, power electronics, and connection to energy storage.
- Increases in the Smart Grid program to develop next-generation distribution management system and controls to accommodate new end-use technologies and develop microgrid systems.
- Increases in R&D to improve building control system interoperability with new grid control systems and improve building internal controls to adapt to efficient and improved grid connectivity.
- Increases to link plug-in electric vehicle systems to building and grid systems.

Recommendations in Brief

The Administration and Congress should support or incentivize investment in electricity infrastructure reliability, resilience, and affordability through the development of tools, methods, and new funding for planning and operating the grid of the future. Accordingly, we recommend the following:

Provide grid modernization R&D, analysis, and institutional support. DOE should continue to pursue a multi-year, collaborative, and cost-shared research and development, analysis, and technical assistance program for technology innovation that supports grid operations, security, and management; and for analyses, workshops, and dialogues to highlight key opportunities and challenges for new technology to transform the grid.

Establish a framework and strategy for storage and grid flexibility. DOE should conduct regional and state analyses of storage deployment to produce a common framework for the evaluation of benefits of storage and grid flexibility, and a strategy for enabling grid flexibility and storage that can be understood and implemented by a wide range of stakeholders.

Conduct a national review of transmission plans and assess barriers to their implementation. DOE should carry out a detailed and comprehensive national review of transmission plans, including assessments on the types of transmission projects proposed and implemented, current and future costs, consideration of interregional coordination, and other factors. A critical part of this review should be to assess incentives and impediments to the development of new transmission.

Provide state financial assistance to promote and integrate TS&D infrastructure investment plans for electricity reliability, affordability, efficiency, lower carbon generation, and environmental protection. In making awards under this program, DOE should require cooperation within the planning process of energy offices, public utility commissions, and environmental regulators within each state; with their counterparts in other states; and with infrastructure owners and operators and other entities responsible for maintaining the reliability of the bulk power system.

Coordinate goals across jurisdictions. DOE should play a convening role to bring together public utility commissioners, legislators, and other stakeholders at the Federal, state, and tribal levels to explore approaches to integrate markets, while respecting jurisdictional lines, but allowing for the coordination of goals across those lines.

Value new services and technologies. DOE should play a role in developing frameworks to value grid services and approaches to incorporate value into grid operations and planning. It should convene stakeholders to define the characteristics of a reliable, affordable, and environmentally sustainable electricity system and create approaches for developing pricing mechanisms for those characteristics. The goal should be to develop frameworks that could be used by the Federal Energy Regulatory Commission, state public utility commissions in ratemaking proceedings, Regional Transmission Organizations in their market rule development, or utilities in the operation and planning of their systems.

Improve grid communication through standards and interoperability. In conjunction with the National Institute of Standards and Technology and other Federal agencies, DOE should work with industry, the Institute of Electrical and Electronics Engineers, state officials, and other interested parties to identify additional efforts the Federal Government can take to better promote open standards that enhance connectivity and interoperability on the electric grid.

Establish uniform methods for monitoring and verifying energy efficiency. Through its Uniform Methods Project, DOE should accelerate the development of uniform methods for measuring energy savings and promote widespread adoption of these methods in public and private efficiency programs.

Modernizing U.S. Energy Security Infrastructures in a Changing Global Marketplace

Until recently, the concept of energy security has focused on "oil security" as a proxy for "energy security." It is clear, however, that energy security needs to be more broadly defined to cover not only oil, but other sources of supply, and to be based not only on the ability to withstand shocks, but also to be able to recover quickly from any shocks that do occur. In addition, security is not exclusively domestic; it is dependent on interactions in the interconnected global energy market. U.S. energy security and the infrastructure that supports it should be viewed in the context of this new, broader, more collective definition of energy security.

Key Findings

Multiple factors affect U.S. energy security. These include U.S. oil demand; the level of oil imports; the adequacy of emergency response systems; fuel inventory levels; fuel substitution capacity; energy system resilience; and the flexibility, transparency, and competitiveness of global energy markets.

The United States has achieved unprecedented oil and gas production growth. Oil production growth has enabled the United States to act as a stabilizing factor in the world market by offsetting large sustained supply outages in the Middle East and North Africa and, later, contributing to a supply surplus that has reduced oil prices to levels not seen since March 2009. The natural gas outlook has also changed tremendously. Just 10 years ago, it was projected that the United States would become highly dependent on liquefied natural gas imports, whereas the current outlook projects that the United States will have enormous capacity and reserves and could become a major liquefied natural gas exporter.

The United States is the world's largest producer of petroleum and natural gas. Combined with new clean energy technologies and improved fuel efficiency, U.S. energy security is stronger than it has been for over half a century. Nonetheless, challenges remain in maximizing the energy security benefits of our resources in ways that enhance our competitiveness and minimize the environmental impacts of their use.

The network of oil distribution ("the midstream") has changed significantly. Product that had historically flowed through pipelines from south to north now moves from north to south, and multiple midstream modes (pipelines, rail, and barges) are moving oil from new producing regions to refineries throughout the United States.

The SPR's ability to offset future energy supply disruptions has been adversely affected by domestic and global oil market developments coupled with the need for upgrades. Changes in the U.S. midstream (for example, competing commercial demands and pipeline reversals) and lower U.S. dependence on imported oil have created challenges to effectively distributing oil from the reserve. This diminishes the capacity of the SPR to protect the U.S. economy from severe economic harm in the event of a global supply emergency and associated oil price spike.

Increasing domestic oil production has focused attention on U.S. oil export laws established in the aftermath of the 1973–1974 Arab Oil Embargo. There are now concerns that the U.S. oil slate may be too light for U.S. refineries; although, recent Department of Commerce clarifications that liquid hydrocarbons, after they have been processed through a crude oil distillation tower, are petroleum products, and therefore eligible for export, will help avoid adverse production impacts.

An extensive network of pipelines, electric transmission lines, roads, rail, inland waterways, and ports link the United States with Mexico and Canada. These systems provide not only economic value to all three nations, but also enhance continental energy security and improve system reliability.

Biofuel production in the United States has increased rapidly over the last decade, enhancing energy security and reducing emissions of GHGs from transportation. This growth has been driven in part by the Renewable Fuel Standard. Ethanol now displaces approximately 10 percent of U.S. gasoline demand by volume; biodiesel, advanced, and cellulosic biofuel production volumes have also been growing. Continued growth in ethanol use will depend in part on investment in additional distribution capacity; growth in the use of other biofuels, such as "drop-in" fuels, will depend on continued investment in research, development, demonstration, and deployment.

Selected Recent Federal Government Actions

- **Testing the capabilities of the SPR.** In March 2014, DOE conducted a test sale to demonstrate the drawdown and distribution capacity of the SPR. This test sale highlighted changes needed in the distribution infrastructure in the Gulf Coast region.
- **Addressing SPR deferred maintenance backlogs.** The President's FY 2016 Budget Request provided $257 million for the development, operation, and management of the SPR, including funding to address the backlog of deferred maintenance on the SPR.
- **Addressing changes in propane TS&D infrastructure.** DOE has responded to changes in TS&D infrastructure for propane and other natural gas liquid by adding capability at the EIA to monitor propane inventories on a more granular, state-by-state basis.

Recommendations in Brief

Update SPR release authorities to reflect modern oil markets. Congress should update SPR release authorities to allow the SPR to be used more effectively to prevent serious economic harm to the United States in case of energy supply emergencies.

Invest to optimize the SPR's emergency response capability. DOE should analyze appropriate SPR size and configuration, and, after carrying out detailed engineering studies, DOE should make infrastructure investments to the SPR and its distribution systems to optimize the SPR's ability to protect the U.S. economy in an energy supply emergency.

Support other U.S. actions related to the SPR and energy security infrastructures that reflect a broader and more contemporary view of energy security. The United States should continue to consult with allies and key energy trading partners on energy security issues, building on the G-7 principles on energy security.

Support fuels diversity through research, demonstration, and analysis. DOE and the Department of Defense should continue research and demonstration activities to develop biofuels that are compatible with existing petroleum fuel infrastructure, especially in aviation and for large vehicles. DOE should provide technical support to states, communities, or private entities wishing to invest in infrastructure to dispense higher-level ethanol blends. DOE should ensure adequate support for data collection and analysis on fuels, like propane, that play an important role in the Nation's diverse energy mix and where delivery is challenged by changing TS&D infrastructures.

Undertake a study of the relationship between domestic shipping and energy security. The relevant agencies should conduct a study of the economic, engineering, logistics, workforce, construction, and regulatory factors affecting the domestic shipping industry's ability to support U.S. energy security. The Secretary of Transportation should ensure that the National Maritime Strategy includes a consideration of the energy security aspects of maritime policy in its discussion and recommendations.

Improving Shared Transport Infrastructures

Changes in U.S. energy production and use are stressing and transforming the way that energy and other commodities are transported in the United States. Some energy commodities, such as coal and ethanol, have traditionally relied on rail and barge transport to move from suppliers to distribution points and end users. Their use of transportation modes (e.g., rail, barge, and truck transport) that are also shared by agricultural and other major commodities is being joined by significant growth in the use of these transport modes by crude oil, refined petroleum products, and petrochemicals. Increasingly, the shipment of oil from the wellhead to a refinery may employ a combination of trucks, pipelines, railcars, barges, and other marine vessels—giving oil transportation in the United States a more multi-modal character. Since these transportation modes have been, and continue to be, used for transporting other commodities, they are considered in the QER to be "shared transport infrastructures" for energy commodities. The growing utilization of rail, barge, and truck for oil transport, as well as for other energy supplies and materials, exacerbates underlying issues in these shared transport infrastructures and underscores the need for an expanded infrastructure investment as proposed by the Administration.

Key Findings

Rapid crude oil production increases have changed the patterns of flow of North American midstream (pipelines, rail, and barge) liquids transport infrastructure. Pipelines that previously delivered crude oil from the Gulf of Mexico to Midcontinent refineries have now changed direction to deliver domestic and Canadian oil to the Gulf of Mexico. In addition, oil produced in North Dakota is now being shipped to refineries on the East and West Coasts of the United States. As a result, modes of transport other than pipelines are being employed to move crude oil, including a significant increase in crude oil unit trains and barge shipments.

Limited infrastructure capacities are intensifying competition among commodities, with some costs passed on to consumers. Until new additional capacity becomes available, the competition among commodity groups for existing capacity will intensify. The proximity of Bakken crude oil movements and Powder River Basin coal movements, along with agricultural shipments in the region, affect Midwest power plants and the food industry. Typically, rail and barge service are the most cost-effective shipping methods available for moving grain and other relatively low-value, bulk agricultural commodities, and the Department of Agriculture has indicated that disruptions to agricultural shipments caused by recent unexpected shifts in supply and demand for rail services exceed even those caused by Hurricane Katrina.

Rail, barge, and truck transportation are crucial for ethanol shipment. Ethanol production in the United States has increased over the last few decades. Ethanol is typically shipped from production plants by rail and then delivered by truck (or directly by rail or barge) to petroleum product terminals. Ethanol is likely to rely on shared infrastructure for its transport for the foreseeable future.

The ability to maintain adequate coal stockpiles at some electric power plants has been affected by rail congestion. The Surface Transportation Board (STB) recently acted to require weekly reports of planned versus actual loadings of coal trains.

Funding for the U.S. freight transportation system is complex and involves a combination of Federal, state, local, and private investments. Railroad infrastructure is primarily owned and maintained by the private sector. The marine transportation infrastructure involves a mix of Federal, state, local, and private investments, and roadways are owned and maintained by a range of Federal, state, local, and—in some cases—even private entities.

Navigable waterways are essential for the movement of energy commodities, equipment, and materials, especially petroleum and refined petroleum products. Investments in construction, rehabilitation, and maintenance of this infrastructure must be balanced against other investments, including other water resource investments, such as flood and coastal storm damage reduction projects and aquatic ecosystem restoration.

Increased transportation of crude oil by rail and barge has highlighted the need for additional safeguards. For rail transport, in particular, the Federal Government has a number of efforts underway, including a rulemaking on improving the safety of rail transport of crude oil, including more robust tank car standards and operational requirements, to address these concerns.

Multi-modal shared transportation infrastructure is stressed by increased shipments of energy supplies, materials, and components. Wind turbine blades, for example, have more than tripled in length since the 1980s. Transporting components of this size (and others of significant weight and size, such as large power transformers) creates a range of challenges, including wear on roads, many of which are rural; the need to coordinate movement through ports, tunnels, overpasses, and turning areas; and additional permitting and police escort requirements.

Selected Recent Federal Government Actions

The stresses on shared transport infrastructures as a result of changes in energy production have resulted in a series of responses and initiatives across the Administration, including both regulatory initiatives on the part of responsible agencies for specific infrastructures and broader initiatives to provide new resources to help the modernization of these shared infrastructures. These include the following:

- **Addressing congestion and service for rail transport of commodities.** In light of the problems of rail congestion affecting shipments of key commodities, STB, an independent regulatory body in DOT, has taken a number of actions. Starting in October 2014, STB has required all major (Class I) railroads to publicly file weekly data reports regarding service performance of unit trains carrying coal, crude oil, ethanol, and grain. In December 2014, STB initiated a formal notice and comment rulemaking proceeding for weekly performance data reporting by the Class I railroads and also the freight railroads serving the Chicago gateway. STB has two ongoing proceedings on rail business practices aimed at helping shippers to gain competitive access to railroads and be protected against unreasonable freight rail transportation rates.
- **Improving safe shipment of crude oil by rail.** DOT and other Federal agencies have been taking action to respond to heightened awareness and concern over rail shipments of crude oil from the Bakken and ethanol. DOT issued a proposed rule in August 2014 containing comprehensive proposed standards to improve the rail transportation safety of flammable liquids, including unit trains of crude oil and ethanol. A final rule is anticipated to be issued in mid-2015. DOE, in cooperation with the Pipeline and Hazardous Materials Safety Administration, is supporting studies on the properties (including behavior in fires) of crude oil. The Federal Emergency Management Agency has assessed training needs and requirements in 28 states with oil rail routes identified by DOT. The interagency National Response Team Training Subcommittee launched Emerging Risks Responder Awareness Training for Bakken Crude Oil to help responders better prepare for these incidents.

- **Doubling the size of the Inland Waterways Trust Fund.** This fund currently pays 50 percent of the Federal cost for construction, replacement, rehabilitation, and expansion costs for inland and intracoastal waterways. In December 2014, Congress authorized an increase in the fuel tax supporting this fund from the current $0.20 per gallon to $0.29 per gallon, which took effect April 1, 2015. In addition, the President's Fiscal Year 2016 Budget proposes a new per-vessel user fee that will raise $1.1 billion over the next 10 years, effectively doubling the level of resources available in the Fund.
- **Helping ports through the DOT Maritime Administration StrongPorts initiative.** This program is developing tools and initiatives helpful to port authorities that are pursuing modernization projects, including those interested in public-private partnerships. While the StrongPorts initiative does not provide direct financial assistance, the recently released guide provides an additional resource regarding financing for ports.
- **Creating a multi-modal freight grant program through the GROW AMERICA Act.** The Administration has proposed the GROW AMERICA Act, which includes $18 billion over 6 years to establish a new multi-modal freight grant program to fund innovative rail, highway, and port facilities that will improve the efficient movement of goods across the country. The Generating Renewal, Opportunity, and Work with Accelerated Mobility, Efficiency, and Rebuilding of Infrastructure and Communities throughout America Act (GROW AMERICA Act) also will give shippers and transportation providers a stronger role in working with states to collaborate and establish long-term freight strategic plans.
- **Expanding funding for the DOT TIGER grant program.** The Transportation Investment Generating Economic Recovery (TIGER) program is a competitive grant program that funds state and local transportation projects across the United States. The Administration's GROW AMERICA Act proposal will provide $7.5 billion over 6 years to the TIGER grant program, more than doubling it.

Recommendations in Brief

Enhance the understanding of important safety-related challenges of transport of crude oil and ethanol by rail and accelerate responses. Key activities at DOE and DOT should be strongly supported.

Further analyze the effects of rail congestion on the flow of other energy commodities, such as ethanol and coal. DOE, STB, and the Federal Energy Regulatory Commission should continue to develop their understanding of how rail congestion may affect the delivery of these energy commodities.

Analyze the grid impacts of delayed or incomplete coal deliveries. In assessing these issues, DOE and other relevant agencies should examine whether a minimum coal stockpile for electricity reliability should be established for each coal-fired unit.

Address critical energy data gaps in the rail transport of energy commodities and supplies. Congress should fund the President's FY 2016 Budget Request for the EIA to address critical energy transportation data gaps and continued data sharing with the STB.

Support alternative funding mechanisms for waterborne freight infrastructure. The Administration should form an ongoing Federal interagency working group to examine alternative financing arrangements for waterborne transportation infrastructure and to develop strategies for public-private partnerships to finance port and waterway infrastructure.

Support a new program of competitively awarded grants for shared energy transport systems. A new grant program—Actions to Support Shared Energy Transport Systems, or ASSETS—should be established and supported at DOT, in close cooperation with DOE. This program should be dedicated to improving energy transportation infrastructure connectors. A Federal investment in ASSETS would likely mobilize additional and significant non-Federal investment, based on typical TIGER cost shares.

Support public-private partnerships for waterborne transport infrastructure. Developing a set of shared priorities for investment ensures that public and private sector needs are met.

Coordinate data collection, modeling, and analysis. DOE should lead an interagency effort with DOT, the Department of Agriculture, the Army Corps of Engineers, and the Coast Guard—in cooperation with other relevant agencies with data regarding marine, rail, and other energy transport modes—to improve and coordinate their respective data collection, analytical, and modeling capabilities for energy transport on shared infrastructures.

Assess the impacts of multi-modal energy transport. DOE, working with DOT and the Army Corps of Engineers, should conduct a one-time comprehensive needs assessment of investment needs and opportunities to upgrade the Nation's energy-related shared water transport infrastructure.

Assess energy component transportation. DOE, in coordination with relevant agencies, should examine routes for transportation of energy system-related equipment, materials, and oversized components. The assessment would include the capacity of the Nation's transportation infrastructure systems to safely accommodate more frequent and larger shipments where analyses indicate such transport will be required.

Integrating North American Energy Markets

The United States, Canada, and Mexico, as well as other North American neighbors, benefit from a vast and diverse energy TS&D network that can enable the region to achieve economic, energy security, and environmental goals. Continued integration of the North American energy markets will increase those benefits and address structural changes and constraints that have arisen since new production, processing, consumption, and policies have taken effect.

Energy system integration is in the long-term interest of the United States, Canada, and Mexico, as it expands the size of energy markets, creates economies of scale to attract private investment, lowers capital costs, and reduces energy costs for consumers. There is already a robust energy trade between the United States and Canada (more than $140 billion in 2013) and the United States and Mexico (more than $65 billion in 2012).

The scope and magnitude of the existing and ongoing energy integration among the United States, Canada, and Mexico goes far beyond any one particular infrastructure or project, and continuing to foster this integration is an enduring interest on the part of each country. While a smaller market, there are also needs and opportunities for greater energy trade and integration with individual nations and islands in the Caribbean.

The North American Arctic region, including Alaska and U.S. territorial waters in the Bering, Chukchi, and Beaufort Seas, as well as Canada and its territorial waters, is experiencing rapid changes on land and at sea due to the changing climate. These changes have important implications for TS&D infrastructure in this region. Warming in the North American Arctic is resulting in increased risk of land subsidence from thawing permafrost, which threatens TS&D infrastructure. It also leads to a reduction in late-summer sea ice extent, which will affect offshore energy and mineral exploration and extraction in U.S. and Canadian waters.

Key Findings

The United States has significant energy trade with Canada and Mexico, including oil and refined products, gas, and electricity. Canada is the largest energy trading partner of the United States, with energy trade valued at $140 billion in 2013. Mexican energy trade was valued at $65 billion in 2012. Both countries are reliable sources of secure energy supplies.

Greater coordination will improve energy system efficiency and build resiliency to disruptions of the North American energy market; it will also improve energy market data exchanges and regulatory harmonization.

The electricity systems of the United States and Canada are fully interconnected. There are currently more than 30 active major transmission connections between the United States and Canada, trading approximately $3 billion worth of electricity in 2014. If the transmission projects filed with DOE in the last 5 years are constructed, they would add approximately 4,100 megawatts of additional hydropower to the U.S. electricity mix.

Canadian natural gas production is expected to slightly outpace consumption with exports rising slowly over the projection period. Oil production is anticipated to continue to grow over the next 30 years.

Mexico has reformed its energy sector. Mexico amended its constitution and reformed its energy sector in 2013, retaining government control over its assets while opening oil and gas resources to private sector exploration and development. These reforms provide an opportunity for increased trade with the United States.

Increasing U.S. natural gas exports may help Mexico generate more gas-fired electricity and achieve its environmental goals.

Changing climate conditions in the Arctic are expected to continue with the melting of permafrost and reduced sea ice extent, which will affect increasing energy development that is underway. This presents both an opportunity for greater cooperation between the United States and Canada, but also a need for both countries to undertake risk mitigation.

There is an opportunity to reduce Caribbean electricity costs and emissions. The Caribbean is largely reliant on foreign sources of oil with little energy resources of its own. Energy demand is driven largely by electricity generation, mostly from fuel oil. A 30 percent decrease in carbon dioxide (CO_2) emissions could be achieved by displacement of fuel oil by natural gas—and even more if this were combined with renewable energy.

Selected Recent Federal Government Actions

Recognizing the importance of North American energy, the Administration has been undertaking a number of activities to promote market integration and to address the challenges we share in the North American Arctic region, including the following:

- **Improving data exchange.** The United States, Canada, and Mexico are creating a framework for the sharing of publicly available information and data on their respective energy systems. This initiative was formalized in a memorandum of understanding (MOU) signed by DOE, Canada's Ministry of Natural Resources, and Mexico's Ministry of Energy on December 15, 2014. The President's FY 2016 Budget Request provides an increase of $1 million to the EIA for the purpose of carrying out this collaboration.

- **Leading the Arctic Council.** In April 2015, the United States assumed the chairmanship of the Arctic Council for a 2-year period. This will provide the United States with the opportunity to implement increased international collaboration in such areas as addressing the impact of climate change and Arctic Ocean stewardship and scientific research. In addition to this leadership role in Arctic policy, there is an opportunity for increased and enduring cooperation between the United States and Canada on issues such as Arctic energy infrastructure and climate and ocean science as an important future dimension to the U.S.-Canadian energy relationship.

- **Partnering with remote communities to develop renewable energy.** DOE's National Renewable Energy Laboratory, in partnership with the Department of the Interior, has developed the Remote Communities Renewable Energy partnership to develop, demonstrate, and deploy smaller-scale technologies for remote communities, such as in the Arctic, to utilize local renewable energy resources, reduce diesel fuel dependence and distribution requirements, and create independent microgrid operations.
- **Pursuing a Caribbean Energy Security Initiative.** In 2014, Vice President Biden announced the Caribbean Energy Security Initiative, which recognizes the diversity of Caribbean nations' economies, natural resources, and energy constraints. Led by the State Department, in coordination with the U.S. Overseas Private Investment Corporation, DOE, and other agencies, the initiative seeks to improve energy sector governance, to increase access to affordable finance, and to improve communication and coordination among regional governments and their development partners.

Recommendations in Brief

Continue advances that have been made in the North American energy dialogue. The United States, Canada, and Mexico should encourage further business exchanges and regular minister-level engagement.

Increase the integration of energy data among the United States, Canada, and Mexico. Provide resources for the EIA to collaborate with its Canadian and Mexican counterparts to systematically compare their respective export and import data, validate data, and improve data quality. In addition, efforts should be taken to better share geographic information system data to develop energy system maps and review forward-looking assessments and projections of energy resources, flows, and demand.

Undertake comparative and joint energy system modeling, planning, and forecasting. Enhance comparative and joint modeling, planning, and forecasting activities among U.S., Canadian, and Mexican energy ministries and related governmental agencies. The current scale of activities has aided bilateral and individual goals; however, increasing trilateral engagement on planning, modeling, or forecasting activities would capture greater efficiencies and enhance each country's ability to reach economic, security, and environmental goals. DOE's Offices of Energy Policy and Systems Analysis and International Affairs would lead modeling workshops with their Canadian and Mexican counterparts to share methodologies and collaborate on North American analysis.

Establish programs for academic institutions and not-for-profits to develop legal, regulatory, and policy roadmaps for harmonizing regulations across borders. In partnership with universities, qualified not-for-profits, and relevant U.S. energy regulatory authorities, state/provincial, local, and national energy regulations will be compared to identify gaps, best practices, and inconsistencies with regulations in Canada and/or Mexico with the goal of harmonization.

Coordinate training and encourage professional interactions. This should involve the technical staff in government agencies of the three North American countries that share similar responsibilities to evaluate and implement cross-border energy projects.

Partner with Canada and the Arctic Council on Arctic energy safety, reliability, and environmental protection. Joint work should emphasize research and information sharing on the effects of spills and the effectiveness of countermeasures, the identification and mobilization of the resources necessary to mitigate the effects of a pollution incident, and the development of international guidelines for preparedness and response in this logistically challenging region.

Partner with Canada and the Arctic Council on energy delivery to remote areas. This should be done through promoting and disseminating the work of the Remote Community Renewable Energy partnership.

Promote Caribbean energy TS&D infrastructure. As part of a larger Caribbean strategy, the United States should support the diversification of energy supplies, including actions to facilitate the introduction of cleaner forms of energy and development of resilient energy TS&D infrastructure in the Caribbean.

Addressing Environmental Aspects of TS&D Infrastructure

Energy TS&D infrastructure affects the environment in a variety of ways. While it is important to address the direct environmental impacts and vulnerabilities of TS&D infrastructure, this infrastructure also has enormous potential to enable better environmental performance for the energy system more broadly. Key examples include CO_2 pipeline infrastructure to enable carbon sequestration, smart grid technologies to enable energy efficiency, and long-distance transmission to enable utilization of remote renewable resources. Energy efficiency also reduces the need for new infrastructure.

Understanding the potential positive and negative effects of TS&D infrastructure on the achievement of overall environmental goals—including climate mitigation—is key to siting, constructing, operating, and maintaining TS&D infrastructure in an environmentally responsible manner. Many QER recommendations in other chapters touch on actions that will enhance the ability of the United States to achieve its environmental goals. This chapter focuses on those that relate specifically to the environmental impacts posed by TS&D infrastructure itself.

Key Findings

TS&D infrastructure can serve as a key enabler for—or barrier to—better environmental outcomes. Certain types of TS&D infrastructure enable improvements in system-wide environmental performance at lower cost, such as electric transmission and distribution infrastructure to access renewable energy resources and interstate natural gas pipelines which can facilitate CO_2 emission reductions from the electric power sector.

TS&D infrastructure contributes a relatively small share of total air and water pollution from the energy sector. TS&D infrastructure covered by this installment of the QER contributes to nearly 10 percent of U.S. GHG emissions. Many of the environmental issues related to TS&D infrastructure are subject to rules established by existing statute and regulation.

Energy infrastructure can have direct, indirect, and cumulative land-use and ecological impacts. The nature and magnitude of those impacts depend on a number of factors, including whether construction of a facility will affect endangered species or sensitive ecological areas, or cause land-use impacts such as top-soil erosion or habitat fragmentation.

Energy transport, refining, and processing infrastructure contribute to emissions of criteria air pollutants that pose risks to public health and the environment. Ports and rail yards with high densities of vehicles and congestion often have high concentrations of pollutants and increase risks to nearby urban communities. Reducing emissions of particulate matter from aircraft, locomotives, and marine vessels would have public health benefits. Low-income and minority households are two to three times more likely to be affected by freight-based diesel particulate pollution than the overall U.S. population.

Transportation of crude oil by pipeline, rail, and waterborne vessels has safety and environmental impacts. The Federal Government has a number of efforts underway to mitigate these impacts, including a rulemaking on rail transport of crude oil.

The United States currently has a network of more than 4,500 miles of CO_2 transportation pipelines that can be a critical component of a low-carbon future. The pipelines mostly transport naturally occurring CO_2, but new projects are increasingly linking captured CO_2 from electric power plants and other industrial sources to a productive use in oil fields (through CO_2 enhanced oil recovery) and safe storage in deep saline formations.

Selected Recent Federal Government Actions

In addition to the efforts to improve natural gas pipeline safety discussed under Chapter II (Increasing the Resilience, Reliability, Safety, and Asset Security of TS&D Infrastructure), which will have environmental benefits, the Administration is undertaking a number of other initiatives to reduce methane emissions and address environmental effects of TS&D infrastructure. They include the following:

- **Setting a national goal to reduce methane emissions.** Building on the 2014 interagency Strategy to Reduce Methane Emissions, in January 2015, the President announced a national goal to reduce methane emissions from the oil and gas sector by 40 percent to 45 percent from 2012 levels by 2025.
- **Establishing standards for methane emissions from new and modified sources.** The Environmental Protection Agency (EPA) has initiated a rulemaking to set standards for methane and volatile organic compound emissions from new and modified oil and gas production sources and natural gas processing and transmission sources. EPA will issue a proposed rule in the summer of 2015, and a final rule will follow in 2016.
- **Modernizing natural gas transmission and distribution infrastructure.** Following on its methane roundtables, DOE is taking steps to encourage reduced GHG emissions, including the following:
  - Issuing energy efficiency standards for natural gas and air compressors
  - Funding was proposed in the FY 2016 Budget to advance R&D to bring down the cost of detecting leaks and to improve estimates of methane emissions from midstream natural gas infrastructure for incorporation into EPA's Greenhouse Gas Inventory
  - Implementing an Advanced Natural Gas System Manufacturing Research and Development Initiative
  - Partnering with the National Association of Regulatory Utility Commissioners to help modernize natural gas distribution infrastructure
  - Issuing an Advanced Fossil Energy Projects Solicitation inviting applicants to apply for developing new methane reduction technologies
  - Developing a clearinghouse of information on effective technologies, policies, and strategies.
- **Working cooperatively with industry to reduce methane emissions.** EPA is working to expand on its successful Natural Gas STAR Program by launching a new partnership in collaboration with key stakeholders later in 2015. EPA will work with DOE, DOT, and leading companies—individually and through broader initiatives, such as the One Future Initiative and the Downstream Initiative—to develop and verify robust commitments to reduce methane emissions.
- **Reducing other air pollution from TS&D infrastructure systems.** A number of Administration initiatives are reducing air pollution from TS&D infrastructure. Examples of this include the EPA's guidelines to states to reduce ozone precursors from oil and gas systems; DOE's work to improve the energy efficiency of equipment powering natural gas transmission systems and other TS&D infrastructure; DOT's Federal Highway Administration funding of state and local programs that reduce air emissions through its Congestion Mitigation and Air Quality Improvement program; and funding of the National Clean Diesel Campaign, which issues grants to eligible entities for projects to reduce emissions from existing diesel engines, which are pervasive in TS&D infrastructure.

Recommendations in Brief

Improve quantification of emissions from natural gas TS&D infrastructure. Congress should approve the $10 million requested in the FY 2016 Budget to help update Greenhouse Gas Inventory estimates of methane emissions from natural gas systems. DOE and EPA should undertake a coordinated approach, building on stakeholder input, to ensure that new research and analysis is targeted toward knowledge gaps unaddressed by other researchers.

Expand R&D programs at DOE on cost-effective technologies to detect and reduce losses from natural gas TS&D systems. DOE should leverage its R&D efforts in this area to facilitate broader air quality benefits.

Invest in R&D to lower the cost of continuous emissions monitoring equipment. To further improve safety and reduce emissions from natural gas systems, additional R&D—as proposed in the FY 2016 Budget—is needed to reduce costs and enable deployment of continuous emissions monitoring technologies.

Support funding to reduce diesel emissions. To protect workers and nearby communities through further reductions in diesel particulate matter emissions from ports and rail yards, the Administration proposed, and Congress should provide, funding for the Diesel Emissions Reduction Act and other related programs.

Collaborate on R&D on the beneficial use and/or disposal of dredging material. The Army Corps of Engineers and other appropriate Federal agencies should undertake collaborative R&D on treating and then either beneficially using or disposing of dredging material.

Improve environmental data collection, analysis, and coordination. DOE should work with other Federal agencies to improve data and analysis on the environmental characteristics and impacts of TS&D infrastructures.

Work with states to promote best practices for regulating and siting CO_2 pipelines. Building on successful state models for CO_2 pipeline siting, DOE, in cooperation with Federal public land agencies, should take a convening role to promote communication, coordination, and sharing of lessons learned and best practices among states that are already involved in siting and regulating CO_2 pipelines or that may have CO_2 pipeline projects proposed within their borders in the future.

Enact financial incentives for the construction of CO_2 pipeline networks. Congress should enact the Administration's proposed Carbon Dioxide Investment and Sequestration Tax Credit, which would authorize $2 billion in refundable investment tax credits for carbon capture technology and associated infrastructure (including pipelines) installed at new or retrofitted electric generating units that capture and permanently sequester CO_2.

Enhancing Employment and Workforce Training

The workforce needed to build, maintain, and operate energy infrastructures will continue to evolve and, in many cases, grow significantly. The heavy investment in new U.S. energy infrastructure that is anticipated over the next few decades, combined with the maintenance needed by current infrastructure systems and the looming retirement of a significant fraction of this sector's labor pool, will stimulate the creation of a wide range of new job opportunities for skilled workers. This will pose an increasing challenge for workforce development and job training strategies.

Key Findings

Approximately 1 million people were employed in energy transmission and distribution jobs in 2013. This represented almost 0.75 percent of U.S. civilian jobs. An additional 900,000 jobs were indirectly supported by energy transmission and distribution activity.

Projections indicate that, by 2030, the energy sector overall, including the TS&D segment, will employ an additional 1.5 million workers. Most of these jobs will be in construction, installation and maintenance, and transportation, and approximately 200,000 more workers with computer and mathematics skills will be in demand.

Changes in the electricity sector, in particular, affect the number and types of energy jobs. New technologies are changing the skill sets in demand in the electricity workforce, creating opportunities that include utility management positions for smart grid programs, meter installers and service providers, intelligent transmission and distribution automation device producers, communications system products and services providers, and software system providers and integrators.

Accelerating methane abatement actions in the natural gas TS&D system is projected to support a significant number of jobs. One study projects that an accelerated replacement timeline along with other measures could support 313,000 jobs throughout the economy.

New job-driven training strategies, reflecting a broader range of needed skills, will be required to meet the challenges of the future. Whether it is by expanding training curricula to use the latest educational tools and techniques, moving to a competency-based system of evaluating educational and training outcomes, or engaging new pools of potential talent (such as veterans), innovation in methods to attract and train the TS&D infrastructure workforce of the future will be required.

Defining priorities in the area of jobs and workforce training and establishing effective programs requires good data. It is challenging both to define and quantify jobs in the energy industry because of how employment data in the United States are organized and published. The lack of information is especially critical in job categories experiencing high growth and rapid technological change, such as those dealing with infrastructure associated with the solar industry.

Selected Recent Federal Government Actions

The activities of the Federal Government to respond to changes in employment and workforce for TS&D infrastructures exist in a broader context of initiatives to train a competitive domestic energy workforce that are being undertaken by the energy industry, labor organizations, colleges, trade schools, and state and local governments. Some recent Federal actions and initiatives that are aimed at supporting and partnering with these broader efforts include the following:

- **Expanding existing efforts.** The Administration's Ready to Work Initiative and the passage of the Workforce Innovation and Opportunity Act have led to several important efforts in the energy sector. In addition to the significant investments in energy and advanced manufacturing workforce training, the newly formed Skills Working Group, an interagency task force of 13 Federal agencies chaired by the Secretary of Labor, has focused on the energy sector as one of six key opportunity areas for expanding apprenticeships, building career pathways to the middle class, and initiating place-based initiatives to expand opportunities to underserved communities.
- **Providing financial assistance for training.** The Department of Labor has granted $450 million in Trade Adjustment Assistance Community College and Career Training grants to nearly 270 community colleges across the country. Also, in December 2014, the Department of Labor announced the American Apprenticeship Grants Competition—a $100-million grant program to launch apprenticeship models in high growth fields, such as energy, and expand apprenticeship models that work.
- **Creating an energy Jobs Strategy Council.** DOE has created a new Jobs Strategy Council, which brings together the diverse energy programs of the Department with its laboratories and technology resources to accelerate job creation across all energy sectors in partnership with other Federal agencies, the private sector, and state and local governments.

- **Developing curricula and certification standards.** DOE has been deeply engaged with both traditional and new energy sectors, developing curricula and/or certification standards for the solar, unconventional natural gas extraction, and building energy efficiency industries, for instance. In addition, through DOE's Office of Economic Impact and Diversity and its new Jobs Strategy Council, the Department's programs have focused on driving energy opportunities to traditionally underserved communities and to veterans and other specific populations.

Recommendations in Brief

Support an energy-job skills training system through the interagency Skills Working Group. The training system should include new curricula, apprenticeship programs, industry-based credentialing standards, and innovative online learning systems.

Expand support for an open-source learning community to develop, facilitate, and expand use of state-of-the art courses in energy-related fields. These efforts should work to maintain and improve the National Training and Education Resource platform.

Coordinate efforts to accelerate the development of high-quality energy and manufacturing curricula and apprenticeship programs. DOE should coordinate with existing Department of Labor and National Science Foundation programs.

Facilitate national credentials for energy occupations. DOE should support and facilitate an industry-led process of defining needed skills in a number of emerging occupations.

Facilitate the transition of military veterans into the energy sector. DOE should work with the Departments of Labor and Defense and stakeholders to standardize the applicability of Military Occupation Codes to civilian jobs in energy sectors.

Establish an interagency working group to reform existing energy jobs data collection systems. DOE should convene a group with the Departments of Labor and Commerce to provide complete and consistent definitions and quantification of energy jobs across all sectors of the economy.

Siting and Permitting of TS&D Infrastructure

The trends affecting TS&D infrastructure are discussed in this report—including major increases in oil and gas production, expanding production of renewable energy, changing requirements for what is expected of energy infrastructure, climate change, and steps to maintain electricity grid—are shaping and driving demand for new TS&D infrastructure. Over the last decade, there has been a growing awareness of the gap between the times typically needed to permit new generation and production sources of energy and the much longer times needed for TS&D infrastructure. This discrepancy in permitting time frames affects everything from transmission planning to utility procurement and project finance decisions—making it more challenging to plan, site, permit, finance, and construct energy infrastructure projects. Given these challenges, it is essential to promote more timely permitting decisions while protecting our Nation's environmental, historic, and cultural resources.

Key Findings

The involvement of multiple jurisdictions adds time to siting, permitting, and review of infrastructure projects. As major infrastructure projects are proposed, Federal, state, local, and tribal governments must work to consider and minimize potential impacts on safety and security, as well as environmental and community resources (e.g., air, water, land, and historic and cultural resources). These entities often have overlapping and sometimes conflicting statutory responsibilities for siting and permitting projects. The interplay among the diverse sets of participants and statutorily defined responsibilities is challenging, and for particularly large and complex infrastructure projects, multiple permits and approvals can lead to inefficiencies and delay.

Close collaboration with tribal, state, and local governments is critical to siting, permitting, and review of infrastructure projects. Most infrastructure siting and permitting decisions are made at the state and local levels; some also require consultation with affected Indian Tribes. The bulk of Federal review and permitting responsibilities are also handled at regional offices rather than agency headquarters. The local nature of decision making requires close interaction between local and tribal governments and Federal agencies, as well as appropriate knowledge of resource concerns to be addressed in the permitting process.

Robust public engagement is essential for the credibility of the siting, permitting, and review process. Major infrastructure projects, such as high-voltage transmission lines and pipelines, are likely to trigger potentially conflicting stakeholder interests and have the potential to produce significant impacts on local communities and the environment due to their complexity and scale. Robust stakeholder engagement is necessary to avoid, minimize, and mitigate these potential impacts and is likely to reduce delays in reaching a decision.

Siting timetables vary widely, and processes for siting energy infrastructure differ by sector. Major infrastructure projects typically involve multi-year design, development, and construction timelines with complex approval processes. Timelines and processes for approval vary depending on the scope and type of project.

Selected Recent Federal Government Actions

The Obama Administration has taken steps within and across Federal agencies to modernize the Federal permitting and review process for major infrastructure projects to reduce uncertainty for project applicants, to reduce the aggregate time it takes to conduct reviews and make permitting decisions by half, and to produce measurably better environmental and community outcomes. These include the following actions:

- **Coordinating project review.** The Interagency Steering Committee established under Executive Order 13604 and the Interagency Infrastructure Permitting Improvement Team housed at DOT are currently developing a Policy for Coordinated Review of infrastructure project applications among Federal agencies and with project sponsors.
- **Developing pre-application procedures and cost recovery for project reviews.** In 2013, DOE—through the Council on Environmental Quality and the Administration's Rapid Response Team for Transmission—developed a proposed Integrated Interagency Pre-Application Process for onshore electric transmission lines. DOE is now considering issuing a revised regulation under Section 216(h) of the Federal Power Act that would incorporate that process. In September 2014, the Bureau of Land Management issued a proposed rule that would require all applicants for rights of way across public lands for electric transmission lines of 100 kilovolts or greater and pipelines 10 inches or more in diameter to hold pre-application meetings to coordinate with appropriate Federal and state agencies and tribal and local governments. It would also require proponents to pay reasonable or actual costs associated with the pre-application process.
- **Expanding online project tracking and developing metrics.** The Administration launched a Federal Infrastructure Project Permitting Dashboard to track designated infrastructure project schedules. The dashboard also hosts a "Permit Inventory"—a searchable database of required permits and approvals—as well as National Environmental Policy Act (NEPA) reviews and milestones relating to major infrastructure projects.
- **Expanding availability and sharing of data and geographic information system tools.** The Administration has identified a number of actions and policies to facilitate adequate collection, integration, and sharing of the best available data to assist project sponsors in siting projects in order to minimize resource impacts and to support Federal decision making, including (1) NEPAnode;

(2) the Fish and Wildlife Service Information, Planning, and Conservation Tool; (3) EPA's NEPAssist; (4) the Eastern Interconnection States Planning Council Energy Zones Mapping Tool; (5) the Army Corps' Federal Support Toolbox; (6) the Western Governors' Associations' Crucial Habitat Assessment Tool; and (7) the National Oceanic and Atmospheric Administration's Social Vulnerability Index.

- **Designating corridors for pipelines, electric transmission lines, and related infrastructure.** The Department of the Interior and the Department of Agriculture are conducting a periodic review of the Western energy rights-of-way corridors designated in 2009. As directed in the June 2013 Presidential Memorandum, DOE issued two reports—one for assessing potential corridors in the West, as proposed by the Western Electricity Coordinating Council, and one for the rest of the United States that looks at current and potential crossings for transmission lines and oil and gas pipelines on federally protected national trails.
- **Undertaking landscape- and watershed-level mitigation and conservation planning.** Federal land management agencies have begun to implement mitigation and conservation planning at the landscape, ecosystem, or watershed level. For example, in March 2014, the Department of the Interior released the Solar "Regional Mitigation Strategy for the Dry Lake Solar Energy Zone," and in April 2014, Secretary Jewell issued the "Strategy for Improving the Mitigation Practices of the Department of the Interior."

Recommendations in Brief

Allocate resources to key Federal agencies involved in the siting, permitting, and review of infrastructure projects. Federal agencies responsible for infrastructure siting, review, and permitting have experienced dramatic appropriations cuts and reductions in staff. Many of the components of the overall effort to improve the Federal siting and permitting processes have been stymied in recent years by appropriations shortfalls. Congress should fully fund these priorities.

Prioritize meaningful public engagement through consultation with Indian Tribes, coordination with state and local governments, and facilitation of non-Federal partnerships. Early and meaningful public engagement with affected residential communities, nonprofit organizations, and other non-Federal stakeholders through the NEPA process and other forums can reduce siting conflicts. Federal agency coordination with state and local governments and government-to-government consultation with affected Indian Tribes should remain a Federal Government priority. When possible, Federal agencies should co-locate energy infrastructure environmental review and permitting staff from multiple Federal agencies' regional and field offices.

Expand landscape- and watershed-level mitigation and conservation planning. When adverse impacts to the Nation's landscape cannot be avoided or minimized any further, Federal agencies should seek innovative approaches to compensate for adverse project impacts commensurate with the scope and scale of the project and effects to resources. Through mitigation planning at a landscape, ecosystem, or watershed scale, agencies can locate mitigation activities in the most ecologically important areas.

Enact statutory authorities to improve coordination across agencies. Congress should authorize and fund the Interagency Infrastructure Permitting Improvement Center in DOT, as set forth in Section 1009 of the Administration's draft legislation for the GROW AMERICA Act.

Adopt Administration proposals to authorize recovery of costs for review of project applications. Consistent with the proposal in the President's FY 2016 Budget Request, additional flexibility for certain agencies to accept funds from applicants would be appropriate and could expedite the Federal permitting and review process.

Investing in Energy Infrastructure

The replacement, expansion, and modernization of dedicated and related energy infrastructure require major investment over an extended period of time. Most of the resources will come from the private sector—sometimes as approved costs under Federal and state-regulated rate structures for energy delivery to consumers and businesses. Nevertheless, a significant number of the infrastructure recommendations put forward in this QER call for Federal funds, either for direct investment or for stimulating and incentivizing other investments. The desirability of Federal engagement comes in large part from classic market failures of a variety of kinds, above all public goods and negative externalities. As noted in a 2012 report by the Department of the Treasury and the President's Council of Economic Advisers, moreover, there is a large body of evidence showing significant private sector productivity gains from public infrastructure investments, in many cases with higher returns than private capital investment.[8]

The QER calls for increased Federal investments, targeted both at areas of traditional Federal responsibility and at new approaches to inform, incentivize, and leverage the investment decisions of state and local governments and the private sector that reinforce overarching economic, security, and environmental objectives (see Table SPM-2).

Table SPM-2. Examples of Federal Mechanisms/Tools Applied to Each Energy Infrastructure Objective

Objectives ▶ / Mechanisms/Tools ▼	Resilience, Reliability Safety and Security	Electricity Grid Modernization	Energy Security and Supporting Infrastructures	Shared Transport Infrastructures Improvement
Direct Federal Infrastructure Investments	Provide competitive, cost-shared implementation grants to harden and enhance the resilience of electricity TS&D infrastructures	Provide competitive grants for State and multi-State reliability planning to meet environmental, resilience, and efficiency goals	De-bottleneck Strategic Petroleum Reserve (SPR) distribution capability through marine terminal enhancements	Provide cost sharing for investments in shared energy transportation systems
Research, Development and Analysis	Develop and demonstrate cost-effective technologies to detect and reduce GHG losses from natural gas transmission and distribution systems	Assess flexibility and value of electricity storage	Enhance research on Arctic energy safety and accident prevention	Support research on disposal of dredging materials
Data Collection and Information Management	Develop a framework and metrics for modeling and measuring resiliency	Institutionalize energy efficiency evaluation, measurement, and verification	Increase the integration of EIA energy data with Canada and Mexico	Improve data collection on shared energy transportation infrastructure
Federal Regulation	Enhance safety standards for gas transmission pipelines	Develop grid connectivity and interoperability standards to enhance safe and reliable grid operation	Revise legal, regulatory, and policy roadmaps for harmonizing regulations for energy emergency response	Eliminate regulatory impediments to ensure adequate power plant fuel reserves.
Workforce Development	Develop curricula, training programs, and industry-based credentialing standards to expand energy sector workforce			

Some of these investments were already proposed in the President's FY 2016 Budget Request. The recommendations that were not proposed in the FY 2016 Budget, both on the mandatory and discretionary side, will be subject to the President's Budget process, including, for example, identification of revenue sources or other offsets. Other recommendations would require new authorizing legislation and were not proposed in the FY 2016 Budget. Figure SPM-6 summarizes select recommendations by chapter, together with initial order-of-magnitude cost estimates. More precise cost estimates will depend upon more detailed program design and final statutory language. The Administration looks forward to working with Congress to advance these recommendations.

Figure SPM-6. Select Recommendations by Chapter

Smart Grid of the Future

- Grid Modernization* ($3.5B)
- Grants for state and multi-state grid reliability planning* ($300-$350M)

Modernizing Global Energy Security Infrastructures

- SPR modernization and life extension ($1.5-$2B)
- G-7 Collective Energy Security Initiative

Resiliency, Recovery, Safety and Asset Recovery

- Implementation Grants for Energy System Hardening ($3-$5B)
- Rate Mitigation for accelerated NG distribution pipe replacement ($2.5-$3.5B)
- State Energy Assurance/Resiliency Planning Grants* ($350-$500M, depending on 2 or 3 year cycle)
- Strategic Transformer Reserve

Improvements to Shared Infrastructure

- ASSETS grants for energy-intensive connector projects ($2-$2.5B)

Integrating North American Energy Markets

- Enhance North American energy integration through cooperative measure with Canada and Mexico
- Caribbean Renewables/LNG project planning support

Note: Most funding is over 10 years and would be incremental to agency baseline budgets. Programs identified with an asterisk would require incremental funding over a shorter time period.

Endnotes

1. Department of Energy. "Grid 2030: A National Vision for Electricity's Second Hundred Years." 2003. http://www.ferc.gov/eventcalendar/files/20050608125055-grid-2030.pdf. Accessed January 26, 2015.

2. Edison Electric Institute. "Transforming America's Power Industry: The Investment Challenge 2010-2030." November 2008. http://www.eei.org/ourissues/finance/Documents/Transforming_Americas_Power_Industry_Exec_Summary.pdf. Accessed January 15, 2015.

3. Intergovernmental Panel on Climate Change. "Climate Science 2014: Synthesis Report." http://www.ipcc.ch/.

4. National Academy of Sciences and Royal Society of London. "Climate Change: Evidence and Causes." 2014. http://nas-sites.org/americasclimatechoices/more-resources-on-climate-change/climate-change-evidence-and-causes/.

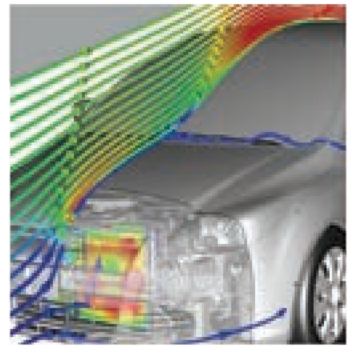
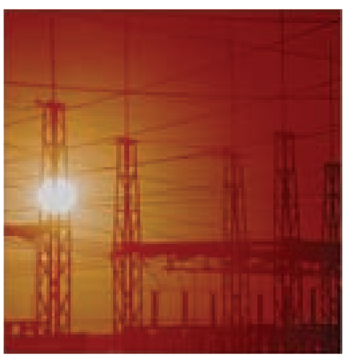
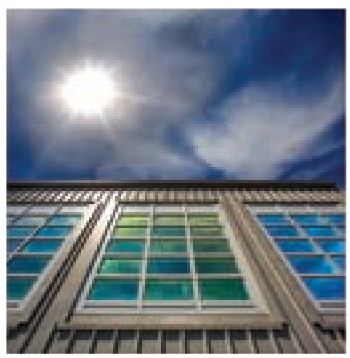
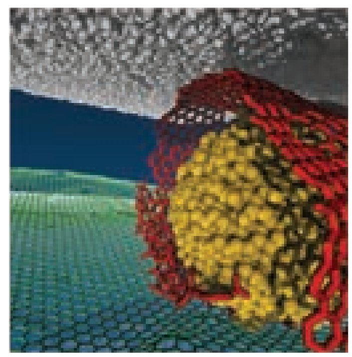
5. Global Change Research Program. "Climate Change Impacts in the United States: The Third U.S. National Climate Assessment." 2014. http://nca2014.globalchange.gov.

6. The White House. "The President's Climate Action Plan." June 2013. https://www.whitehouse.gov/sites/default/files/image/president27sclimateactionplan.pdf.

7. The White House. "President Obama's Climate Action Plan: Progress Report." June 2014. https://www.whitehouse.gov/sites/default/files/docs/cap_progress_report_update_062514_final.pdf.

8. "A New Economic Analysis of Infrastructure Investment." Prepared by the Department of the Treasury with the Council of Economic Advisers. March 23, 2012.



QUADRENNIAL TECHNOLOGY REVIEW

AN ASSESSMENT OF ENERGY TECHNOLOGIES AND RESEARCH OPPORTUNITIES

Executive Summary
September 2015

ES Executive Summary

Introduction

The United States is in the midst of an energy revolution. Over the last decade, the United States has slashed net petroleum imports, dramatically increased shale gas production, scaled up wind and solar power, and cut the growth in electricity consumption to nearly zero through widespread efficiency measures. Emerging advanced energy technologies provide a rich set of options to address our energy challenges, but their large-scale deployment requires continued improvements in cost and performance. Technology is helping to drive this revolution, enabled by years to decades of research and development (R&D) that underpin these advances in the energy system.

The energy revolution underway creates additional opportunities for technologies and systems with superior performance and reduced costs. The convergence of many energy sectors—such as the electric grid, electricity production, buildings, manufacturing, fuels, and transportation—into systems linked through information and communications technologies (ICT), advanced modeling and simulation, and controls, has the potential to revolutionize energy services throughout the economy. These advances can enable the United States to address pressing national energy challenges—security, economic vitality, and climate change.

The 2015 Quadrennial Technology Review (QTR) examines the status of the science and technology that are the foundation of our energy system, together with the research, development, demonstration, and deployment (RDD&D) opportunities to advance them. It focuses primarily on technologies with commercialization potential in the midterm and beyond. It frames various trade-offs that all energy technologies must balance across such dimensions as cost, security and reliability of supply, diversity, environmental impacts, land use, and materials use. Additionally, it provides data and analysis on RDD&D pathways to assist decision makers as they set priorities, within budget constraints, to develop more secure, affordable, and sustainable energy services. Policies and regulations are examined separately by the Quadrennial Energy Review (QER).

National Energy System Strategic Objectives

Three enduring strategic objectives are foundational to our nation's energy system: energy security, economic competitiveness, and environmental responsibility.

Secure and resilient: There are four interrelated dimensions to energy security: physical, cyber, supply, and conflict-related. Physical security risks are related to damage to energy supply, storage, and delivery infrastructures, such as the electric grid, pipeline networks, and rail and marine systems. Cybersecurity vulnerabilities are related to the compromise of ICT-based controls that operate and coordinate energy supply, delivery, and end-use systems. Supply security risks are related to price shocks and international supply disruptions of energy commodities, critical materials, and/or equipment. Conflict–related security risks are associated with unrest in foreign countries linked to, or impacting, energy. Climate change increases physical security risks with sea level rise and intensification of extreme weather.

Economically competitive: Energy underpins every facet of the nation's economy and modern way of life. Low energy costs are beneficial to consumers and therefore the broader economy. Decades of research have gone into reducing the capital, operating, and fuel costs of conventional and advanced energy technologies. The benefits of this research are evident in the recent price declines of natural gas, domestic oil, wind turbines, photovoltaics, and efficient lighting. Progress in a broader array of advanced technologies could increase the diversity and stability of energy supplies, and spark competition to drive further price declines.

Environmentally responsible: Development of a clean energy system will rely on increasingly advanced technologies to minimize its environmental footprint. Over the last several decades, the United States has made significant progress in reducing pollution—atmospheric, water, land—from energy-related activities. For example, energy-related atmospheric emissions of conventional pollutants such as particulates, sulfur, and nitrogen compounds have been reduced through improved combustion strategies and "end-of-pipe"—e.g., scrubbers, catalytic converters—emissions controls. Additional emissions reductions have been achieved by improving efficiency and transitioning to cleaner fuels and low-carbon resources. These successes demonstrate what can be accomplished with RDD&D and policy. Advanced technologies can have a significant impact on the next generation of challenges, especially deep reductions in greenhouse gas (GHG) emissions to moderate the otherwise increasing damage from climate change and ocean acidification. The United States can demonstrate the viability of sustainable energy systems to the global community and provide leadership in creating vibrant economies, enhancing human progress, and assuring a sustainable biosphere.

Developing energy systems that balance trade-offs to simultaneously advance toward these objectives requires RDD&D across a diversified portfolio of technologies. It also requires understanding the multiple dimensions of each of these objectives.

Energy System Perspective

To help identify where RDD&D can have the greatest impact, it is first necessary to understand how energy is used in the United States. A complex and vast array of systems and associated technologies extract energy resources; convert them into usable forms of energy; and deliver them to end users to provide desired services such as manufactured goods, thermal comfort, lighting, and mobility. The current state of energy supplies and end uses is described in Chapter 1.

Increasing the interconnectedness and resulting interdependency among energy sectors creates both opportunities and challenges that should be approached from an energy system perspective. Strategies for advancing technology across the entire energy system, in contrast to individual energy technologies, are necessarily broad.

First, certain technologies affect the energy system by impacting more than one energy sector. Application of an energy system view of technology can help to identify the crosscutting impacts of technologies developed for a particular application as applied to other sectors, as well as the elements of the value chain that must be in place for success. Realizing the full benefit of developing these crosscutting technologies requires the involvement of stakeholders from across the energy economy.

Second, the systems perspective can illuminate opportunities to improve performance and/or mitigate risk through sector integration. Success requires advancing the operation, planning, modeling, and simulation of technical systems integrated across sectors.

Finally, application of an energy system view can be used to develop solutions to complex energy challenges. New paradigms based on the science of large and complex systems can help enable the prediction and control of emergent properties and behaviors, including disruptions that arise from sector and technical system interconnectedness. The focus of Chapter 2 is *Energy Sectors and Systems.*

Overarching Themes, Energy Sectors, and Crosscutting RDD&D Opportunities

By studying the whole energy system and the interdependency of the energy sectors, four overarching themes, six sets of core RDD&D opportunities (organized by energy sector), and twelve crosscutting technology areas are identified and presented.

Overarching Themes

Four overarching themes emerged from the QTR and associated technology assessments: 1) the convergence of energy systems across sectors; 2) diversification within energy supplies and services; 3) confluence of R&D, computational tools, and analysis of complex systems; and 4) energy efficiency.

Convergence: Virtually all sectors of the energy system are becoming increasingly interdependent. Further, the power, grid, buildings, manufacturing, fuels, and transportation sectors of the energy system are necessarily coupled to water systems, material flows, waste products, and energy financial markets. Properly tuned and integrated energy sectors and technology systems have the potential to improve their overall operations, increase their efficiency, and enable fundamentally new concepts in the structure of the energy economy.

Diversification: Most energy sectors in the United States are experiencing a trend toward increased diversification. For example, electricity, hydrogen, natural gas, and biofuels are entering the transportation sector, while the power sector is shifting to greater use of natural gas and renewables. This diversification creates challenges for energy infrastructures, but it can also provide flexibility.

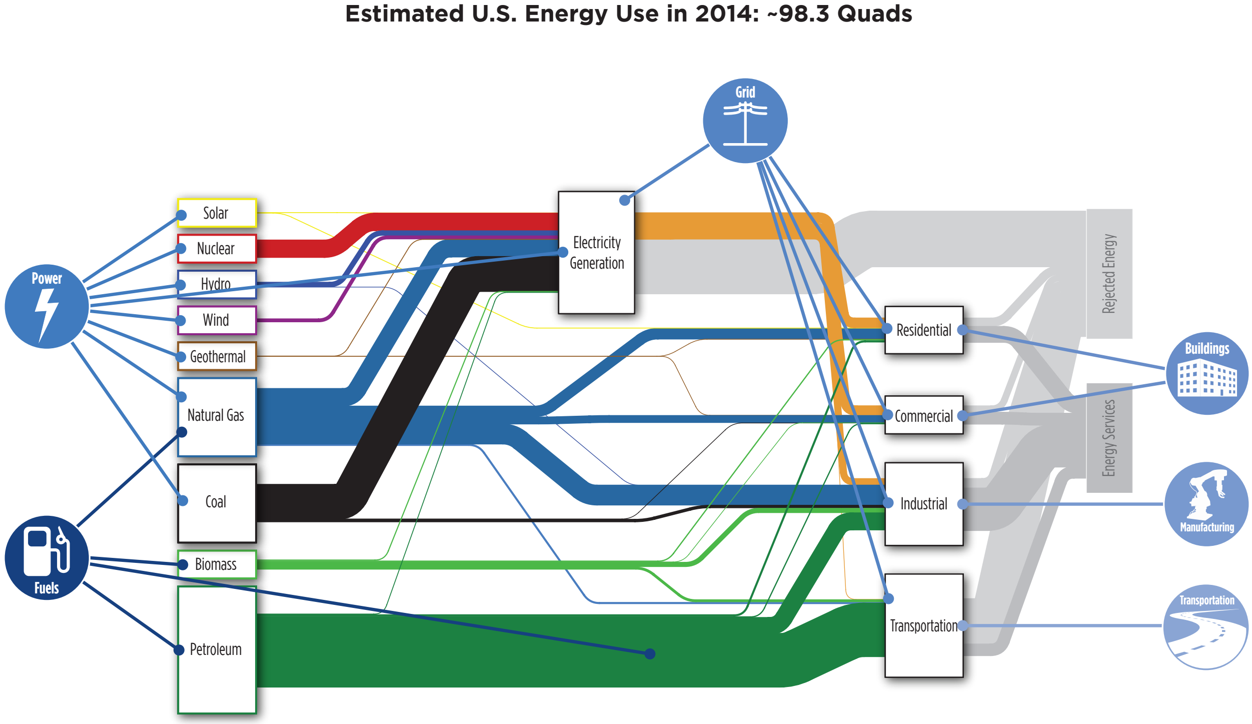
Confluence: The confluence of advances in computing power and software, theory, modeling, synthesis and characterization is rapidly ushering in a new era of "systems by design" for materials, chemicals, and biological science. This transformation from observation to control and design of complex systems has the potential to accelerate development of these systems with desired properties. This set of concepts—generalized to new classes of sensors, big data management, and computational modeling—is applicable across the spectrum of complex systems topics encountered in the energy system.

Efficiency everywhere: Achieving greater efficiency is a proven means to help achieve national energy security, cost, and environmental goals. As raw energy resources are transformed into services and products, losses compound along the energy value chain. Efficiency improvements in any step along the value chain can materially impact costs, consumption, and emissions. RDD&D opportunities to advance cost-effective efficiency technologies permeate all of the energy sectors and systems.

Energy Sectors

The QTR describes the national energy system as comprising six individual sectors: 1) the electric grid, 2) electricity production (power), 3) buildings (residential and commercial), 4) manufacturing (the majority of the larger industrial sector), 5) fuels (with an emphasis on fuels for transportation), and 6) transportation. Each of these sectors comprises numerous technical systems, sub-systems, and component technologies. The QTR dedicates a chapter to each of these six sectors, exploring its related technologies, challenges, and RDD&D opportunities.

Figure ES.1 Sankey Diagram of the U.S. Energy System Depicting Major Areas of Coverage by the Technical QTR Chapters 3–8



Electric grid sector: The U.S. electric power sector is the centerpiece of the nation's energy economy. However, the design and operation of today's grid is being challenged to meet the evolving security, cost, and environmental needs of a low-carbon, digital economy. Shifts are occurring on the supply side (e.g., increased adoption of renewable resources) and demand side (e.g., growing use of demand side management). Accompanying these changes is the growing adoption of digital communications and control systems (i.e., smart grid technologies) to improve performance and engage consumers. Additionally, grid operation is moving from controlling systems with a handful of control points at central stations to ones with potentially millions of highly interactive distributed control points. In short, the power grid is confronted with new requirements as it attempts to perform in ways for which it was not designed. Meanwhile, the nation's reliance on a dependable, efficient, and resilient power grid is rising. The focus of Chapter 3 is *Enabling Modernization of the Electric Power System.*

Electricity production sector: The current portfolio of electricity production includes a combination of reliable but aging base-load generation, evolving renewable resources, new natural gas plants, and new and pending nuclear and clean coal facilities. As the industry evolves to meet growing electrification and GHG reduction goals, challenges arise in optimizing the system, minimizing risks, and maintaining reasonable cost. Future developments will likely include a mix of three broad categories: 1) fossil-based generation with carbon capture and storage (CCS), 2) nuclear energy, and 3) renewables, such as solar and wind. Technologies that enable higher efficiencies and effective pollution control are an essential complement to this evolving generation mix. Similarly, crosscutting concepts—such as supercritical carbon dioxide Brayton cycles—could, if broadly applied, impact efficiency, emissions, and water consumption across fossil, nuclear, geothermal, and solar thermal plants. While supporting aggressive emission reductions, the traditional market drivers such as reliability, safety, and low cost must be maintained and enhanced. The focus of Chapter 4 is *Advancing Clean Electric Power Technologies.*

Buildings sector: Considerable potential exists to reduce building energy use. The residential and commercial buildings sector accounts for about 74% of electricity use and 40% of all U.S. primary energy use. Many building technologies are available today that would significantly reduce energy use relative to the existing building stock. Yet, the best available and most cost effective ones are only beginning to be widely adopted in the marketplace. It has become increasingly apparent that technology developments in the buildings sector have the potential to simultaneously accelerate cost reductions, service improvements, and efficiency gains. Advanced heating/cooling and lighting are current R&D priorities, as they represent the greatest end-use energy-saving opportunities. Much progress is being made in areas such as light-emitting diode (LED) lighting, appliances, and non-vapor compression heating, ventilation, and air conditioning (HVAC). Miscellaneous electric loads and an eclectic mix of technologies (e.g., grills, spa and pool pumps, laundry, and elevators) are expected to be an increasing share of the remaining load as other end uses become significantly more efficient. The focus of Chapter 5 is *Increasing Efficiency of Building Systems and Technologies.*

Manufacturing sector: Manufacturing consumes twenty-four quads of primary energy annually in the United States—about 79% of total industrial energy use. However, this sector's energy impacts are much broader, as manufactured goods affect the production, delivery, and use of energy across the economy. Improved manufacturing technologies can drive economy-wide energy impacts, including energy efficiency in the manufacturing sector; new types of manufactured products; and sustainability of U.S. industry supply chains and their life-cycle impacts. The focus of Chapter 6 is *Innovating Clean Energy Technologies in Advanced Manufacturing.*

Fuels sector: Fuels supply 99.8% of the energy currently used in the transportation sector and 70% of the energy used to generate electricity in the United States. The economy will need to balance the various strengths and shortcomings of a broad mix of fuels during the transition from a high-carbon to a low-carbon economy. This fuel mix includes the following:

- **Fossil fuels:** Chemical fuels, primarily derived from fossil energy resources, supply about 83% of total U.S. primary energy use.
- **Bioenergy fuels:** With technology improvement and a mature market, available bioenergy could provide more than fifty billion gallons of fuels per year, equivalent to about 25% of current transportation fuel demand.
- **Hydrogen fuels:** Technologies for producing hydrogen from large natural gas reforming plants are mature, but the costs of converting the end-to-end fuels infrastructure, including delivery, to accommodate hydrogen are high. While the near-term deployment challenge is to reduce the cost of infrastructure for fueling vehicles, in the longer term the major challenge is to reduce the cost of hydrogen production from regionally optimized renewable and low-carbon resources.

With recent growth in domestic shale gas and tight oil production, near-term concerns over fuel supply and energy security are easing. However, the economic and environmental impacts of heavy reliance on fossil fuels make their further cleanup or transition to clean alternatives imperative. The trade-offs between conventional (oil and gas) and alternative fuels (primarily biofuels and hydrogen) or substitution with electricity—i.e., cost, performance, infrastructure, security, and environmental impacts—are complex. Optimizing the benefit of fuel diversification is challenged by the varying time frames for development and deployment of fuels, production and distribution infrastructures, and end-use devices such as vehicles. The focus of Chapter 7 is *Advancing Systems and Technologies to Produce Cleaner Fuels*.

Transportation sector: Transportation provides essential passenger, freight, and other mobility services to individuals and the economy. It is the primary user of petroleum in the United States and a major emitter of air pollutants and GHGs. Currently, light- and heavy-duty vehicles account for approximately three-quarters of transportation energy use and emissions. Other modes in the transportation system include rail, marine, aircraft, and pipelines, the proportional emissions from which are likely to grow in importance as the efficiency of on-road transportation technologies improves. To greatly reduce GHG emissions, a larger share of vehicles must efficiently use fuels or power with drastically reduced life-cycle carbon emissions. The technology portfolio benefits from a set of complementary RDD&D pathways, including advanced combustion, light-weighting, battery storage, electric drivetrain, fuel cell systems, and recharging and refueling infrastructure. Addressing the transportation sector as a holistic system that encompasses more than just vehicle technologies is another important emerging research opportunity. The focus of Chapter 8 is *Advancing Clean Transportation and Vehicle Systems and Technologies.*

Crosscutting RDD&D Opportunities

Inevitably, many technology themes were identified that cut across the six sectors. As a result, they should be integrated in ways that bridge strict sectoral boundaries. In a simplified view, the crosscutting topics can be grouped into two major categories: "technical topics" and "enabling tools."

The "technical topics" include the following:

- **Grid modernization:** Advanced grid technologies are needed to improve the agility and flexibility of the system to better integrate the changing characteristics of devices and technology systems on both the supply and demand sides.
- **Systems integration:** Appropriate application of systems integration requires understanding, control, and optimization across multiple sectors, time frames, and spatial scales. An integrated systems approach can address complexity and enable more efficient deployment of advanced energy technologies.
- **Cybersecurity:** Opportunities to improve cybersecurity are being actively pursued for the energy sector (i.e., electric, oil, and gas), and also exist in industrial automation systems and information technology-enabled innovations across the fuels, power generation, buildings, manufacturing, and intelligent vehicle spaces.
- **Energy-water:** Science and technology advancements at the intersection of energy and water can reduce energy use and increase water availability for human consumption, other non-energy uses, and natural systems.
- **Subsurface:** Understanding and controlling fractures, fluid flow, and complex chemistry in subsurface rock formations on timescales of microseconds to millennia are important for oil and gas production, geothermal energy, CCS, and nuclear waste disposal.
- **Materials:** Across all energy sectors, advancements in materials could dramatically accelerate and reduce the cost of developing new energy technologies. Examples include development of materials for extreme working conditions, advanced processing of them, and their rapid qualification.
- **Fuel-engine co-optimization:** With bio-derived and/or other synthetic fuels there is an opportunity to optimize the end-to-end fuel-vehicle system for improved efficiency and reduced environmental impacts.
- **Energy storage:** Fundamental research on efficient, durable storage could enable transformational change across multiple sectors, including transportation, and the electricity system.

The "enabling tools" include the following:

- **Computational modeling and simulation:** Advances in high performance computation have enabled simulation of increasingly complex physical phenomena. High-fidelity simulations, in turn, inform models that improve and accelerate the RDD&D phases of the energy innovation cycle.
- **Data and analysis:** Opportunities to apply advanced analytics transect the entire clean energy economy. The emerging science of extracting actionable information from large data sets is both an opportunity to accelerate RDD&D and a research need.

- **Analysis of complex systems:** Increasing complexity resulting from the convergence of the sectors of the energy system introduces a need for foundational, conceptual research on integrated, networked, and complex systems.
- **Characterization and control of matter at multiscales:** Extraordinary advances in characterization and modeling of materials and chemistry have paved the way for manipulating and synthesizing materials at the atomic-, nano-, and mesoscale to create new tailored functionalities. The research spans a range of dimensions from the atom, to biological cells, to macroscopic structures, with applications across many scientific and engineering disciplines.

The crosscutting RDD&D opportunities listed here offer the potential to dramatically improve the performance and posture of all energy resources and end uses. They represent a condensed set of concepts—linked by an overarching goal to understand, predict, and control complex energy systems—that appear in more than one of the technology areas of this report (see Table 2.1).

Enabling Capabilities for Science and Energy

Investment in basic science research is expanding our understanding of how structure leads to function—from the atomic- and nano-scale to the meso-scale and beyond—and is enabling a transformation from observation to control and design of new systems, with properties tailored to meet the requirements of the next generation of energy technologies. The challenges in energy science and technology development increasingly necessitate interdisciplinary collaboration. The multidisciplinary and multi-institutional research centers supported by DOE and others have the potential to accelerate development of new and transformative energy technologies by more effectively integrating basic science and applied research. At the core of this new paradigm is a diverse suite of complex experimental and computational tools that enable researchers to probe and manipulate matter at unprecedented resolution. The planning for and development of these tools are rooted in basic science, but they are critically important for technology development, enabling discoveries that can lead to broad implementation. These tools are available through a user facility access model that provides open access, regardless of institutional affiliation, for nonproprietary research based on merit review of submitted proposals. This is a synergistic model: thousands of scientists and engineers leverage the capabilities and staff expertise for their research, while the facilities leverage user expertise toward maintenance, development, and application of the tools in support of the broader community of users. The focus of Chapter 9 is *Enabling Capabilities for Science and Energy.*

Concepts in Integrated Analysis

A goal of technology development programs, whether in the private sector or in government institutions, is to maximize the positive impact of RDD&D portfolio investments in energy technologies. The many technologies described in this QTR illustrate the potential impacts that further RDD&D could have to create a secure, competitive, and clean energy system. Weighting of these impacts, as well as the metrics from which they are built (e.g., cost, performance, land use, water quality, GHG emissions, etc.), will necessarily vary with the perspective of the observer. Research institutions must consider multiple impact metrics that address their overarching goals from a business or public perspective. To this end, portfolio analysis is widely employed, but at varying levels of thoroughness, analytic rigor, and transparency. Many tools for technology planning and projection, analysis, metrics calculation, and impact evaluation exist already, but are not necessarily fully developed or packaged in a way that can be readily used for evaluating energy portfolios. This QTR explores processes to shape an energy portfolio and estimate the potential impacts, articulates the current state of integrated technology assessment, gives examples of sector-specific applications of metrics and tools for technology analysis in use in various organizational contexts (i.e., corporate, nonprofit, academic, and government), and identifies gaps that require further development of technical assessment capabilities. The focus of Chapter 10 is *Concepts in Integrated Analysis.*

Conclusion

The world of energy-related research is rich with opportunities to help create a secure, resilient, economically efficient, and environmentally responsible set of energy systems. Those systems will rely on more efficient energy conversion technologies and will benefit from improved understanding of complex, interdependent systems that provide electricity, transportation, water, and materials for manufacturing. Underlying the advances in those areas will be the many technologies and capabilities described in this report, as well as fundamental scientific research and advanced scientific computing for complex systems. The technology development community is beginning to take advantage of the rapidly emerging set of tools for creating new generations of materials, devices, and systems for energy applications; however, much more can be done. A goal is to put these new tools in their hands to drive a well-diversified portfolio of energy research that will enable leadership by the United States to provide the energy services essential to modern societies.

DOE/EIA-0383(2016) | August 2016

Annual Energy Outlook 2016

with projections to 2040

Independent Statistics & Analysis
U.S. Energy Information Administration

Executive Summary

Projections in the Annual Energy Outlook 2016 (AEO2016) focus on the factors expected to shape U.S. energy markets through 2040. The projections provide a basis for examination and discussion of energy market trends and serve as a starting point for analysis of potential changes in U.S. energy policies, rules, and regulations, as well as the potential role of advanced technologies.

Key issues addressed in the AEO2016 Reference and alternative cases and discussed in this Executive summary include:

- Recent changes in laws and regulations, including the U.S. Environmental Protection Agency's (EPA) Clean Power Plan (CPP) [1], which requires states to reduce carbon dioxide (CO_2) emissions from existing fossil fuel generators, and an extension of tax credits for wind and solar energy. Together with lower natural gas prices, these changes significantly affect the projected electricity generation fuel mix.

- Implications of the changing electricity generation fuel mix for overall coal demand and the coal production outlook across U.S. coal supply regions.

- Slower electricity demand growth and increases in onsite generation, which together determine the demand for generation from central power stations.

- The effects of resource and technology improvements and prices on the outlook for U.S. oil and natural gas production, and the effect of changing production levels on prices projected consumption.

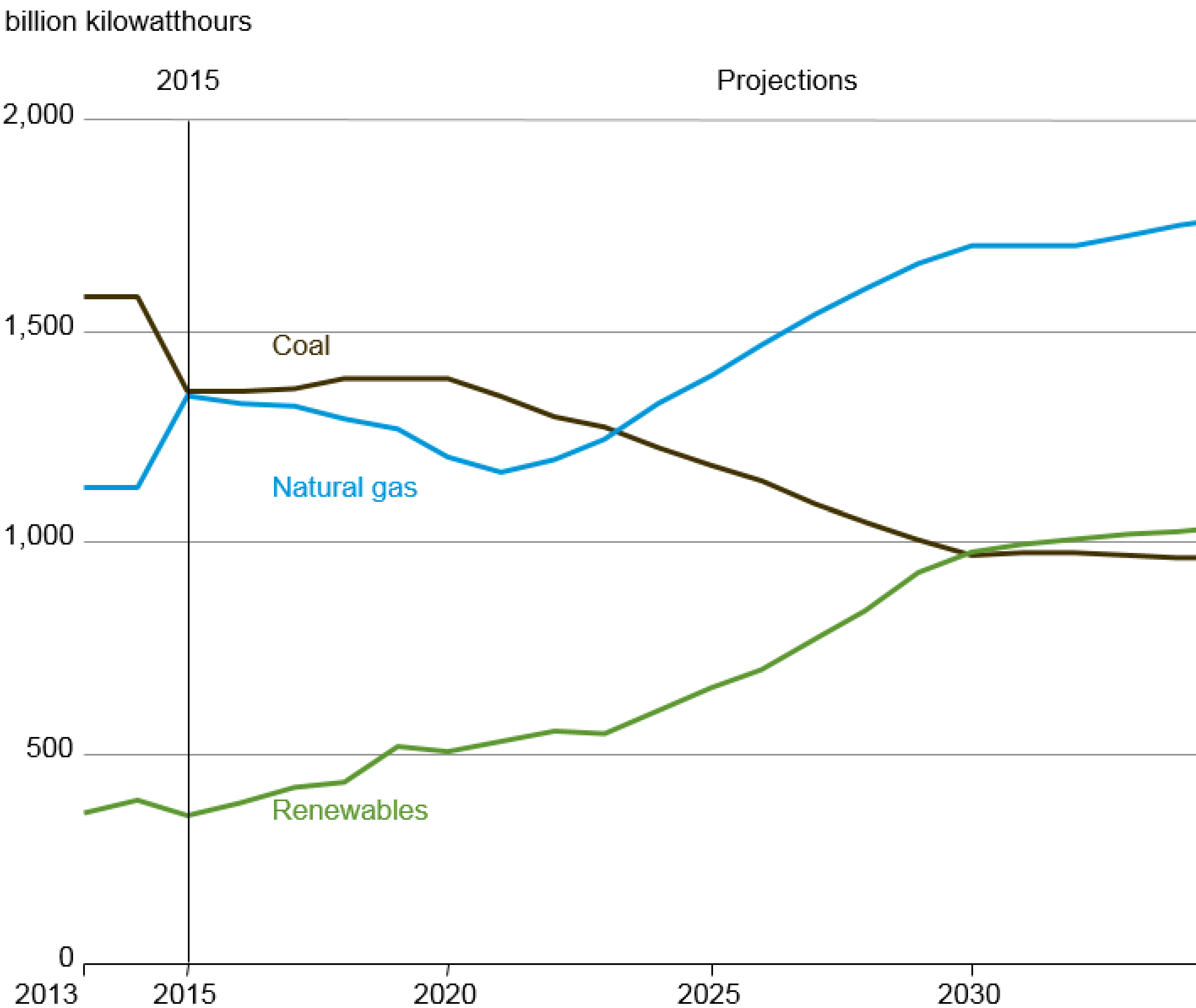
- Implications of the California Air Resources Board's Zero-Emission Vehicle program [2], which nine states have joined, representing 33% of the total U.S. market for new light-duty vehicles.

- Implications of EPA's proposed medium- and heavy-duty vehicle Phase 2 standards [3] for CO_2 emissions and projected fuel use.
- Implications of alternative economic, energy market, and policy scenarios for energy-related CO_2 emissions.

The Clean Power Plan's requirement to reduce carbon dioxide emissions accelerates the shift in the generation mix

The CPP requirement for states to develop plans to reduce CO_2 emissions imposes additional costs on higher-emitting energy sources. Combined with lower natural gas prices and the extension of renewable tax credits, the CPP accelerates the shift toward less carbon-intensive generation. In the AEO2016 Reference case, which includes the CPP, 92 gigawatts (GW) of coal-fired capacity is retired by 2030—32 GW more than is retired by 2030 in the No CPP case, which excludes the CPP. In the Reference case, coalfired generation in 2040 is 32% lower than the 2015 total (Figure ES-1).

Figure ES-1. Net electricity generation from coal, natural gas, and rene
AEO2016 Reference case, 2013-40



[figure data](#)

From 2015 levels, natural gas-fired electricity generation in the Reference case increases by 26% in 2030 and by 44% in 2040, and generation from renewables increases by 99% in 2030 and by 152% in 2040. These projected changes result in electricity generation with both natural gas and renewables surpassing coal generation in 2024 (natural gas) and in 2028 (renewables). In the No CPP case, electricity generation with natural gas does not surpass coal generation until 2029, and renewable generation does not overtake coal-fired generation in the 2015–40 time frame of the projection (Figure ES-2).

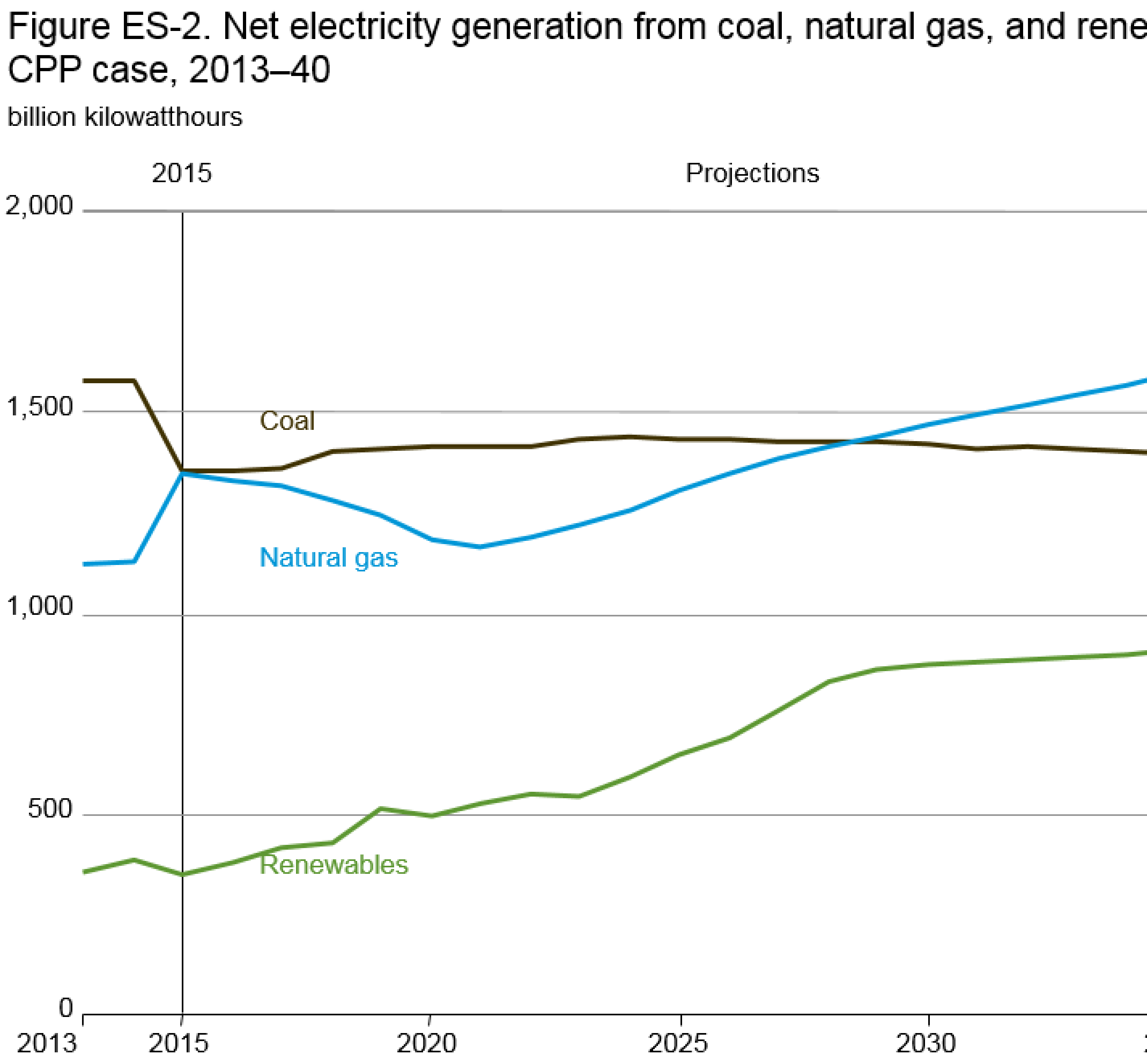


figure data

How the states implement the Clean Power Plan influences its effect on electricity generators

The EPA provides several kinds of flexibility to states in implementing the CPP [4]. This flexibility allows the states to choose between a mass-based approach (with a cap on total CO2 emissions) and a rate-based approach (with a cap on pounds of CO2 emitted per megawatthour of electricity produced), with different potential consequences for electricity generators and customers. In the CPP Rate case, a rate-based target provides a more direct incentive for switching to carbon-free sources of energy by rewarding generators that produce emissions below the intensity target and penalizing those with emissions above the target. The mass-based target in the AEO2016 Reference case, as modeled by EIA, treats every ton of CO2 emitted by fossil-fired generation uniformly, which does not provide the same incentive.

The changes in the mix of generating capacity (including central station and end-use generators) are affected differently by the two implementation approaches. In the CPP Rate case, with a rate-based approach, more renewable capacity is added (an additional 28 GW by 2040) than in the AEO2016 Reference case that assumes mass-based implementation. In the Reference case, 14 GW more coal-fired capacity is retired, and 48 GW more natural gas capacity is added between 2015 and 2040 than in the CPP Rate case.

With the mass-based implementation approach assumed in the Reference case in 2040, coal-fired generation is 436 billion kWh lower than in 2015; natural gas-fired generation is 594 billion kWh higher than in 2015; and renewable generation is 828 billion kWh higher than in 2015. With the rate-based approach adopted in the CPP Rate case in 2040, coal-fired generation is 275 billion kWh lower than in 2015, natural gas-fired generation is 375 billion kWh higher than in 2015; and renewable generation is 898
billion kWh higher than in 2015.

Allocating emissions allowances under a mass-based program can also affect how overall program costs are passed along to suppliers, service providers, and consumers. In the Reference case, the allocation of allowances to load-serving entities reduces the impact on retail electricity prices by reducing retailers' costs of compliance. With this allocation method, the average real (2015 dollars) electricity price in 2030 in the Reference Case is 1.7% lower than in the Allocation to Generators case, which assumes allocation of CPP carbon allowances to generators rather than to load-serving entities.

The coal-fired generation share of total electricity production continues to decline, even in the absence of the Clean Power Plan, and natural gas becomes the predominant fuel for electricity generation

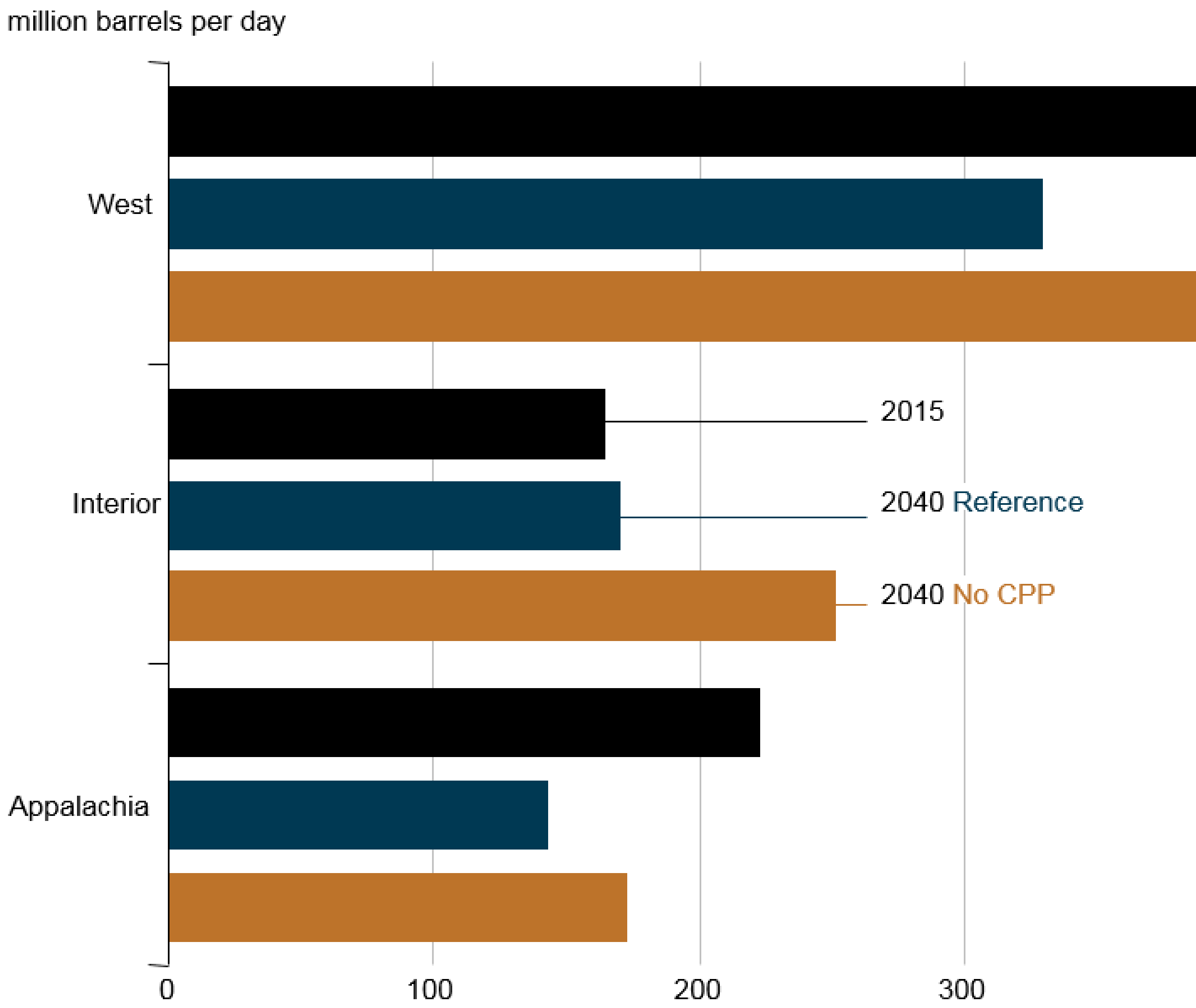
Even in the absence of the CPP, the extension of renewable tax credits, as well as declining capital costs for solar photovoltaics (PV), other emissions regulations that affect coal, and low natural gas prices contribute to a reduction in coal's share of total generation. In the No CPP case, coal-fired generation changes little from 2015–40, and the coal share of total electricity generation falls from 33% in 2015 to 26% in 2040. Additions to coal-fired capacity are limited in the near term by emission regulations and in the long term by low natural gas prices and increased pressure from renewable generation. In the No CPP case, 60 GW of coal-fired generating capacity is retired from 2016–30.

Natural gas-fired generation declines from 2016–20 in response to a surge in wind and solar capacity builds resulting from both declining installation costs and the extension of key federal tax credits for these technologies. After 2020, however, the natural gas share of total generation increases steadily in the No CPP case, overtaking coal before 2030 and accounting for 34% of total generation in 2040.

All coal supply regions are affected—though not equally—when the Clean Power Plan is implemented

The West region—which accounted for the largest share of total coal production in 2015—experiences the biggest decline in coal production, at about 155 million short tons from 2015–40 (Figure ES-3). Implementation of the Mercury and Air Toxics Standards beginning in 2015 and 2016 encouraged near-universal adoption of emissions control equipment at existing coal-fired plants, which enables more coal-fired generators to use high-sulfur coal from the Interior region. The lower demand for coal in the AEO2016 Reference case, which includes the CPP, results in slow growth of coal production in the Interior region over the projection period. In the No CPP case, production of higher sulfur coal from the Interior region increases by nearly 90 million short tons. The lower level of Appalachian coal production in the Reference case in 2040 compared to the No CPP case represents the smallest difference among the coal-producing regions. Production of coal in the Appalachian region declined sharply before 2015 as domestic coal buyers shifted from Appalachian steam coal toward other coal sources or to other fuels for economic reasons. The Appalachian region remains a major source of metallurgical coal, whose markets are not directly affected by the CPP. With or without the CPP, Appalachia’s producers have a relatively high dependence on sales of both metallurgical and steam coal in international coal markets.

Figure ES-3. Petroleum and other liquid fuels production by region and
Reference case, 2000-2040



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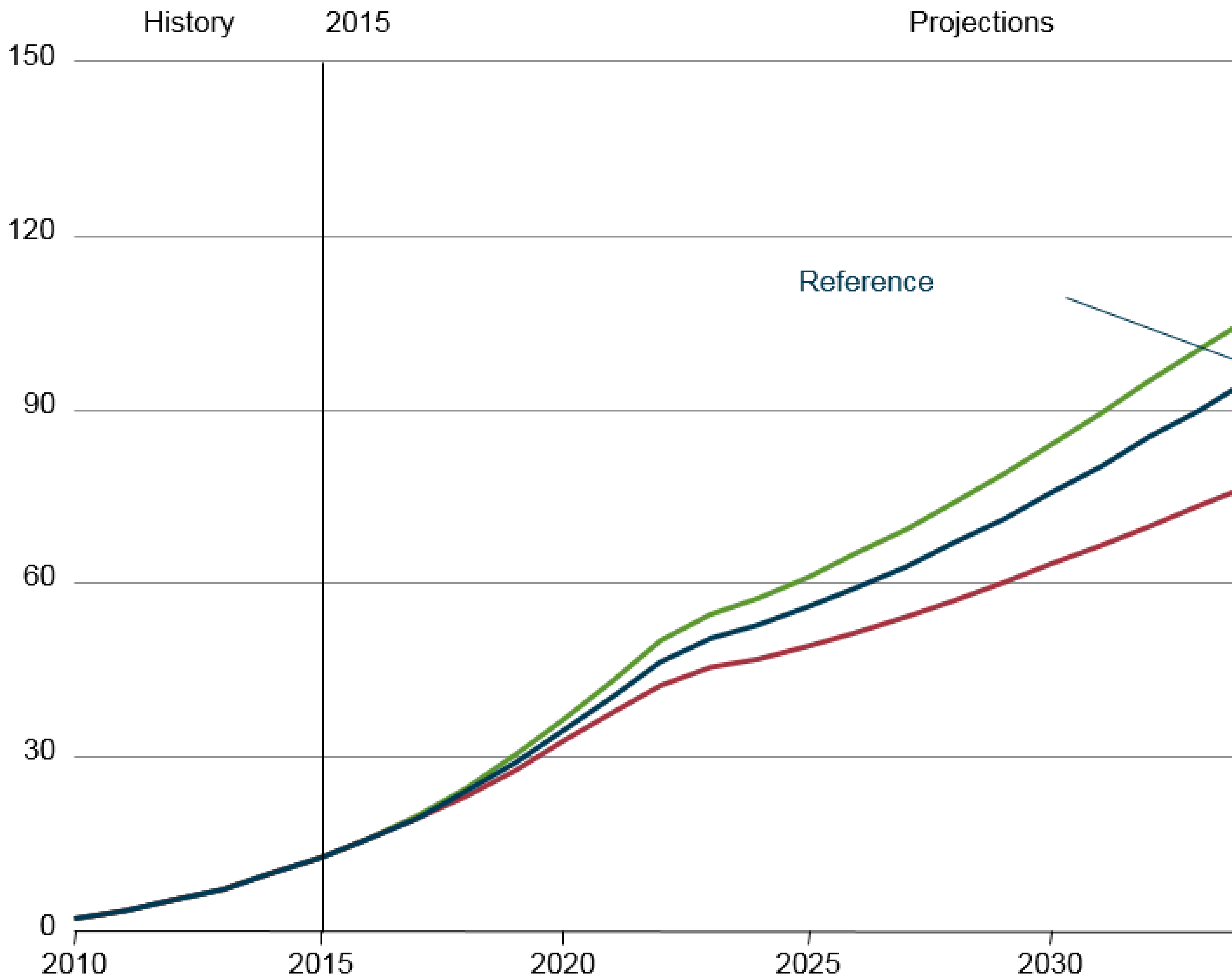
Electricity demand growth slows as more on-site generation reduces the need for central-station generation

The extension of federal tax credits for PV systems, combined with a continued decline in PV prices, spurs the adoption of residential and commercial PV in the AEO2016 Reference case (Figure ES-4). Installed residential PV capacity increases by an average of 10%/year from 2015–40, while installed commercial PV capacity increases by an average of 6%/year. In 2040, generation from residential systems totals 90 billion kWh, and generation from commercial systems totals 37 billion kWh in the Reference case. Without the electricity generated by residential PV systems that is used onsite, electricity sales to residential customers would be nearly 6% higher in 2040. In addition, net PV generation accounts for more than 2% of commercial sector electricity sales in 2040.

Figure ES-4. Electricity generation from solar power in the buildings se
cases, 2010-40
billion kilowatthours



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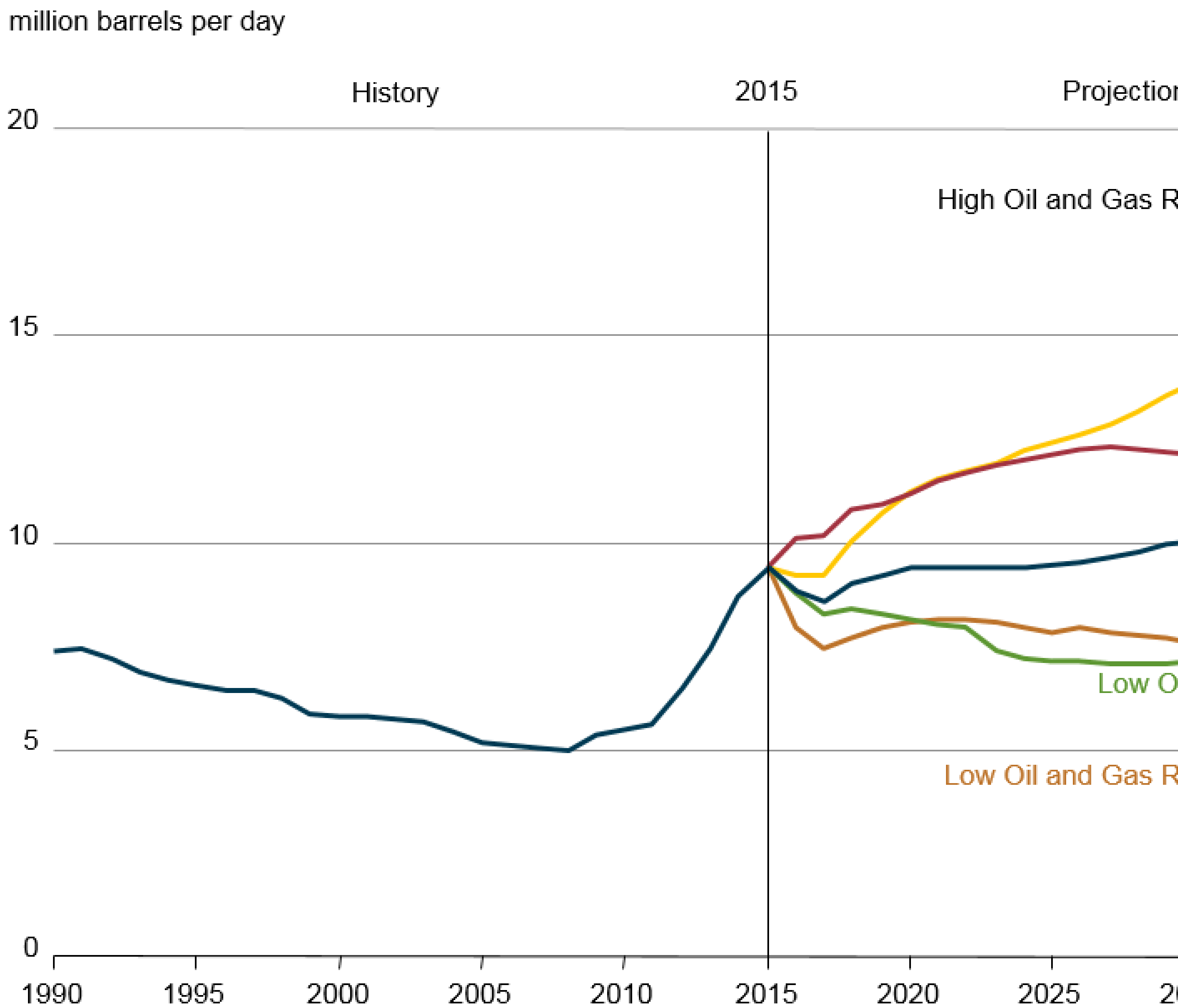
Spurred by higher energy demand and lower interest rates in the High Economic Growth case, solar PV net generation is 16% higher in the residential sector and 4% higher in the commercial sector in 2040 than in the Reference case. With the higher level of total electricity generation in the High Economic Growth case, residential electricity sales back to the grid are 15% higher in 2040 than in the Reference case. In the Low Economic Growth case, solar PV net generation is

30% lower in the residential sector and 4% lower in the commercial sector in 2040 than in the Reference case.

After 2017, U.S. oil production increases as prices rise

Total U.S. oil production in the AEO2016 Reference case falls from 9.4 million barrels per day (b/d) in 2015 to 8.6 million b/d in 2017. After 2017, the total production grows to 11.3 million b/d in 2040 as real (2016 dollars) crude oil prices recover from an annual average of less than $50/barrel (b) in 2017 to more than $130/b in 2040 (Figure ES-5). The Lower 48 states lead the increase in crude oil production, which results largely from higher oil prices, continued advances in industry practices, and further development of technologies that reduce costs and allow for increased recovery of tight oil resources.

Figure ES-5. Total U.S. crude oil production in five cases, 1990-2040



[figure data](#)

The Bakken, Western Gulf Basin (including the Eagle Ford play), and Permian Basin lead the continued development of tight oil resources in the Lower 48 states in the Reference case. With the recent decline in oil prices, tight oil production shows the largest reduction, from 4.9 million b/d in 2015 to 4.2 million b/d in 2017, before increasing to 7.1 million b/d in 2040. After 2017, higher oil prices, as well as ongoing exploration, appraisal, and development programs that expand operator knowledge about producing reservoirs, could result in the identification of additional tight oil resources and the development of technologies that reduce costs and increase oil recovery.

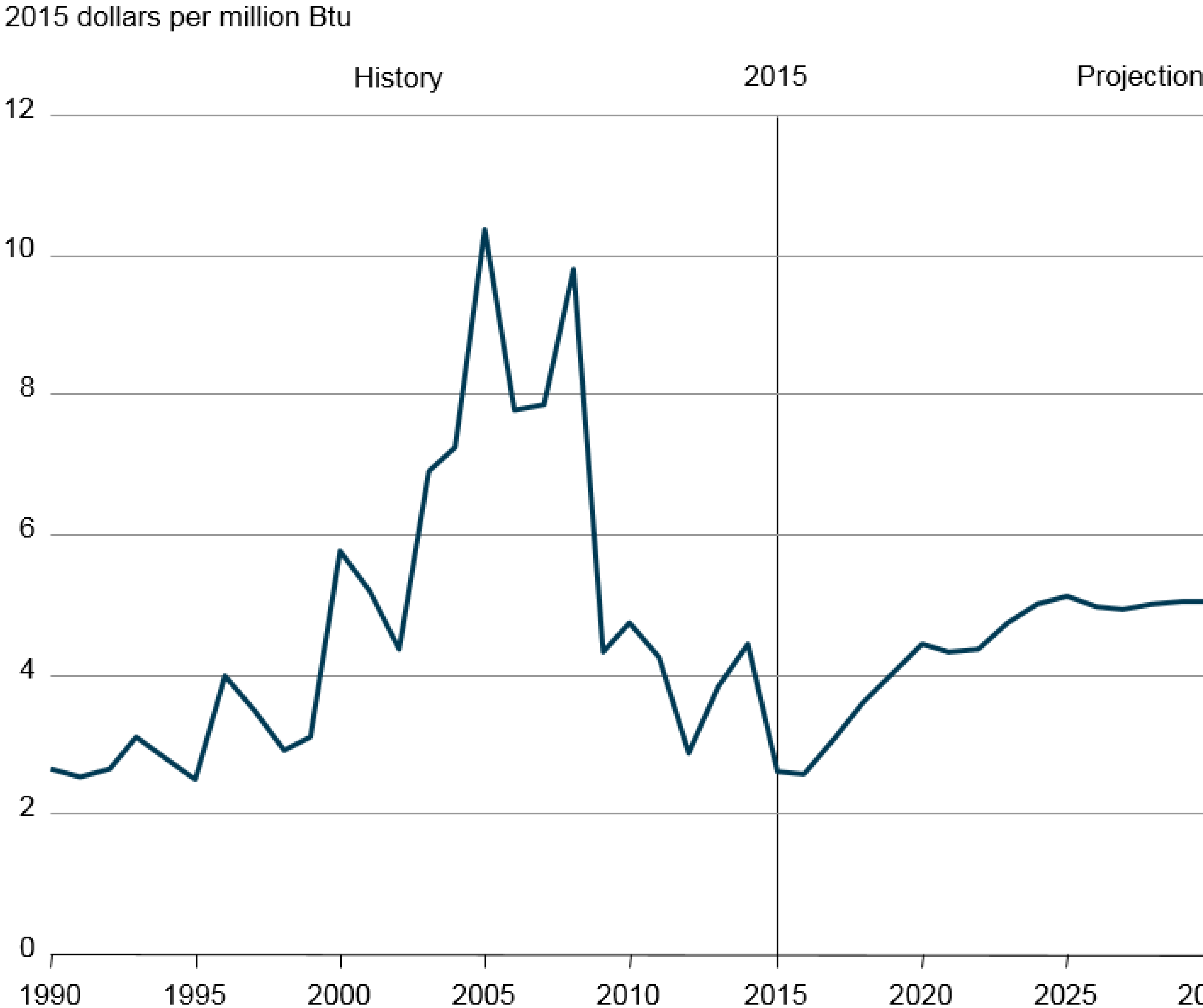
In the Lower 48 states, offshore production (which is less sensitive to short-term price movements than onshore production), increases to 2.0 million b/d in 2021, led by new deepwater projects in the Gulf of Mexico, including the Heidelberg and Appomattox fields that are scheduled to begin operations in 2016 and 2017, respectively. After 2021, Lower 48 offshore crude oil production declines to roughly 1.6 million b/d in 2030 and remains at about that level through 2040, as production from newly developed fields is offset by declines in legacy fields.

Lower 48 onshore crude oil production using CO_2-enhanced oil recovery increases from 0.3 million b/d in 2015 to 0.7 million b/d in 2040 as oil prices rise and affordable sources of CO_2 become available. Both onshore and offshore production in Alaska continue to decline, from a total of nearly 0.5 million b/d in 2015 to less than 0.2 million b/d in 2040.

U.S. natural gas production continues to rise despite low or moderately rising prices

Total U.S. dry natural gas production increases in the Reference case from 27.2 trillion cubic feet (Tcf) in 2015 to 42.1 Tcf in 2040, while average annual U.S. natural gas prices at the Henry Hub (in 2015 dollars) remain at about $5.00/million British thermal units (Btu) (Figure ES-6). Although natural gas prices remain relatively low and stable, projected development of natural gas resources in shale gas and tight oil plays, tight gas, and offshore increases as a result of abundant domestic resources and technology improvements.

Figure ES-6. Annual average Henry Hub natural gas spot market price
Reference case, 1990-2040



[figure data](#)

Production from shale gas and tight oil plays leads the increase in natural gas production in the Reference case from 13.6 Tcf in 2015 to 29.0 Tcf in 2040, as their share of total U.S. dry natural gas production grows from 50% in 2015 to 69% in 2040 (Figure ES-7). Shale gas and tight oil plays are resources in low-permeability reservoirs. They include the Sanish-Three Forks

Formation beneath the Bakken, Eagle Ford, Woodford, Austin Chalk, Spraberry, Niobrara, Avalon/Bone Springs, and Monterey formations.

Figure ES-7. U.S. dry natural gas production by source in the Referenc
2040

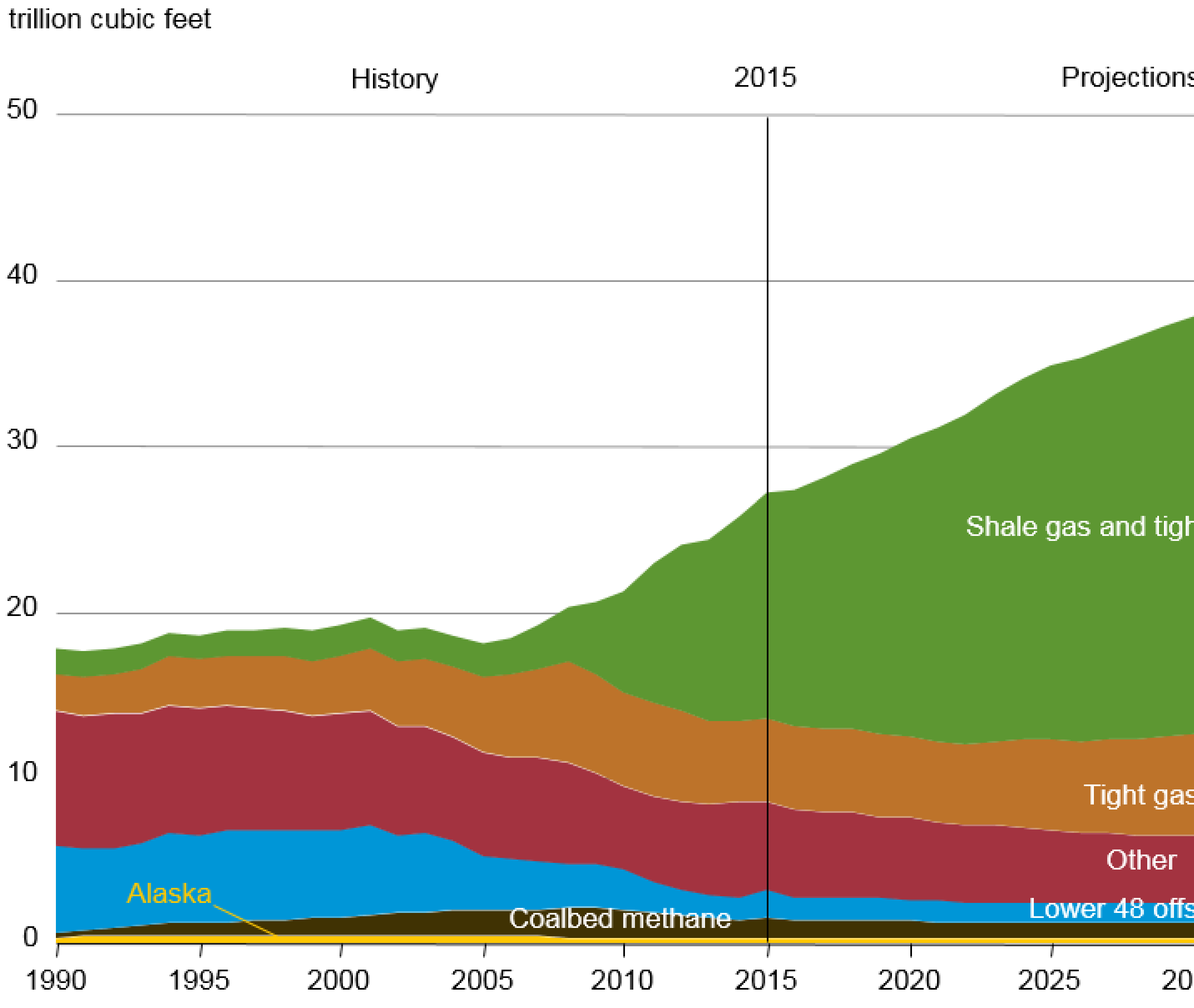


figure data

U.S. offshore natural gas supply, after declining from 2015 to 2016 to around 1.4 Tcf, remains stable from 2015–20 in the Reference case, then falls to 1.2 Tcf in 2023, reflecting declines in production from legacy offshore fields. After 2027, as increased production from new discoveries offsets the decline in legacy fields, offshore natural gas production increases to 1.7 Tcf in 2040.

Growing natural gas demand in the industrial and electric power sectors and increasing exports of liquefied natural gas (LNG) place upward pressure on domestic natural gas prices. Improvements in drilling technology allow production to keep pace with demand (both for domestic consumption and for export), resulting in relatively stable prices throughout the projection period.

Technology improvements increase U.S. production from tight and shale formations

Growth in U.S. oil and natural gas resources (proved reserves and technically recoverable resources) and cumulative production have averaged 1.8%/year and 2.5%/year for crude oil and natural gas, respectively, from 1990–2005, and 3.6%/year and 3.1%/year from 2005–15. Examples of technology improvements include better rigs and drill bits that can drill wells faster at lower unit costs, improved hydraulic fracturing techniques that expose more of the rock to the well, better control of the drill bit path, and better offshore rigs and platforms that can reach great depths and handle extreme pressures and temperatures. Multi well pad drilling and improvements in logistics also have contributed to the cost reductions. These technology improvements have allowed, and are likely to continue to allow, the expansion of tight and shale gas production, as indicated in Figure ES-7.

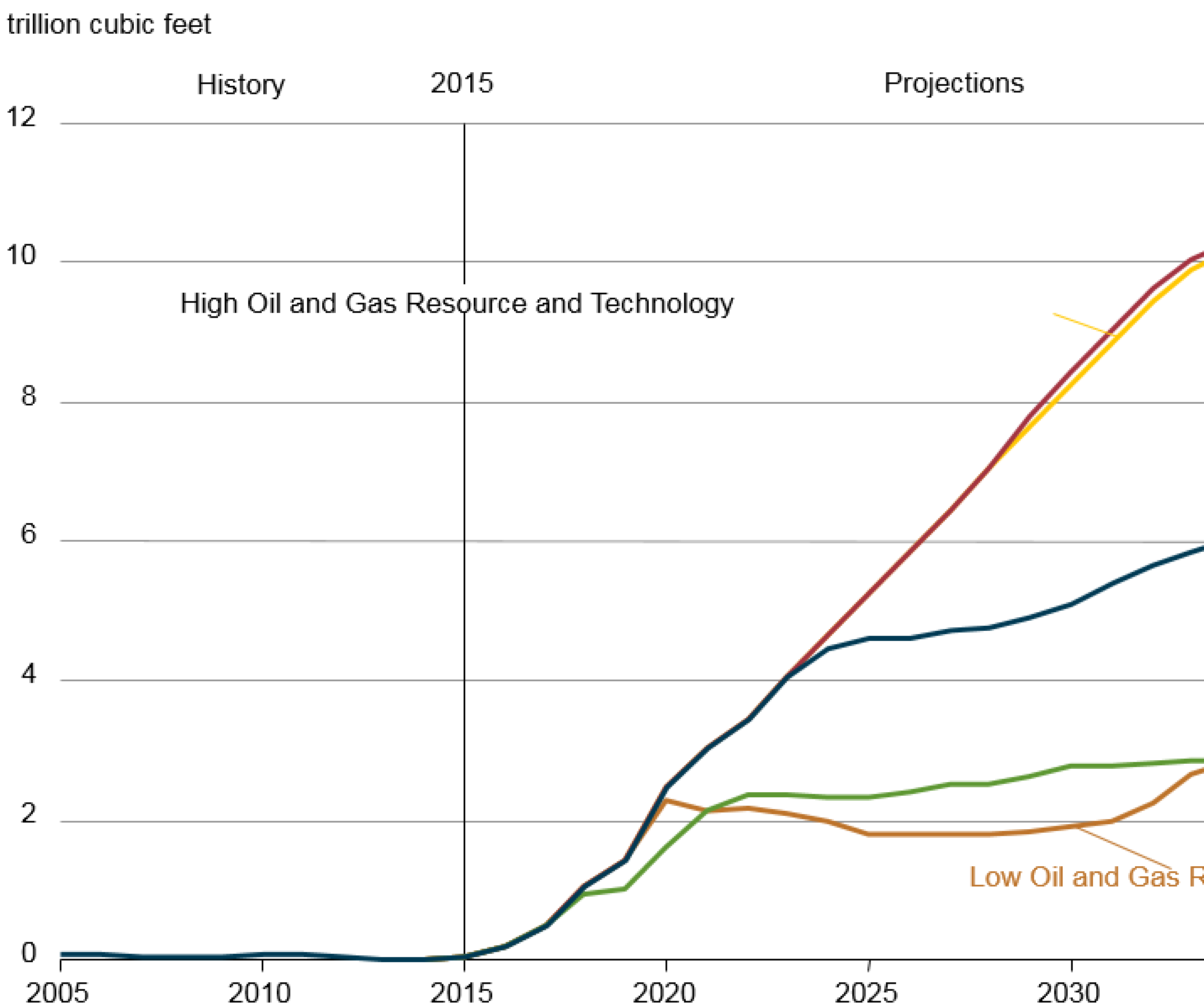
The Reference case incorporates assumptions about changes in upstream technologies and industry practices in developing tight oil, tight gas, and shale gas plays. The plays are divided into two tiers, with different aggregate technology change rates depending on their levels of development, which are based on the potential effects of future breakthrough technologies on resource recovery rates and drilling and operating costs, particularly in areas that are less developed.

Natural gas trade and LNG exports depend on the differential between U.S. and world natural gas prices

The size of the domestic oil and natural gas resource and technology improvement rates affect the ability of U.S. producers to supply natural gas and the cost of domestic supplies. Lower world oil prices reduce the competitiveness of U.S. LNG in world markets, while exports to Canada and Mexico are affected more directly by U.S. natural gas prices, with exports falling when natural gas prices rise and increasing when natural gas prices fall.

In the Reference case, total U.S. exports of natural gas increase to 8.9 Tcf in 2040, with LNG exports of 6.7 Tcf (Figure ES-8). In the High Oil Price case, with higher international natural gas prices, particularly in Asia, U.S. LNG exports are more competitive. The greater growth in LNG exports in the High Oil Price case increases the call on domestic production, which in turn leads to higher domestic natural gas prices. The increased demand for LNG exports is offset somewhat by lower natural gas exports to Canada and Mexico as prices rise. U.S. exports of natural gas increase in the High Oil Price case to 12.5 Tcf in 2035 and remain near that level through 2040, and LNG exports increase to 10.5 Tcf in 2040. In the Low Oil Price case, where there is less incentive for LNG exports, total U.S. exports of natural gas increase only to 6.8 Tcf in 2040, with LNG exports of 5.6 Tcf.

Figure ES-8. U.S. exports of liquefied natural gas in five cases, 2005-40



[figure data]()

In the High Oil and Gas Resource and Technology case, lower production costs lead to more natural gas production. With assumptions of a larger resource base and more rapid improvement in production technologies in the High Oil and Gas Resource and Technology case than in the Reference case, the United States becomes a net exporter of natural gas to Canada in 2029 and U.S. LNG exports increase to 10.3 Tcf in 2035–40. In the Low Oil and Gas Resource and

Technology case, U.S. natural gas production is lower because of a smaller resource base and slower improvement in technology than in the Reference case. In this case, U.S. natural gas exports total 4.7 Tcf in 2020, with LNG exports of 2.3 Tcf in that year, and remain at roughly the same level through 2034 before declining slightly through 2040.

California zero-emission vehicle program drives increasing sales of zero-emissions vehicles and transitional zero-emissions vehicles

The California zero-emissions vehicles (ZEV) (electric and hydrogen fuel cell) program issued in July 2014 is part of California's Advanced Clean Cars Program. The Advanced Clean Cars Program was adopted in the Annual Energy Outlook as part of AEO2016. The Advanced Clean Cars Program combines control of Clean Air Act-defined criteria emissions, including greenhouse gases, and the ZEV program. The program was enacted in addition to national corporate average fuel economy standards,
primarily to increase the percentage of ZEVs and transitional zero-emissions vehicles (TZEV)s (plug-in hybrid-electric and hydrogen internal combustion engine vehicles) to combat California-specific smog and emissions concerns. Nine other states have adopted the California ZEV program. California and those 9 states represented 33% of the total U.S. market for new lightduty vehicles in 2015.

Manufacturers are required to produce ZEV credits equal to a percentage of their average conventional vehicle sales. Large manufacturers (more than 20,000 annual sales in California) are required to produce a minimum percentage of ZEVs. The remainder of the credits can be earned with TZEVs. Starting in model year (MY) 2018, manufacturers are required to produce ZEV credits equal to 4.5% of their conventional vehicle sales, and in MY 2025 the percentage requirement increases to 22%, with a minimum of 16% ZEVs. The credits awarded vary, depending on the vehicle type and driving range. With limitations, credits may be traded between manufacturers and between states, and requirements are lessened for smaller manufacturers.

The updated California ZEV program for MY 2018 and later drives increasing ZEV sales. In the AEO2016 Reference case, total U.S. annual sales increase to 590,000 ZEVs and 348,000 TZEVs in 2025, partly as a result of the ZEV program (Figure ES-9). Combined ZEV and TZEV sales account for 6% of national light-duty vehicle (LDV) sales in 2025, the first year of complete implementation. In 2025, states in the ZEV program account for 415,000 combined ZEV and TZEV sales, or 50% of total ZEV and TZEV sales. Currently, ZEV and TZEV sales in covered states account for 39% of total ZEV and TZEV sales. This represents compliance, as the credits earned would meet the credit percentage required. By 2040, nationwide ZEV and TZEV sales reach a combined 1.1 million sales.

Figure ES-9. Sales of zero-emission vehicles and transitional zero-emis
2010-40
thousands

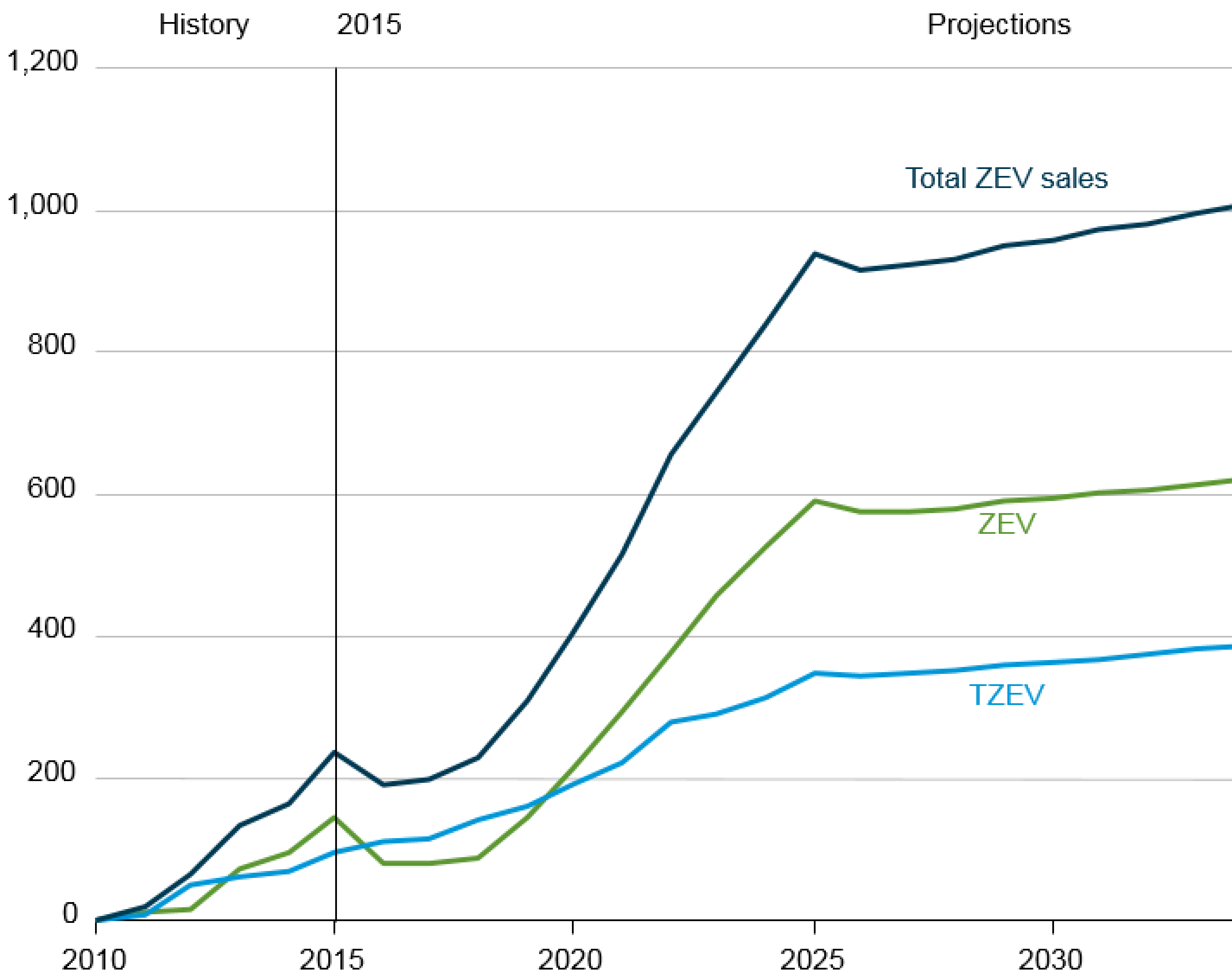


figure data

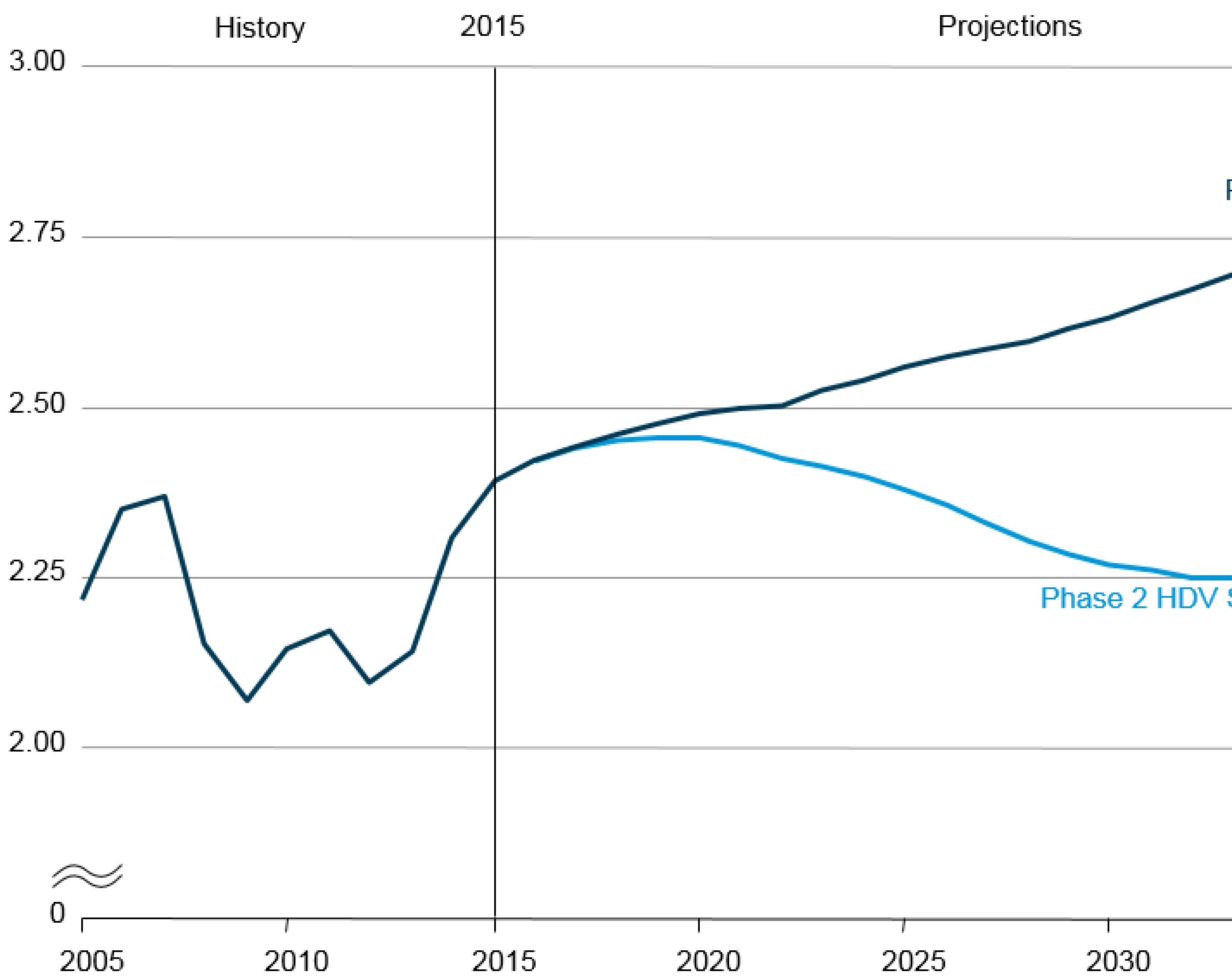
Proposed medium- and heavy-duty vehicle Phase 2 standards reduce diesel fuel demand and carbon dioxide emissions

AEO2016 includes a Phase 2 Standards case that analyzes the estimated effects of more stringent regulations for fuel consumption and greenhouse gas emissions from medium- and heavy-duty vehicles. The proposed Phase 2 standards, issued jointly by the National Highway Transportation Safety Administration and the EPA, are a continuation of the Phase 1 standards, which expire at the end of MY 2018. The Phase 2 standards would take effect in MY 2021, with total implementation in MY 2027, addressing vehicles in four discrete categories: combination tractors, trailers, heavy-duty pickup trucks and vans, and vocational vehicles [5].

In the AEO2016 Phase 2 Standards case, the vehicle categories are reduced to three gross vehicle weight groups: Class 3, Classes 4–6, and Classes 7–8. Compared with average new vehicle fuel economy in 2027 in the AEO2016 Reference case, average new vehicle fuel economy in the Phase 2 Standards case for combined Classes 3–8 increases by 28%. After 2027, the standards remain constant, but technology adoption continues as new cost-effective technologies become available. In 2040, the combined average fuel economy for vehicles in all three categories in the Phase 2 Standards case is 10.6 miles per gallon (mpg)—compared to 8.0 mpg in the Reference case—a 33% improvement. Higher on-road fuel economy of the medium- and heavy-duty truck stock, which is slowly affected by the introduction of new vehicles, reduces energy consumption in the Phase 2 Standards case by 22% in 2040 compared with the Reference case level. Cumulative medium- and heavy-duty vehicle consumption of diesel fuel from 2021–40 in the Phase 2 Standards case is 2.5 billion barrels lower than in the Reference case (Figure ES-10). Consequently, cumulative CO2 emissions in the transportation sector from 2021–40 are 1,186 million metric tons (3%) lower in the Phase 2 Standards case than in the Reference case.

Figure ES-10. Diesel fuel consumption by large trucks, Classes 3-8, in
2005-40

million barrels per day



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Class 2b pickup trucks and vans are included in the Phase 2 Standards case; however, the fuel economy and fuel consumption for these vehicles are not reported individually in AEO2016. Class 2b is included in the data for total transportation fuel consumption and emissions. Trailers are not explicitly modeled in the Phase 2 Standards case because of a lack of inventory and usage data. Despite improvements since the start of Phase 1, many limitations still exist in the availability of data on the technologies used to meet the Phase 1 compliance standards and on Phase 2 vehicle baseline performance, which makes it difficult to estimate future energy effects. The EPA baseline for Phase 2 is established by assuming compliance with Phase 1 in MY 2017, which is evaluated differently. Therefore, it is unknown whether Phase 1-compliant vehicles in MY 2017 accurately represent the proposed Phase 2 baseline. The discussion of the Phase 2 Standards case in the AEO2016 Issues in Focus details the proposed standards, the vehicles affected, and regulatory and modeling issues.

With lower natural gas prices, industrial sector energy consumption increases through 2040

The AEO2016 Reference case projects robust growth in industrial energy use of natural gas as shipments increase over the 2015–40 period. Low natural gas prices and increased availability of natural gas and related resources, including hydrocarbon gas liquids (HGL), benefit the U.S. industrial sector and the manufacturing sector, in particular, in several ways. Natural gas is used as a fuel to produce heat and to generate electricity. Natural gas is also used, along with HGL products, as a feedstock to produce chemicals, pharmaceuticals, and plastics. Low energy prices result in more rapid economic growth and increasing demand for industrial products.

Industrial shipments and improvements in energy efficiency over time have significant effects on energy consumption in the industrial sector in the Reference case. As a result of efficiency improvements, industrial energy consumption grows more slowly than shipments. Total delivered energy consumption in the industrial sector grows by 1.2%/year from 2015–40. In the near term, energy consumption grows by 1.8%/year in the Reference case between 2015 and 2025, more than twice the rate from 2025 to 2040, as a result of more rapid growth in shipments in the near term, 2.4%/year from 2015–25, compared with 1.5%/year from 2025–40.

Growth in industrial production leads to increased natural gas consumption in the industrial sector, from 9.4 quadrillion Btu in 2015 to 11.3 quadrillion Btu in 2025 and to 12.9 quadrillion Btu in 2040. The projected rate of growth in natural gas consumption, at 1.3%/year from 2015–40, is slightly higher than the rate of growth for total industrial sector energy consumption. The bulk chemical industry is the largest user of natural gas in the industrial sector. Other large users include refining, food products, mining, iron and steel, paper products, and metal-based durables.

The bulk chemical industry accounts for much of the growth in industrial energy consumption, with a competitive price advantage for feedstocks, especially HGL, reflected in the growth of shipments from 2015–40. In the Reference case, energy consumption in the bulk chemical industry grows by 80% from 2015–40, compared with 18% for other manufacturing and 30% for nonmanufacturing industries (Figure ES-11). Energy consumption growth in the bulk chemical industry is concentrated in the 2015–25 period (4.3%/year, compared with 1.1%/year from 2025–40), and shipments of bulk chemicals increase by 4.8%/year from 2015–25, compared with 1.4%/year from 2025–40.

Figure ES-11. Industrial sector energy consumption by application in th
case, 2010-40

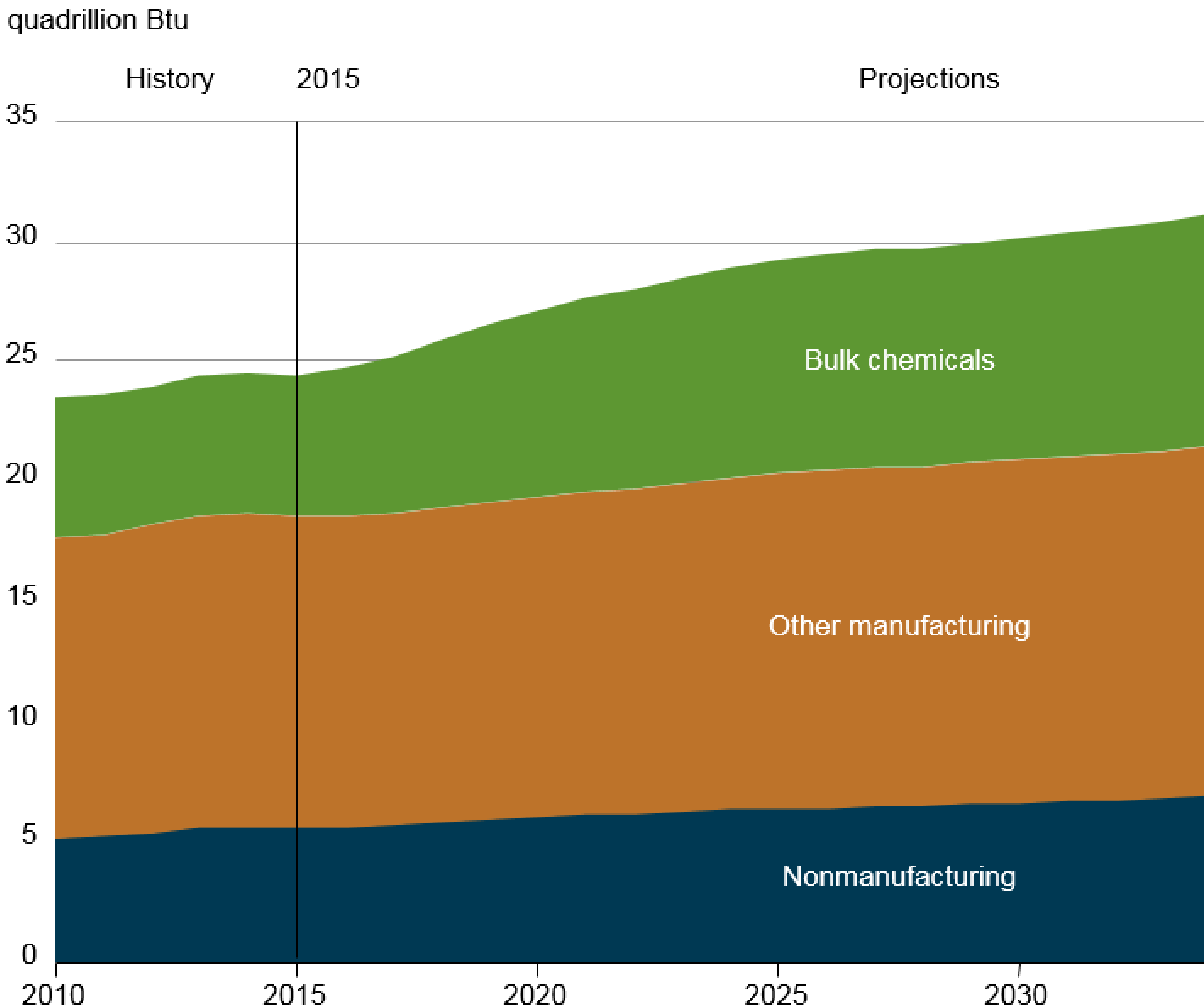
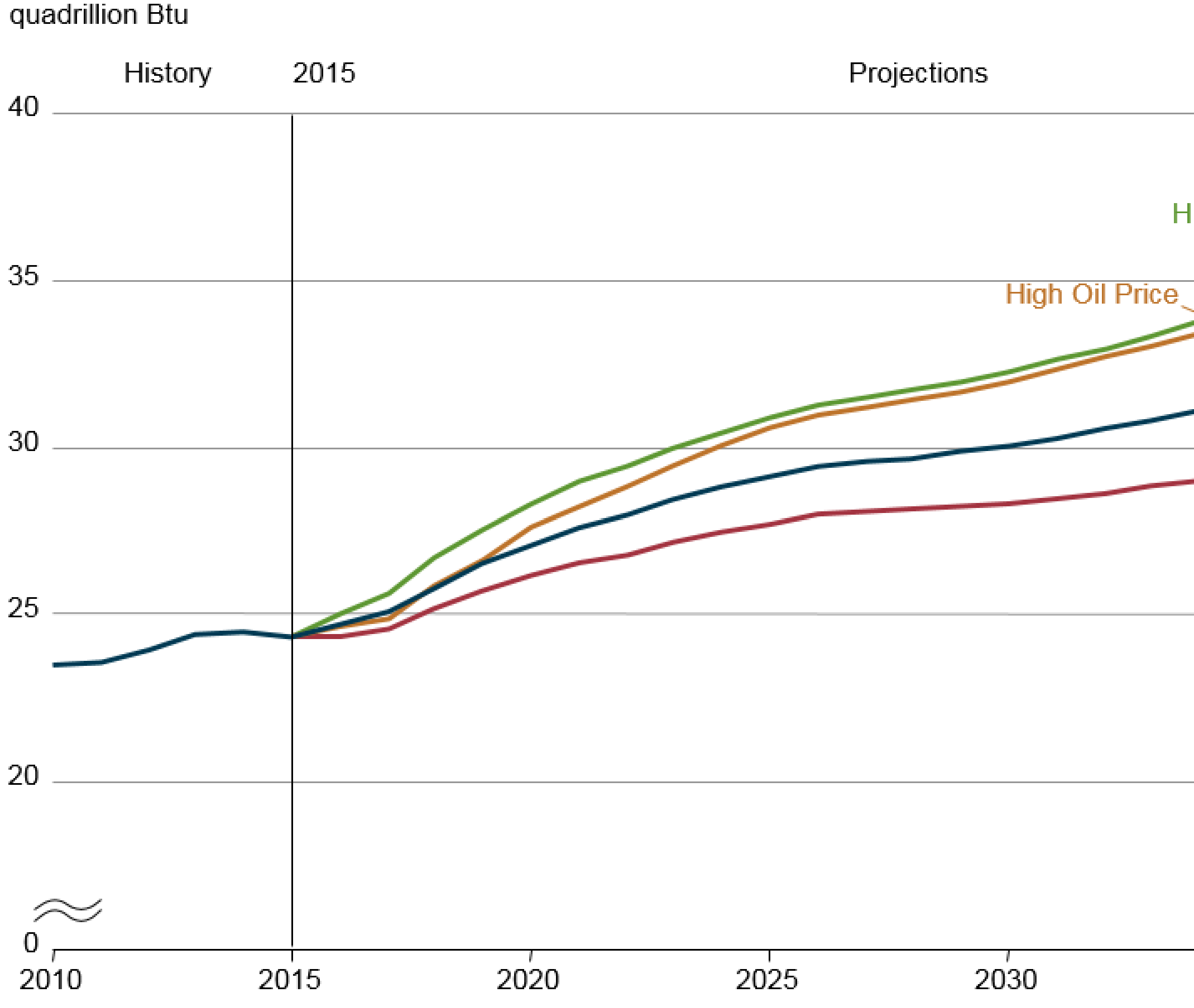


figure data

Different assumptions about the rate of economic growth and the levels of oil and natural gas prices also affect energy consumption growth rates in the industrial sector (Figure ES-12). In both the High Economic Growth case and the High Oil Price case, energy consumption growth slows in the later years of the projections. In the High Oil Price case, energy consumption growth in the mining industry is considerably higher than in the Reference case and higher than in the High Economic Growth case, as shipments from the oil and gas extraction industry grow rapidly when energy prices are high. Energy consumption in the bulk chemical industry grows by more than 2%/year in the Reference, High Oil Price, Low Economic Growth, and High Economic Growth cases.

Figure ES-12. Industrial sector delivered energy consumption in four ca



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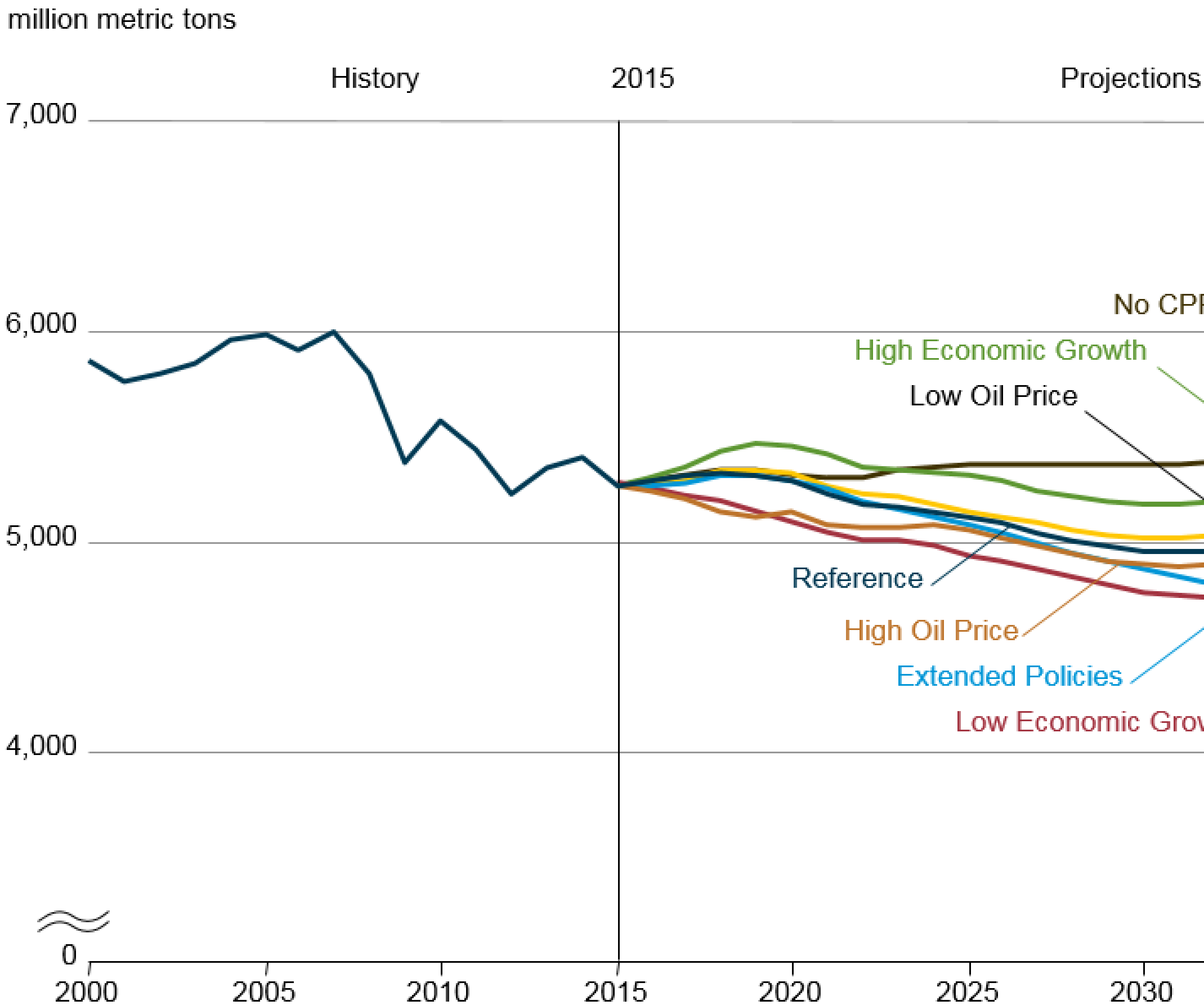
Energy-related CO2 emissions vary widely with different assumptions about economic growth, energy prices, and policies

The AEO2016 Reference case assumes that current laws and regulations remain in effect through 2040; however, the status of the CPP, which is on hold pending judicial review, is uncertain. In the Reference case, the CPP is assumed to be implemented as scheduled, using mass-based standards that impose limits on CO2 emissions from fossil fuel-fired generators. The No CPP case assumes that no federal carbon reduction program is implemented.

Across the alternative AEO2016 cases, total energy-related CO2 emissions in 2040 vary by more than 800 million metric tons, depending on the assumptions in each case about economic growth, energy prices, and energy policies (Figure ES-13). In the High Economic Growth case, which includes the CPP, total emissions in 2040 are close to the No CPP case total of 5,468 million metric tons because emissions from sectors other than electric power increase as the economy grows. In the Extended Policies case, CO2 emissions fall to 4,623 million metric tons in 2040, which is 23% lower than the 2005 total. The Extended Policies case assumes that existing policies and regulations remain in effect or are extended beyond sunset dates specified in current regulation; that efficiency policies—including corporate average fuel economy standards, appliance standards, and building codes—are expanded beyond current provisions; and that EPA CPP regulations that reduce CO2 emissions from electric power generation are tightened after 2030. As a result, energy-related CO2 emissions in 2040 in the Extended Policies case are 845 million metric tons lower than in the No CPP case.

Figure ES-13. Energy-related carbon dioxide emissions in seven cases



[figure data]()

Variations in energy prices have a smaller effect than the CPP requirements on total CO_2 emissions. Because the CPP imposes a limit on CO_2 emissions in the electric power sector that are met in all cases, differences in energy-related emissions are seen only in the end-use sectors. As a result, the difference in 2040 CO_2 emissions between the Low Oil Price and High Oil Price cases is smaller than the difference between the No CPP case and the Extended Policies case.

Endnotes

1. U.S. Environmental Protection Agency, "Standards of Performance for Greenhouse Gas Emissions From New, Modified, and Reconstructed Stationary Sources: Electric Utility Generating Units" (Washington, DC: October 23, 2015) https://www.federalregister.gov/articles/2015/10/23/2015-22837/standards-of-performance-for-greenhouse-gas-emissionsfrom-new-modified-and-reconstructed-stationary; and U.S. Environmental Protection Agency, "Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units" (Washington, DC: October 23, 2015) https://www.federalregister.gov/articles/2015/10/23/2015-22842/carbon-pollution-emission-guidelines-for-existing-stationarysources-electric-utility-generating.
2. California Environmental Protection Agency, Air Resources Board, "Zero-Emission Vehicle Standards for 2018 and Subsequent Model Year Passenger Cars, Light-Duty Trucks, and Medium-Duty Vehicles" (Sacramento, CA: July 10, 2014), http://www.arb.ca.gov/msprog/zevprog/zevregs/1962.2_Clean.pdf.
3. U.S. Environmental Protection Agency and National Highway Transportation Safety Administration, "Greenhouse Gas Emissions and Fuel Efficiency Standards for Medium- and Heavy-Duty Engines and Vehicles – Phase 2" (Washington, DC: June 19, 2015), http://www.nhtsa.gov/fuel-economy.
4. For example, whether or not to engage in interstate trading programs, to allow credits for outside-the-fence options like energy efficiency, to auction allowances or to allocate them freely if electing a mass-based approach, how to credit renewable energy projects under a rate-based program, and other options.
5. Vocational vehicles include any medium- or heavy-duty vehicle that is not a heavy-duty pickup or van or a semi-truck tractor with a 5th wheel trailer attachment (including vehicles like box or delivery trucks, buses, dump trucks, tow trucks, refuse haulers, and cement trucks).