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Thank you, Mr. Chairman, Ranking Member Frelinghuysen, and Members of the Committee for the opportunity to testify today. I am pleased to appear before your Committee for my first budget presentation as Director of the Department of Energy's Office of Science. I would like to thank the Committee for your strong support of the Office of Science in recent years. This support has enabled the Office of Science to make investments in basic science and advanced research capabilities that are essential to improving U.S. competitiveness, energy security, the environment, and our fundamental understanding of the universe.

The FY 2011 budget request of $5.12 billion supports the President's Plan for Science and Innovation, which encompasses the entire Office of Science budget, as part of a strategy to double overall basic research funding at select agencies. As part of this plan, the FY 2011 request supports the training of students and researchers in fields critical to our national competitiveness and innovation economy, investments in areas of research critical to our clean energy future and to making the U.S. a leader on climate change, and unique facilities that keep the U.S. at the vanguard of science.

As you have heard from Secretary Chu and Under Secretary Koonin, science and technology lie at the heart of the Department of Energy's mission to solve our nation's most critical energy, environment, and national security challenges. The Office of Science plays a crucial role both for the Nation and the Department as a prime supporter of basic research spanning many disciplines of the physical and life sciences. The Department depends on the Office of Science to support the basic science that will enable transformative energy technologies and advance our understanding of climate change and the environment; the FY 2011 budget request supports new research initiatives for these critical priorities. The Office of Science budget has far-reaching impact in its direct support for investigators from more than 300 academic institutions and from all of the DOE laboratories. In total, the FY 2011 budget request will support about 27,000 scientists, engineers, students, and technicians across all fifty States.

The Office of Science also provides the Nation's researchers with state-of-the-art user facilities—the large machines of modern science. Increasingly, they are first-of-a-kind facilities that offer capabilities unmatched anywhere in the world and that enable U.S. researchers and industries to remain at the forefront of science, technology, and innovation. The 2009 Nobel Prize in Chemistry was awarded for work on the molecular structure of ribosome performed in part at the Office of Science's four x-ray synchrotron light sources—facilities that enable

groundbreaking research by thousands of researchers annually. In total, nearly 26,000 researchers from universities, national laboratories, industry, and international partners are expected to use the Office of Science scientific user facilities in FY 2011. The FY 2011 budget request provides support for the construction, maintenance, and operation of the Office of Science user facilities.

The Office of Science is also one of the nation's primary supporters of the next generation of scientists and engineers. The Office of Science, through its six research programs, supports the training of undergraduates, graduate students, and postdoctoral researchers as an integral part of the ongoing sponsored research activities at universities and DOE national laboratories. Office of Science programs also support the development of individual research programs of outstanding scientists early in their careers to stimulate research careers in disciplines supported by the Office of Science. The FY 2011 request provides support to bring 60 new scientists into the Office of Science Early Career Research program and to double the number of graduate fellowships in basic science awarded through the Office of Science Graduate Fellowships program.

As the material that follows will explain, the Office of Science FY 2011 budget request of $5.12 billion is focused on accelerating the pace of discovery that addresses key national priorities. Our investments in fundamental science, unique world-leading research facilities, and outstanding researchers and students are aligned to advance our core missions.

Office of Science
FY 2011 President's Request
Summary by Program

(dollars in thousands)

	FY 2009 Approp.	FY 2009 Recovery Act Approp.[1]	FY 2010 Approp.	FY 2011 Request to Congress	FY 2011 Request to Congress vs. FY 2010 Approp.	
Office of Science						
Basic Energy Sciences	1,535,765	+555,406	1,636,500	1,835,000	+198,500	+12.1%
Biological and Environmental Research	585,176	+165,653	604,182	626,900	+22,718	+3.8%
Advanced Scientific Computing Research	358,772	+161,795	394,000	426,000	+32,000	+8.1%
High Energy Physics	775,868	+232,390	810,483	829,000	+18,517	+2.3%
Nuclear Physics	500,307	+154,800	535,000	562,000	+27,000	+5.0%
Fusion Energy Sciences	394,518	+91,023	426,000	380,000	-46,000	-10.8%
Workforce Development for Teachers and Scientists	13,583	+12,500	20,678	35,600	+14,922	+72.2%
Science Laboratories Infrastructure	145,380	+198,114	127,600	126,000	-1,600	-1.3%
Safeguards and Security	80,603	—	83,000	86,500	+3,500	+4.2%
Science Program Direction	186,695	+5,600	189,377	214,437	+25,060	+13.2%
SBIR/STTR (SC funding)[2]	104,905	+18,719	—	—	—	—
Subtotal, Office of Science	4,681,572	+1,596,000[3]	4,826,820	5,121,437	+294,617	+6.1%
Adjustments[4]	125,598	+36,918	76,890	—	-76,890	-100.0%
Total, Office of Science	4,807,170	+1,632,918	4,903,710	5,121,437	+217,727	+4.4%

[1] The Recovery Act Approp. column reflects the allocation of funding as of September 30, 2009 from the American Recovery and Reinvestment Act of 2009, P.L. 111–5.
[2] Reflects funding reprogrammed within the Science total to support the SBIR and STTR programs.
[3] $4,000,000 of the original $1,600,000,000 Recovery Act appropriation has been transferred to Departmental Administration for management and oversight.
[4] Adjustments include Congressionally-directed projects (FY 2009 and FY 2010), SBIR/STTR funding transferred from other DOE programs (FY 2009 and FY 2009 Recovery Act), and Congressionally-directed offsetting use of prior year balances (FY 2009 only).

Basic Energy Sciences

The Basic Energy Sciences (BES) program is the nation's lead sponsor of basic research needed to achieve transformational energy technologies. BES also supports the construction, operation, and maintenance of widely-used and impactful open-access scientific user facilities that advance a broad range of physical science directly relevant to the Department's energy mission.

The FY 2011 budget request supports investments in critical new areas for advanced energy. A centerpiece of this investment is the Energy Innovation Hubs. Modeled after the Office of Science Bioenergy Research Centers, the Energy Innovation Hubs focus on critical energy technology challenges by building creative, highly-integrated research teams that can accomplish more, faster, than researchers working separately. With your support, the Department launched the first three Hubs in FY 2010 with the Office of Science leading the Fuels from Sunlight Hub.

The FY 2011 request fully supports the first full year of operations of the Fuels from Sunlight Hub and proposes a new Energy Innovation Hub in BES for batteries and energy storage. The Administration's Energy Plan has two goals that require improvements in the science and technology of energy storage: 1. solar and wind providing over 25% of electricity consumed in the U.S. by 2025; and 2) 1 million all-electric or plug-in hybrid vehicles on the road by 2015. While batteries used in mobile (vehicles) and stationary (grid) applications differ in requirements for device size and weight, the critical scientific issues—electrodes, electrolytes and interfaces—that need to be addressed to advance these technologies are the same. Achieving technology breakthroughs in these areas requires understanding atomic and molecular processes that occur across these three components, which will in turn enable materials to be designed at the nanoscale, with architectures and functionalities to optimize charge storage and transfer.

Because the research challenges are inherently multi-disciplinary and the Administration has placed a priority on developing U.S. manufacturing capabilities in this area, the Hub approach is essential to accelerate progress towards achievement of our goals as rapidly as possible. The Batteries and Energy Storage Hub will target science knowledge gaps that are preventing breakthroughs in technology platforms for both grid and mobile applications. The Hub will expand our scientific base for synthesis of novel nanoscale materials with architectures tailored for specific electrochemical performance; will develop new methodologies to characterize materials and dynamic chemical processes at the atomic and molecular level; and will expand our competencies in simulation and prediction of structural and functional relationships using modern computational tools.

Following the successful launch of 46 Energy Frontier Research Centers in FY 2009 with FY 2009 appropriated funds and American Recovery and Reinvestment Act funds, the FY 2011 request makes a substantial new investment to support single investigators, small groups, and additional Energy Frontier Research Centers in several areas critical to energy innovation. Specifically, BES is moving aggressively to recapture U.S. leadership in the rapidly expanding area of materials synthesis. These funds will also be used to support fundamental science related to carbon capture and advanced nuclear systems. Specific focus areas will include the rational design of novel materials and separation processes for post-combustion CO_2 capture in existing power plants and catalysis and separation research for novel carbon capture schemes to aid the

design of future power plants. Research for advanced nuclear energy systems will focus on radiation resistant materials in fission and fusion applications, and separation science and heavy element chemistry for fuel cycles.

The FY 2011 budget also enables a new initiative to develop the science base for computational design of advanced engines. Predictive simulation of combustion in an evolving fuel environment is essential for developing more efficient and cleaner engines. This new BES activity, in concert with its ongoing collaboration with the Office of Energy Efficiency and Renewable Energy's Vehicle Technology Program, will provide a new paradigm for simulation of the complex physical processes that govern combustion. Through robust partnership with industry, the program will seek to build a set of capabilities that will give U.S. industry a competitive advantage in reducing the cost to design and produce advanced engine designs.

The FY 2011 budget also transfers the gas hydrates from the Office of Fossil Energy to the Office of Science. BES research will investigate fundamental scientific questions about methane hydrates: their formation and occurrence; their stability in natural or engineered systems; their role in geological/ ecological systems; and their role in the carbon cycle. The program will also study hydrates via controlled in situ depressurization and physical, thermal, and chemical stimulation of hydrate formations in the Arctic and the Gulf of Mexico. This research will be supported by theory and multi-scale modeling and simulation in areas such as the intermolecular forces that govern the structure and properties of gas hydrates.

The FY 2011 budget continues support for core research programs in materials sciences and engineering critical to the development of materials that improve the efficiency, economy, environmental acceptability, and safety of energy generation, conversion, transmission, storage, and use; research in chemistry and physics underpinning advances in efficient combustion systems with reduced emissions of pollutants, new solar photoconversion processes, improved catalysts for the production of fuels and chemicals, and better separations and analytical methods for applications in energy processes, environmental remediation, and waste management; research in geosciences for advanced monitoring and measurement techniques for reservoir definition and improved understanding of the fluid dynamics of complex fluids through porous and fractured subsurface rock; and research in the molecular and biochemical nature of photosynthesis for the development of solar photo-energy conversion.

The FY 2011 budget request provides continued support for the operations of the suite of BES scientific user facilities, including five x-ray light sources, three neutron sources, and five nanoscale science research centers. These facilities provide key capabilities for the fabrication of novel materials, for the examination of materials and their transformations at the atomic scale, and to enable scientists to correlate microscopic structures to macroscopic properties.

The Linac Coherent Light Source (LCLS) at SLAC National Accelerator Laboratory will begin the first full year of operations in FY 2011. LCLS is the Office of Science's newest x-ray light source user facility, providing an unprecedented combination of high spatial and temporal resolution for the investigation of atomic-scale structure and processes with brightness 10 orders of magnitude beyond conventional x-ray sources. The LCLS is on target for an on-time, within-

budget completion in FY 2010; the time between first start up and first light last April was under two hours, a remarkable achievement for a first-of-its kind machine.

The construction of the National Synchrotron Light Source II (NSLS-II) will continue at Brookhaven National Laboratory, including the largest component of the project—the building that will house the accelerator ring. When complete, NSLS-II will be a new synchrotron light source highly optimized to deliver ultra-high brightness and flux with exceptional beam stability and high-resolution, serving a large number of concurrent users. By contrast, LCLS operates with a laser-like intensity that is approximately ten orders of magnitude higher than NSLS-II and is capable of high-resolution studies of individual chemical reactions.

Biological and Environmental Research

The Biological and Environmental Research (BER) program supports world-leading research exploring the frontiers of genome-enabled biology; discovering the physical, chemical, and biological drivers and environmental impacts of climate change; and seeking the geochemical, hydrological, and biological determinants of environmental sustainability and stewardship.

The FY 2011 budget request supports substantially enhanced activities in climate research to improve our predictive capability. While the demands on climate change modeling to inform policy and investment decisions are increasing, the current state of climate models is insufficient to predict with detail and accuracy the future interactions between climate change and human activity. Improving the precision and accuracy of climate models is therefore of paramount importance. The FY 2011 budget increases in BER support the development of a predictive capability that will rapidly incorporate new science into state-of-the-art climate models and that will improve uncertainty quantification.

These new and enhanced activities will emphasize research and atmospheric data collection for improving representation of the feedbacks produced by the indirect effect of aerosols; enhanced uncertainty quantification for climate model simulations and predictions; conversion of observational data sets into specialized, multi-variable data sets for Earth System Model testing and improvement; model development testbeds in which model components can be rapidly prototyped and evaluated using integrated observational datasets; and development of numerical methods to enable climate models to use future computer architectures.

The FY 2011 request also supports continuing climate research efforts to develop an additional large-scale, manipulative experiment in the arctic tundra to improve understanding of the impacts of climate change on ecosystem structure and function. Research will be expanded to improve understanding of the role of terrestrial ecosystems as sources and sinks of greenhouse gases. These efforts will focus on the role of natural processes that control terrestrial carbon sequestration and how those processes might be managed to enhance carbon sequestration in terrestrial ecosystems. Atmospheric system research and operation of new Atmospheric Radiation Monitoring (ARM) Climate Research Facility instruments will provide critical data for improving representation of clouds and aerosols in climate models.

The FY 2011 request provides strong support for genomic science research, including the DOE Bioenergy Research Centers (BRCs) and the Joint Genome Institute (JGI). In only their third year, the BRCs have already pioneered new approaches to accelerate biofuels research. The BRCs will continue to advance our understanding of how plant and microbial system functions are specified by genome organization, expression, and regulation. This includes developing genomic, analytical, and computational approaches to study the structure, interdependence, and function of microbial communities and the identification of plant traits for improved bioenergy production or carbon sequestration. The JGI will continue to support the sequencing needs of the Genomic Science program, especially the Bioenergy Research Centers. Sequencing the 3 billion base-pair human genome took 13 years and multiple national and international partners. Today JGI sequences a trillion base pairs of DNA annually and has significantly expanded its role in large-scale genome sequencing and analysis, including enhanced data analysis tools for sequencing microbial communities. JGI activities will reflect the steady increase in production DNA sequencing as well as the resulting need for high-throughput, complex genome annotation and analysis.

The FY 2011 budget request also supports basic research on the fate and transport of contaminants in the subsurface. This research addresses unique physical, chemical, and biological processes controlling the flux of contaminants across and within the root zone of soils and the flux of contaminants to surface water bodies. Processes in these critical zones influence fluxes of carbon and key nutrients between the atmosphere and terrestrial biosphere. Support for updated equipment at the Environmental Molecular Sciences Laboratory (EMSL), including enhancement of leading capabilities in proteomics and advanced magnetic resonance, will sustain EMSL's position as a state of the art scientific user facility.

Advanced Scientific Computing Research

The United States currently leads the world in supercomputing capabilities. ASCR's Jaguar Supercomputer at Oak Ridge National Laboratory ranks #1 of the world's fastest computers. By pushing the boundaries of computation, modeling, and simulation, ASCR research is changing the landscape for scientific discovery and promoting an area of technical leadership for America.

The FY 2011 ASCR budget request capitalizes on continued gains in computer hardware and computational science, and positions DOE to address scientific challenges through modeling and simulation in the next decade. The coming decade will see increases in computing capabilities of a factor of 1000—the so-called exascale of computing. Continued support for existing facilities and programs broadens the number of applications and users with access to leadership scale computational capabilities, while new investments anticipate the ever growing need for enhanced computational capabilities in a number of critical science applications.

The FY 2011 budget request continues support for the Leadership Computing Facilities at Oak Ridge National Laboratory (OLCF) and Argonne National Laboratory (ALCF). Supercomputing systems at both facilities are openly available to the scientific community through the Innovative and Novel Computational Impact on Theory and Experiment (INCITE) program, and provide access and assistance to tool and library developers and to researchers seeking to scale their

application to this new realm of computing power—critical activities for harnessing the complexity of this and future architectures.

The FY 2011 budget request also includes site preparation and acquisition activities at Argonne National Laboratory for a next generation machine with approximately five times the current capacity of the Jaguar machine at Oak Ridge; and provides for the acquisition of an experimental prototype machine at Oak Ridge National Laboratory with a hybrid architecture offering greater efficiency and computing power but also new programming challenges. By actively participating in the development of these next-generation machines, we ensure that the most appropriate architectures for science are developed, and allow researchers to get a head start on understanding and overcoming the challenges of these new designs.

The National Energy Research Scientific Computing Center (NERSC) facility at Lawrence Berkeley National Laboratory (LBNL) will operate at a capacity of nearly one quadrillion operations per second (roughly half the capacity of the Jaguar machine) in FY 2011 to meet ever growing demand from Office of Science researchers. The NERSC focus will be on assisting applications to effectively utilize the potential of this facility and to move beyond NERSC to the leadership computing machines.

Building on the Recovery Act-supported Advanced Networking Initiative, the Energy Sciences Network (ESnet) will deliver 100–400 gigabit per second (Gbps) connections to Office of Science laboratories in FY 2011, with a goal of achieving 1,000 Gbps connectivity in 2014. These increases in bandwidth are necessary to move massive amounts of data to and from the supercomputing facilities and from other research facilities such as the Large Hadron Collider at CERN and Spallation Neutron Source. The ESnet is also critical to effective utilization of the growing amounts of data in climate research, nuclear structure, genomics, and proteomics that advance DOE's energy and environment missions.

The FY 2011 budget continues the critical research efforts in Scientific Discovery through Advanced Computing (SciDAC) and the core research programs in Applied Mathematics and Computer Science. These investments enable scientists to effectively utilize the capabilities of the Leadership Computing Facilities and beyond. Core research in Applied Mathematics and Computer Science for FY 2011 will continue to focus on long-term research needs. In networking, the focus will continue to be on developing the advanced tools to harness the growing capabilities and requirements of the ESnet and the SC research community.

High Energy Physics

The High Energy Physics (HEP) program supports investigations at the far reaches of our knowledge of matter, energy, and the universe. HEP-supported researchers explore the *energy frontier* with powerful particle accelerators designed to discover as-yet-undetected particles, search the *intensity frontier* with accelerator and reactor systems specifically designed to detect rare subatomic events, and investigate the *cosmic frontier* with detectors in space, on the earth's surface, and underground.

The FY 2011 HEP budget request continues support for unique domestic research facilities and partnerships to ensure that the U.S. will continue to lead the search for the Higgs Boson—whose existence is predicted by the Standard Model of high energy physics—through Fiscal Year 2011. The request also supports investments in proposed new experiments that will position the United States for a world leading program at the intensity frontier of particle physics in the next decade.

The primary scientific goals at the *energy frontier* over the next five years are to enable discoveries of, for example, the Higgs boson and supersymmetric particles—either at the Tevatron or the Large Hadron Collider (LHC) at CERN. The Fiscal Year 2011 HEP budget request continues support for operation of the Tevatron Collider at Fermi National Accelerator Laboratory because Tevatron's record-breaking performance in delivering data over the last few years means that it will remain competitive with the LHC for significant discoveries throughout FY 2011. Experiments at the Tevatron systematically search for the Higgs boson. Continuing operations through FY 2011 will allow researchers to thoroughly explore the most likely mass ranges where the Higgs is expected to be found.

The FY 2011 budget request also provides for the U.S. LHC program, which supports researchers in the U.S., at universities and national laboratories, to build components for the LHC, design experiments, analyze experimental data, and host data centers here at home. Fermi National Accelerator Laboratory hosts the Tier 1 computing center for the Compact Muon Solenoid experiment at the LHC, and Brookhaven National Laboratory hosts the Tier 1 computing center for the LHC ATLAS experiment.

Following the guidance of the Particle Physics Project Prioritization sub-panel of the High Energy Physics Advisory Panel (the "P5 Report"), Fermi National Accelerator Laboratory is preparing to shift its primary science focus to the *intensity frontier*. Using incredibly intense source beams of particles and highly sensitive detectors, scientists can increase their ability to observe rare interactions among the most fundamental constituents of matter, and characterize one of the most elusive particles—the neutrino. The FY 2011 HEP budget request advances a suite of experiments employing these techniques at the so-called *intensity frontier* of particle physics. This includes project engineering and design for the proposed Long Baseline Neutrino Experiment (LBNE) and Muon to Electron Conversion Experiment, both of which will leverage existing infrastructure at Fermi National Accelerator Laboratory along with new technologies. The LBNE project, which proposes to examine properties of the neutrino particle that could help explain why there is more matter than anti-matter in the universe, is being developing by the Office of Science in coordination with the National Science Foundation. The NSF is considering the development of a Deep Underground Science and Engineering Laboratory (DUSEL) in an old gold mine in South Dakota -- an potentially attractive location for the large LBNE far neutrino detector. The Muon to Electron Conversion Experiment promises insights into the relationship between the fundamental forces of matter. Sustained investment in these domestic facilities will ensure a leading role for the US at the Intensity Frontier.

The FY 2011 budget request also supports DOE partnerships with NASA and NSF in world class, space-based and ground-based particle astrophysics observatories for exploration of the *cosmic frontier*. HEP and NASA are presently jointly supporting analysis of data from NASA's Fermi Gamma-ray Space Telescope that detects gamma-rays emanating from astrophysical

sources, and HEP continues support for commissioning and integration activities for the Alpha Magnetic Spectrometer experiment which is on NASA's Space Shuttle manifest for launch in 2010. HEP is collaborating with NSF on experiments using ground-based observatories, including the Baryon Oscillation Spectroscopic Survey, which is currently operating, and the Dark Energy Survey, currently in fabrication, and on research and development aimed at developing large, next-generation telescopes that can significantly advance our knowledge of dark energy. HEP and NASA continue to work together to consider the possibility of developing a space-based Joint Dark Energy Mission that would complement and extend the ground-based measurements. HEP will also continue to collaborate with NSF on a phased program of research and technology development that is designed to directly detect dark matter particles using ultrasensitive detectors located underground.

The FY 2011 request also supports U.S. efforts in developing the technologies for more powerful and improved accelerators, and more accurate and sensitive detectors. The request supports Advanced Technology research and development for the most promising accelerator and detector technologies, including operations of two new advanced technology test facilities.

Nuclear Physics

The Office of Science is charting new directions at the frontiers of nuclear science: advancing our knowledge of the world and leading to applications in energy research, medicine, national security, and isotopes for a wide variety of purposes.

The Fiscal Year 2011 Nuclear Physics (NP) budget request provides for enhancements, upgrades, and construction of high priority scientific user facilities. This budget supports an increase in operations for the Relativistic Heavy Ion Collider (RHIC)—the only machine in the world colliding heavy ions at near light speed. Researchers at the RHIC facility recently announced the experimental discovery of a quark-gluon plasma—a remarkable new form of matter thought to have filled the very early universe.

In FY 2011, construction continues for the upgrade to the Continuous Electron Beam Accelerator Facility (CEBAF)—the world's most powerful probe for studying the nucleus of the atom. The Nuclear Science Advisory Committee identified the 12 GeV CEBAF Upgrade as the highest priority in their long-range plan. This upgrade will enable scientists to better understand the mechanism for quark confinement, which prevents quarks from being observed independently.

Engineering and design efforts for the Facility for Rare Isotope Beams (FRIB) continue in FY 2011 consistent with the project profile. FRIB will probe the properties of rare nuclear isotopes found in the universe to better understand the origin of the elements and fundamental symmetries of nature.

Stable and radioactive isotopes are vital to the mission of many Federal agencies and play a crucial role in basic research, medicine, industry, and homeland defense. The FY 2011 NP budget request continues support for Isotope Development and Production for Research and

Applications to support research, development, and production of research and commercial isotopes that are of critical importance to the Nation and in short supply.

Fusion Energy Sciences

The Fusion Energy Sciences (FES) program is the primary supporter of U.S. research to expand the fundamental understanding of plasmas and matter at very high temperatures and densities, and to lay the scientific foundations needed to develop a fusion energy source. Fusion has the potential to provide an energy source that is virtually inexhaustible and environmentally benign, producing no combustion products or greenhouse gases.

The FY 2011 budget request maintains the U.S. commitment to ITER, the flagship international fusion research project being constructed in Cadarache, France, that will realize self-sustaining "burning" plasmas for the first time. Burning plasma physics as it will be explored on ITER is both a grand scientific challenge and an undertaking of tremendous practical import to demonstrate the scientific and technological feasibility of sustained fusion power. What we learn through ITER will guide our choices in the development of a subsequent demonstration power plant. Like all non-host Members, the U.S. share for ITER's construction is 1/11 (9.09%) of the total value estimate and guarantees the U.S. full participation in and access to the ITER scientific program; roughly 80% of the U.S. share will be in-kind components manufactured by U.S. industry.

Over the past several months, a schedule has been developed and agreed upon by all participating countries. A cost estimate will be generated in early May and all countries are expected to agree to the combined scope, schedule, and cost in early June. In addition, the project is working hard to improve its management structure. The U.S. fully supports all of these activities. The reduction of the request for ITER in FY 2011 compared to the FY 2010 appropriated level is a reflection of the pace of ITER construction as of the end of 2009. The FY 2011 funding request will be used to make substantial progress on all of the design, R&D, and long-lead procurement activities for the U.S. hardware contribution. The United States will continue funding the Construction Phase of the ITER Project including research and development of key components, long-lead procurements, and contributions of personnel and funds to the ITER Organization (IO).

The FY 2011 budget request supports an expansion of research efforts in the emerging science of high energy density laboratory plasma (HEDLP)—the study of ionized matter at extremely high density and temperature. HEDLP science is enabling deeper understanding of extreme phenomena in a range of disciplines including fusion energy science, condensed matter physics, materials science, fluid dynamics, nuclear science, and astrophysics. The requested increase in the FES HEDLP program will enable new research awards under the HEDLP joint program between FES and the National Nuclear Security Administration (NNSA), which began in FY 2009. This research will leverage world-class FES and NNSA facilities to provide information in assessing the viability of inertial fusion energy as a future energy source; first-of-kind laboratory studies of astrophysical phenomena that include testing of models used to infer the

age of the universe; and opportunities for junior researchers to ensure continued excellence in scientific disciplines closely aligned with fusion energy science and stockpile stewardship

The FY 2011 request continues support for research at the major U.S. experimental fusion facilities—DIII-D, Alcator C-Mod, and NSTX. These facilities will continue to focus on building the predictive science needed for ITER operations and providing solutions to high-priority ITER technical issues. More specifically, these facilities will conduct experiments to improve active control of various plasma parameters, measure the effects and mitigation of disruptions in the plasma, and develop a scientific basis of advanced operating scenarios for ITER. Recent advances at our domestic facilities have had significant and direct positive impacts on the ITER design.

The FY 2011 request also supports the transition of the Fusion Simulation Program (FSP) from its 2-year (FY 2009-FY 2010) planning phase to the full program. The FSP is a computational initiative led by FES with collaborative support from the Office of Advanced Scientific Computing Research (ASCR). It is aimed at the development of a world-leading, experimentally validated, predictive simulation capability for fusion plasmas in the regimes and geometries relevant for practical magnetically confined fusion energy.

The FY 2011 budget also continues support for the Plasma Science Centers (PSCs), multi-institutional research teams dedicated to solving critical challenges in basic plasma science. In addition to the science that is fostered in this research, the education and training of plasma scientists is a major goal of this program.

Workforce Development for Teachers and Scientists

The Workforce Development for Teachers and Scientists (WDTS) program contributes to the national effort that will ensure that DOE and the Nation have a sustained pipeline of highly skilled and diverse science, technology, engineering, and mathematics (STEM) workers.

Workforce Development for Teachers and Scientists (WDTS) is implementing the DOE Office of Science Graduate Fellowship (DOE SCGF) program to encourage talented students to pursue research-focused graduate studies in physics, chemistry, biology, mathematics, computer science, engineering, and environmental science.

In FY 2011, WDTS increases funding for the DOE Office of Science Graduate Fellowship program to support a second cohort of students who will pursue advanced science and engineering degrees in fields of basic research relevant to the DOE mission.

The FY 2011 request also establishes a Science of Science Policy initiative focused on developing improved data, tools, and methods to assess the effectiveness of investments in science.

Science Laboratory Infrastructure

The Science Laboratories Infrastructure (SLI) program mission is to support scientific and technological innovation at the Office of Science laboratories by funding and supporting mission-ready infrastructure and fostering safe and environmentally responsible operations. Paramount among these is the provision of infrastructure necessary to ensure world leadership by the Office of Science national laboratories in the area of basic scientific research now and in the future.

In Fiscal Year 2011, the Science Laboratory Infrastructure program is focused on an ongoing Infrastructure Modernization Initiative. We completed and initiated several construction and general plant projects with Recovery Act funds. The initiative currently includes 35 projects across 10 laboratories. Five ongoing construction projects will continue in FY 2011, and, with several projects coming to completion in FY 2010, two new line item construction projects will be initiated in FY 2011. Although the budget remains constant, new projects will be initiated as current projects are completed.

Safeguards and Security

The Safeguards and Security (S&S) program supports the Departmental research missions at Office of Science laboratories by ensuring appropriate levels of protection against unauthorized access, theft, diversion, loss of custody, destruction of Department assets, or hostile acts that may cause adverse impacts on fundamental science, national security, and the health and safety of DOE and contractor employees, the public, and the environment.

The FY 2011 budget request maintains S&S activities at the current level of effort in the Office of Science laboratory complex in the following areas: protective forces, security systems, information security, cyber security, personnel security, material control and accountability, program management, personnel, and policy, oversight, and administration to establish the requirements associated with the preceding activities.

Science Program Direction

The mission of the Science Program Direction (SCPD) program is to support and sustain a skilled and motivated Federal workforce that oversees the Office of Science investments in world-leading scientific research. The Office of Science workforce is responsible for developing and shaping the science program, executing and managing science funding, and overseeing construction of large scientific user facilities. Oversight includes the health and safety of the workforce and overall security requirements. Additionally, the Federal workforce provides administrative, business, legal, and technical management of research grants and contracts, the oversight of the management and operating (M&O) contracts for the 10 Office of Science DOE national laboratories, and public access to DOE's research and development results.

Over the last several years the Science Program Direction (SCPD) budget and workforce have not kept pace with increase in workload associated with recent increases in the total Office of

Science budget. The Fiscal Year 2011 SCPD budget request closes this gap and helps to address the challenges associated with new program activities.

In FY 2011, the average research portfolio managed by a headquarters Program Manager will have increased almost 30% over the FY 2009 level. The Integrated Support Center processed and managed over 4,800 award actions in FY 2009; this number has doubled in the last 7 years and is anticipated to continue to increase as the SC research budget grows. In FY 2009, over 4,000 hours of overtime were logged by Office of Science staff. Furthermore, new program oversight will be needed for Energy Frontier Research Centers, the Energy Innovation Hub, SC Graduate Fellowships, and the SC Early Career Research Program. The FY 2011 budget request will provide the resources required to ensure fulfillment of the Office of Science mission.

Conclusion

I want to thank you, Mr. Chairman, for providing this opportunity to discuss the Office of Science research programs and our contributions to the Nation's scientific enterprise and clean energy future. On behalf of the Department, I am pleased to present this FY 2011 budget request for the Office of Science.

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