DOE/CF-0156

Department of Energy

FY 2020 Congressional Budget Request

Budget in Brief

March 2019

Office of Chief Financial Officer

DOE/CF-0156

Department of Energy

FY 2020 Congressional Budget Request

Budget in Brief

March 2019

Office of Chief Financial Officer

TABLE OF CONTENTS

OVERVIEW

The President requests $31.7B in discretionary funds for the Department of Energy (DOE) in FY 2020 to secure America's future through energy independence, scientific innovation, and national security. The Budget Request advances key Administration investments in early-stage research and development (R&D) to facilitate private sector energy activity, cybersecurity, next generation supercomputers, artificial intelligence, technology transfer, cleanup of U.S. cold war nuclear sites, and modernization of the Nation's nuclear deterrent based on the 2018 Nuclear Posture Review (NPR).

The FY 2020 Budget Request provides:

DEPARTMENT OF ENERGY

DOE Programs	FY20 ($M)
• Energy	2,407
• Science	5,546
• Environmental Management	6,469
• National Nuclear Security Administration	16,485
• Administration and Oversight	796
DOE Total	**31,703**

- $2.4B to fund innovations that will make U.S. energy sources more affordable, reliable, and efficient; focused on energy storage and harsh environment materials, investments in federal R&D infrastructure and testbeds, as well as other activities that build on U.S. energy dominance
- $5.5B to conduct cutting-edge scientific R&D and build state-of-the art scientific tools and facilities to keep U.S. researchers at the forefront of scientific innovation, including achieving exascale computing in 2021 and 2022 and increasing funding for Quantum Computer and Artificial Intelligence (AI)/Machine Learning (ML)
- $6.5B to continue our commitment for the cleanup of sites resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research
- $16.5B to support national security including sustainment and modernization of the U.S. nuclear stockpile and aging infrastructure, reducing global nuclear threats, and propelling the nuclear Navy

SECURING AMERICA'S FUTURE THROUGH ENERGY INDEPENDENCE, SCIENTIFIC INNOVATION, AND NATIONAL SECURITY

The FY 2020 Budget Request advances key mission areas through significant investments in early-stage scientific research, energy storage, cybersecurity, next generation supercomputers, artificial intelligence, cleanup of the sites under the Department's Environmental Management program, and modernization of the nuclear security enterprise.

The Request continues to focus the Department's energy ($2.4B) and science ($5.5B) programs on early-stage R&D at the national laboratories to advance American primacy in scientific and energy research in an efficient and cost effective manner. In order to help facilitate and accelerate private sector innovation, the Request prioritizes support for federal R&D infrastructure and testbeds, including $100 million for the Versatile Advanced Test Reactor, a key element of the Civil Nuclear Review. This puts the facility on the path to construction and helps demonstrate the Administration's commitment to revitalize the U.S. nuclear sector. The Request also provides funding to accelerate the conversion of the National Wind Technology Center into an experimental microgrid capable of testing grid integration at the megawatt scale. The Request also includes funding to establish the new Grid Storage Launchpad, part of the Advanced Energy Storage Initiative (AESI), which will create a new, dedicated testing bed space for the development of new technologies aimed at the strength and resilience of the US electrical grid.

The Request also emphasizes cutting-edge innovation including $158 M for the new AESI that will, through intradepartmental collaboration, accelerate the development of energy storage R&D as a key to increasing energy security, reliability, resilience, and system flexibility technologies. This approach with the full suite of DOE technologies, takes a broad, holistic view of energy storage as a set of capabilities that enable temporal flexibility in the conversion of energy resources to useful energy services. Building on current applied energy program activities, this initiative would develop a coordinated strategy for aligning DOE R&D and establish aggressive, yet achievable goals for cost competitive energy storage services. In addition, the Budget Request funds $59M for a new Harsh Environment Materials Initiative (HEMI) that will exploit synergies in materials and component manufacturing process research for advanced thermoelectric power plants. Building on current applied energy program activities, this initiative would leverage activities related to advanced reactor technologies and high efficiency low

emissions modular coal plants to align R&D of novel materials, integrated sensors, and manufacturing processes. The Request also will continue to expand the commercial impact of DOE's innovation portfolio by supporting transition of new and evolving energy technology to U.S markets through the Office of Technology Transitions ($9M). National and economic security also depends on the reliable function of the Nation's overall energy infrastructure in face of the threat posed by malicious cyber actors. Cybersecurity is one of the Administration's highest priorities, and the FY 2020 Budget Request provides funding in multiple programs to help prevent and address cyberattacks on the energy sector and to secure the DOE enterprise.

The Request provides $157M for Cybersecurity, Energy Security, and Emergency Response (CESER), including funding to improve energy sector cybersecurity, which has emerged as one of the Nation's most important security challenges. The Request reflects the critical need to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats and mitigate vulnerabilities, focusing on enhancing the speed and effectiveness of cyber threat and vulnerability sharing, establishing a national cyber supply chain assessment capability in partnership with industry, and accelerating game-changing R&D.

Also, the Request includes $444.3M for DOE Enterprise cybersecurity, an increase of $35M from the FY 2019 Enacted amount, to reduce DOE exposure to threats and to manage enterprise cybersecurity risks. This includes $78M for the Department's Office of Chief Information Officer to continue to improve cybersecurity, scale capacity commensurate with demand, and establish IT enterprise capabilities allowing for commercial/managed service implementations of services with engineered and inherent cybersecurity capabilities, such as Virtual Datacenter services, and Desktop-as-a-Service (DaaS), while providing foundational requirements for enhanced cybersecurity tools, products, and capabilities. The Request also includes over $366M in other program office budgets to support improved DOE cybersecurity, including $234M for the cybersecurity of NNSA.

The Request proposes for elimination the Advanced Research Projects Agency—Energy (ARPA-E) program. This elimination facilitates opportunities to integrate the positive aspects of ARPA-E into DOE's applied energy research programs. In addition, the Title XVII Innovative Technology Loan Guarantee Program; the Advanced Technology Vehicle Manufacturing Loan Program; and the Tribal Energy Loan Guarantee Program are also proposed for elimination as the private sector is better positioned to provide financing for the deployment of commercially viable projects. To further achieve fiscal discipline and reduce taxpayer risk, the Budget Request proposes to repeal the Western Area Power Administration's borrowing authority that finances the construction of electricity transmission projects. Investments in transmission assets are best carried out by the private sector where there are appropriate market and regulatory incentives.

The Request provides $809M, including $500M in the Office of Science and $309M in the National Nuclear Security Administration (NNSA) to achieve exascale computing in 2021 with a second system with a different architecture in 2022, reasserting U.S. leadership in this critical area along with research to enable the use of exascale computing in science research activities. The Budget Request funds research, development, and design at Argonne National Laboratory and Oak Ridge National Laboratory. The Science/NNSA partnership will bolster America's national security by supporting the nuclear stockpile while supporting the next generation of science breakthroughs not possible with today's fastest computing systems.

The Request funds $119M ($71M in Science and $48M in NNSA) to improve the robustness, reliability, and transparency of AI and Big Data technologies, uncertainty quantification, and development of software tools to tightly couple simulation, data analysis, and AI for DOE mission applications.

The Request also invests $168.5M in address the emerging urgency of building U.S. competency and competitiveness in the developing area of quantum information science, including quantum computing and quantum sensor technology. This early stage, fundamental research will concentrate on accelerating progress towards application of quantum computing techniques and quantum sensing to grand challenge science questions that are beyond the capabilities of classical computers.

The Request invests $6.5B to meet the challenges of the nation's Manhattan Project and Cold War legacy responsibilities to and address cleanup of sites resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research.

Demonstrating the Administration's commitment to nuclear waste management, the Request of $116M resumes support for Yucca Mountain regulatory activities and develops and implements a robust interim storage program. The Yucca Mountain and Interim Storage programs are critical to enhancing the national and economic security goals of the nation.

The Request provides $16.5B to NNSA to support the security and safety of our nation by modernizing the nuclear security enterprise, including the ongoing refurbishment of the nuclear weapon stockpile, in alignment with the 2018 NPR, reducing global nuclear threats, and designing and maintaining safe and effective nuclear propulsion of the U.S. Navy.

The Request includes $796M in savings and receipts offsets and funding for the Department supporting activities.

ENERGY

The FY 2020 Budget Request advances energy independence by investing in America's leadership in energy innovations that will make U.S. energy sources more affordable, reliable, and efficient. The FY 2020 Request provides $2.4B for energy and related programs, $2.8B below FY 2019 Enacted, and continues the Administration's prioritization of the early-stage R&D that takes place at the National Laboratories.

Highlights include:

- $343M in new funding and proposed use of $353M in prior year balances for a total of $696M in FY 2020 for Energy Efficiency and Renewable Energy, $1.7B below FY 2019 Enacted. The Request focuses on early stage R&D on energy technologies including two new crosscutting initiatives: Advanced Energy Storage and Harsh Environmental Materials. EERE's budget request also includes an expansion of the diverse capabilities of the National Wind Technology Center (NWTC) campus at National Renewable Energy Laboratory.

  EERE invests in early-stage research to spur private-sector research, development, and commercialization of critical energy technologies: sustainable transportation technologies to increase fuel diversity and improve efficiency across the transportation sector ($153.4M); renewable power generation technologies to compete with other electricity sources without subsidies ($163.7M); and energy efficiency to improve affordability, energy productivity, and resiliency of homes, buildings, and manufacturing sectors ($145.9M). The request eliminates the Weatherization and State Energy subprograms more appropriately funded at the state level.

ENERGY

Energy Programs	FY20 ($M)
• Energy Efficiency and Renewable Energy	343
• Electricity	182
• Power Marketing Administrations	78
• Cyber Security, Energy Security, & Emergency Response	157
• Fossil Energy Research and Development	562
• Petroleum Reserves	188
• Nuclear Energy	824
• Yucca Mountain and Interim Storage	116
• Indian Energy	8
• Loan Programs	-169
• Energy Information Administration	118
Energy Total	**2,407**

- $182M for Electricity (OE), $27M above FY2019 enacted, to continue support of the mission of secure and resilient sources of energy; develop an integrated North American Energy Resiliency Model to conduct planning and contingency analysis to address vulnerabilities in the North American energy system; pursue megawatt-scale storage capable of supporting voltage and frequency regulation, ramping and energy management for bulk and distribution power systems; pursue integration of high-fidelity, low-cost sensing technology for predictive and correlation modeling for electricity and interdependence with oil and natural gas systems; and pursue electricity-related policy issues by carrying out statutory and executive requirements, while also providing policy design and analysis expertise to Federal, State, tribal, territorial, and regional entities.

- $78M for the Power Marketing Administrations (PMA), $1M above FY 2019 Enacted for the four PMAs to sell electricity primarily generated by federally owned hydropower projects to public entities and electric cooperatives. The Request includes a mandatory budget proposal to authorize the Federal government to sell the transmission assets of Southwestern Power Administration, Western Area Power Administration, and Bonneville Power Administration. The

Request also includes a legislative proposal for all four of the PMAs to change their statutory rate structure requirements from cost recovery to a market based structure that takes into consideration rates charged by comparable utilities and which could allow for faster recoupment of the taxpayer investment.

- $157M for Cybersecurity, Energy Security, and Emergency Response (CESER), $37M above FY2019 enacted, to continue support of emergency preparedness and response by supporting the energy sector, pursuing enhancements to national efforts, and cooperating with public and private-sector stakeholders, for preparedness, and resilience, and recovery of U.S. energy infrastructure from all threats and hazards. The Request funds early-stage research and development to deliver game-changing tools and technologies that help utilities secure and reduce risks to today's energy infrastructure from advanced cyber threats and design next-generation future systems that are built from inception to automatically detect, reject, and withstand cyber incidents, regardless of the threat.

- $562M for Fossil Energy R&D, $178M below FY 2019 Enacted, to conduct research that supports the clean, affordable and efficient use of domestic fossil energy resources. Through multiple R&D efforts with academia, National Laboratories, and the private sector generates knowledge that industry can use to develop new products and processes, improve the reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. The Request supports R&D focused on: (1) novel fossil-fueled power systems and components that improve the reliability and efficiency of new and existing units; (2) advanced materials and computational systems; (3) utilization of coal and CO_2 for the production of critical materials and products; (4) transformational CO_2 capture technologies applicable to both new and existing fossil-fueled facilities; and (5) CO_2 storage, with emphasis on storage in depleted oil and gas fields; offshore geologic reservoirs; and addressing injection challenges across all reservoir types. The Request also will fund early-stage research to generate new understanding of shale geology and fracture dynamics to enable industry to further develop unconventional oil and natural gas resources and conduct work focused on characterizing gas hydrates and new concepts for technologies that could improve the reliability and operational efficiency of natural gas transmission, distribution, and storage facilities.

- $824M for Nuclear Energy, $502M below FY 2019 Enacted, to support diverse civilian nuclear energy programs including research and development of nuclear energy technologies, including generation, safety, and security technologies, to help unleash an era of energy dominance through strategic support for innovation.[1] The Request supports efforts to extend the life of the existing commercial nuclear reactor fleet through early-stage research in materials aging and degradation, safety margin characterization, safety technologies, and instrumentation and controls. The Request also supports progress towards developing one or more light water reactor fuel concepts with significant enhanced accident tolerance, investigating technologies for providing high assay low enriched uranium (HALEU) feedstock for advanced reactor fuels, and early-stage R&D and strategic investments in developing innovating and crosscutting nuclear energy technologies.

- $116M for the Yucca Mountain and Interim Storage Program, to accelerate progress on fulfilling the Federal Government's obligations to address nuclear waste, enhance national security, and reduce future taxpayer burden. The Request proposes funding from two separate appropriation accounts, Nuclear Waste Disposal ($90M) and Defense Nuclear Waste Disposal ($26M), to resume regulatory activities concerning Yucca Mountain and initiate a robust interim storage program.

- $8M, $10M below FY 2019 Enacted, to advance electrification and energy development and deployment on Indian lands, reducing energy costs, and assisting economic development in tribal communities where unemployment and poverty rates far exceed national averages.

- Terminates the Loan Programs and cancels credit subsidy and loan volume authority and will utilize balances toward shut down of all activities not related to monitoring existing loan guarantees and portfolios.

- Terminates the Advanced Research Projects Agency – Energy, by utilizing portions of its unobligated balances to execute the multi-year termination of the program, with all operations ceasing by FY 2022.

[1] Amounts for FY 2019 do not reflect the transfer of funds from Naval Reactors to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

- $188M for Petroleum Reserves, $77M below FY 2019 Enacted, and provides funding for the Strategic Petroleum Reserve (SPR) and the Naval Petroleum and Oil Shale Reserves. The Request proposes to disestablish the Northeast Gasoline Supply Reserve and the Northeast Home Heating Oil Reserve (NEHHOR). The President's Budget continues the sale of SPR oil for the Energy Security and Infrastructure Modernization Fund authorized by the Bipartisan Budget Act of 2015 to support an effective modernization program for the SPR.

- $118M for the Energy Information Administration, $7M below FY 2019 Enacted, to continue supporting the collection, analysis, and dissemination of independent and impartial energy information and analysis to promote sound policymaking, efficient markets, and public understanding.

SCIENCE

The FY 2020 Budget Request includes $5.5B for the Office of Science, $1B below the FY 2019 Enacted, to focus on its core mission of conducting cutting edge, early-stage research. The Request supports a balanced research portfolio of basic scientific research probing some of the most fundamental questions in areas such as: high energy, nuclear, and plasma physics, materials and chemistry, biological and environmental systems, applied mathematics, next generation high-performance computing and simulation capabilities, and basic research for advancement in new energy technologies.

The Budget Request furthers discovery at the frontiers of science, maintaining 40% of its budget for research supporting over 22,000 researchers, including $500M to achieve exascale computing; operation of the national labs and world-class scientific instruments for over 32,000 users; and construction of the next generation of scientific facilities and tools, including the Linac Coherent Light Source-II at SLAC; Advanced Photon Source Upgrade at Argonne National Laboratory (ANL); Advanced Light Source Upgrade at LBNL; Matter in Extreme Conditions Petawatt Upgrade at SLAC; Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNF/DUNE), FNAL; Proton Improvement Plan II), FNAL ; U.S. Stable Isotope Production and Research Center at ORNL; Facility for Rare Isotope Beams (FRIB) at MSU; Critical Utilities Rehabilitation Project at Brookhaven National Laboratory; the Seismic and Safety Modernization at Lawrence Berkeley National Laboratory; the Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion at Thomas Jefferson National Accelerator Facility ay TJNAF; the Craft Resource's Support Facility at Oak Ridge National Laboratory (ORNL); Large Scale Collaboration Center at the SLAC National Accelerator Facility; and $107M for the ITER project.

Highlights include:

- $921M for Advanced Scientific Computing Research (ASCR), $15M below the FY 2019 Enacted level. The funding includes $464M to accelerate the development of exascale-capable computing systems, applications and software infrastructure in order to deploy the first exascale system in calendar year 2021 that will provide the next-generation tools for scientific discovery and meet national security needs. The Request supports advanced computational research, applied mathematics, and computer science, as well as development and operation of multiple, large high-performance and leadership computing user facilities and high-performance networking.

SCIENCE

Science Programs	FY20 ($M)
• Advanced Scientific Computing Research	921
• Basic Energy Sciences	1,858
• Biological and Environmental Research	494
• Fusion Energy Sciences	403
• High Energy Physics	768
• Nuclear Physics	625
• Science Laboratory Infrastructure	164
• Security and Administration	294
• Workforce Development for Teachers and Scientists	20
Science Total	**5,546**

- $1.9B for Basic Energy Sciences (BES), $308M below the FY 2019 Enacted level. The Request supports early-stage, fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. The Request includes funding for core research activities to support Quantum Information Sciences (QIS), next-generation microelectronics, data analytics and machine learning for data-driven science, ultrafast science, catalysis science, synthesis, instrumentation science, and materials and chemical research related to future nuclear energy systems, next-generation electrical energy storage, interdependent

energy-water issues, and fundamental research to enable advancement of clean energy technologies. Priority areas also include the Energy Frontier Research Centers, two Energy Innovation Hubs, five x-ray light sources, two neutron scattering sources, and five research centers for nanoscale science.

- $494M for Biological and Environmental Research (BER), $211M below the FY 2019 Enacted level. BER supports fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental and ecological processes at the scale of the planet Earth. The Request continues operation of the three BER scientific user facilities: the Joint Genome Institute, the Atmospheric Radiation Measurement Research Facility, and the Environmental Molecular Sciences Laboratory.

- $403M for Fusion Energy Sciences, $161M below FY 2019 Enacted, supports research to understand matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. The Request funds the DIII-D program research and facility operations; the Materials-Plasma Exposure eXperiment (MPEX) project; high-energy-density laboratory plasma science enabled by the Matter in Extreme Conditions instrument of the Linac Coherent Light Source (LCLS); and National Spherical Torus Experiment Upgrade (NSTX-U) at Princeton Plasma Physics Laboratory. ITER funding focuses on the highest-priority First Plasma hardware components, including the central solenoid superconducting magnet modules.

- $768M for High Energy Physics (HEP), $212M below 2019 Enacted, supports research to understand how the universe works at its most fundamental level by discovering the most elementary constituents of matter and energy, probing the interactions among them, and exploring the basic nature of space and time. The Request supports LBNF/DUNE, the High-Luminosity Large Hadron Collider (HL-LC) Accelerator and Detector Upgrade projects at CERN, and the Muon to Electron Conversion Experiment project. The request also funds QIS research and Artificial Intelligence.

- $625M for Nuclear Physics, $65M below the FY 2019 Enacted level, supports research to discover, explore, and understand all forms of nuclear matter. The Request funds Relativistic Heavy Ion Collider (RHIC) operation, the CEBAF, and isotope production facilities. The Request also funds FRIB construction and several Major Items of Equipment.

- $20M for Workforce Development for Teachers and Scientists (WDTS), $3.0M below the FY 2019 Enacted level, ensures that DOE has the sustained pipeline of science, technology, engineering, and mathematics (STEM) workers to meet national goals and objectives, now and in the future. The Request funds programs that place highly qualified applicants in authentic STEM learning and training opportunities at DOE laboratories, as well as supports the National Science Bowl® competition.

- $164M for Science Laboratories Infrastructure (SLI), $69.3M below the FY 2019 Enacted level, sustains mission-ready infrastructure and safe and environmentally responsible operations by providing the infrastructure necessary to support leading edge research by the SC national laboratories. The Request funds five new construction projects: the Critical Utilities Rehabilitation Project at BNL; the Seismic and Safety Modernization at LBNL; the CEBAF Renovation and Expansion at TJNAF; the Craft Resources Support Facility at ORNL; and the Large Scale Collaboration Center at SLAC and continues funding of ongoing construction projects.

ENVIRONMENTAL MANAGEMENT

The Budget Request includes $6.5B for Environmental Management, $706M below the FY 2019 Enacted, to continue managing the cleanup resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research. It involves some of the most dangerous materials known to mankind. This request will clean up of millions of gallons of liquid radioactive waste and thousands of tons of spent (used) nuclear fuel and nuclear materials. It will dispose of large volumes of transuranic and mixed/low-level waste, huge quantities of contaminated soil and water, and deactivate and decommission thousands of excess facilities. To date, EM has completed cleanup activities at 91 sites in 30 states and in the Commonwealth of Puerto Rico. EM is responsible for clean up at 16 remaining sites in 11 states.

Highlights include:

ENVIRONMENTAL MANAGEMENT

DOE Cleanup Sites and Program	FY20 ($M)
• Savannah River	1,642
• River Protection	1,392
• Richland/Hanford	718
• Oak Ridge	429
• Portsmouth	426
• Carlsbad/Waste Isolation Pilot Plant (WIPP)	398
• Idaho	348
• Program Direction	279
• Paducah	277
• Los Alamos	195
• Lawrence Livermore National Laboratory	130
• West Valley Demonstration Project	78
• Nevada	61
• Moab	36
• Uranium Thorium Reimbursements	21
• Energy Technology Engineering Center	18
• Separation Process Research Unit (SPRU)	15
• Headquarters Operations	13
• Other Sites	5
• Sandia National Laboratory	3
• *Offsets*	*-16*
Environmental Management Total	**6,469**

- $1.6B, $91M above the FY 2019 Enacted, to provide general ramp up of the Liquid Waste Program in preparation for initiation of radioactive operations of the Salt Waste Processing Facility. Much work will be executed in support of regulatory commitments with the State of South Carolina. The Request supports continuing Saltstone Disposal Unit #7 cell construction; completing design and initiating construction of Saltstone Disposal Units #8 and #9; and initiating design of Saltstone Disposal Units 10-12. The Request also includes funding of $50M for the design and construction of the Advanced Manufacturing Collaborative Facility.

- $1.4B, $181M below the FY 2019 Enacted, for the Office of River Protection, to safely manage and treat approximately 56 million gallons of radioactive liquid and chemical waste currently stored in 177 underground storage tanks at Hanford, 18 of which have completed waste retrieval and are transitioning to closure, including continued construction, startup and commissioning activities at the Waste Treatment and Immobilization Plant's Low-Activity Waste Facility, Balance of Facilities, Effluent Management Facility and Analytical Laboratory. These facilities are integral to begin treating Hanford low-activity tank waste by December 2023 as required by the 2016 Amended Consent Decree.

- $718M, $236M below FY 2019 Enacted, for continued achievement of important progress required by the Tri-Party Agreement for cleanup activities other than tank waste managed by the Office of River Protection. The Request will maintain safe operations, provide Hanford site-wide services, continue groundwater remediation, operate waste management facilities, support the project for dry storage of the cesium and strontium capsules, and start up preparation activities for the Integrated Disposal Facility to support Direct Feed Low Activity Waste commissioning and startup, and continue remediation of the highly contaminated waste site under the 324 Building.

- $429M, $217M below the FY 2019 Enacted, for cleanup activities at the Oak Ridge site, including support for the ongoing cleanup effort at the East Tennessee Technology Park, continued investment in mercury characterization and remediation technologies, and continued planning for construction of the Outfall 200 Mercury Treatment Facility at the Y-12 National Security Complex.

- $426M, $50M below the FY 2019 Enacted, for the decontamination and decommissioning of the Portsmouth Gaseous Diffusion Plant facilities, including construction of the On-site Waste Disposal Facility #1 and design and construction of the On-site Waste Disposal Facility #2.

- $398M, $5M below the FY 2019 Enacted, to safely continue waste emplacement at the Waste Isolation Pilot Plant (WIPP), the Nation's only mined geologic repository for permanent disposal of defense-generated transuranic waste, including $93M for continued progress on ventilation system and utility shaft projects to increase underground airflow for simultaneous mining and waste emplacement operations.

- $348M, $96M below the FY 2019 Enacted, to continue clean up at the Idaho site. The Request completes the buried waste retrieval activities under the Accelerated Retrieval Project and initiates the decontamination and decommissioning of its structures facilitating the capping of the Subsurface Disposal Area. The Request also supports initiation of Resource Conservation and Recovery Act closure of the Advanced Mixed Waste Treatment Project allowing for decontamination, decommissioning and demolition of the treatment facility, continues shipment of contact-handled transuranic waste to WIPP, continues transfer of spent nuclear fuel elements from wet to dry storage to meet the 2023

milestone, and supports operation of the Integrated Waste Treatment Unit to process sodium bearing waste.

- $277M, $3M above FY 2019 Enacted, for the Paducah site to continue environmental remediation and further stabilize the gaseous diffusion plant.

- $195M, $25M below the FY 2019 Enacted, to continue focus on surface and groundwater management at Los Alamos National Laboratory. The Request also continues the Chromium Plume Control Interim Measure activities to control migration of a hexavalent chromium plume beneath Montandad and Sandia Canyons and continues the Plume-Center Characterization activities to develop corrective measures for remediation of the plume.

- $130M, $103M above FY 2019 Enacted, to support the decommissioning and demolition activities of High Risk excess facilities at Lawrence Livermore National Laboratory.

NATIONAL NUCLEAR SECURITY ADMINISTRATION

The National Nuclear Security Administration (NNSA) is responsible for maintaining a safe, secure, and effective nuclear weapons stockpile; for preventing, countering, and responding to evolving and emerging nuclear proliferation and terrorism threats; for providing safe, reliable and long-term nuclear propulsion to the Nation's Navy as it protects American and Allied interests around the world; and for supporting the federal workforce that carries out these critical responsibilities.

To support these activities, the FY 2020 Budget Request proposes $16.5B for the NNSA, $1.2B over FY 2019 Enacted. The Request makes necessary investments consistent with the NPR to support the security and safety of our nation by maintaining a safe, secure, and effective nuclear weapons stockpile; reduce global nuclear threats; strengthen key science, technology, and engineering capabilities; design and maintain safe and effective nuclear propulsion for the U.S. Navy; and modernize the National Security infrastructure.

NATIONAL NUCLEAR SECURITY ADMINISTRATION

NNSA Programs	**FY20 ($M)**
• Weapons Activities	12,409
• Defense Nuclear Nonproliferation	1,993
• Naval Reactors	1,648
• Federal Salaries and Expenses	435
NNSA Total	**16,485**

Highlights include:

- $12.4B for Weapons Activities, $1.3B above FY 2019 Enacted, to maintain the safety, security, and effectiveness of the nuclear stockpile, to continue the nuclear modernization program, and to modernize NNSA's nuclear security infrastructure portfolio in alignment with the NPR.

    - $2.1B for Life Extension Programs (LEPs), $197M above FY 2019 Enacted, to support the nuclear weapons program. The FY 2020 Budget Request supports the LEP and Major Alterations (Alt) including the W80-4 LEP, the W88 Alt 370, and B61-12 LEP.

    - $3.2B for Infrastructure and Operations, $121M above FY 2019, to continue the long-term effort to modernize NNSA infrastructure, improve working conditions of NNSA's deteriorating facilities and equipment, and address safety and programmatic risks. The Request includes increased funding for the construction of the Uranium Processing Facility (UPF) project, and the completion of the design and construction of the High Explosive Science & Engineering Facility. The Request also continues construction of the Chemistry and Metallurgical Research Replacement (CMRR) project to sustain plutonium science activities.

    - $2.3B for Research, Development, Test and Evaluation (RDT&E), $264M above FY 2019 Enacted, to meet the scientific needs of the LEPs and maintain the scientific base, provide engineering support throughout the enterprise, pursue understanding of high-energy density fundamental physics, provide computing support to the stockpile work, and advance and implement advanced manufacturing and industrial processes. This includes $309M for activities and research leading to deployment of exascale capability for national security

applications. Within these activities there are two projects: (1) $50M for the Exascale Computing Facility Modernization (ECFM) project at Lawrence Livermore National Laboratory (LLNL), and (2) $85.5M for a multi-year non-recurring engineering collaboration to focus on key advanced system engineering efforts and software technologies to turn the 2023 exascale system into a capable and productive computing resource for the Stockpile Stewardship Program.

- $2.0B for Defense Nuclear Nonproliferation, $63M above FY 2019 Enacted, to address the entire nuclear threat spectrum by preventing the acquisition of nuclear weapons or weapons-usable materials, countering efforts to acquire such weapons or materials, and responding to nuclear or radiological incidents. The Budget Request also includes $220M to continue the orderly and safe closure of the Mixed Oxide (MOX) Fuel Fabrication Facility project and $79M for the Surplus Plutonium Disposition (SPD) project to support the dilute and dispose strategy.

- $1.6B for Naval Reactors (NR), a decrease of $140M from the FY 2019 level to continue the support of the current and future fleet.[2] The request funds continued research, development and design for the Columbia-class submarine, recapitalizing the capability to handle naval spent nuclear fuel, and continued work to ensure the fleet remains the most advanced, well-maintained, and capable nuclear fleet in the world.

ADMINISTRATION AND OVERSIGHT

The Budget Request includes $796M for Other Defense Activities, Departmental Administration, and other supporting activities and offsets.

Highlights include:

- $1B for Other Defense Activities that relate to and support the defense-oriented activities within the Department. These include Environment, Health, Safety and Security (EHSS), Enterprise Assessments (EA), Specialized Security Activities (SSA), Legacy Management (LM), Hearings and Appeals (OHA), and Defense Related Administrative Support (DRAS). Funding from DRAS is used to offset administrative expenses for work supporting defense-oriented activities.

ADMINISTRATION AND OVERSIGHT

Administration and Oversight Programs	FY20 ($M)
• Other Defense Activities	1,035
• Administration and Oversight	208
• *Savings and Receipts*	*-448*
Administration and Oversight Total	**796**

  $141M within Legacy Management for the return of program management of the Formerly Utilized Sites Remedial Action Program (FUSRAP) from the United States Army Corps of Engineers (USACE) to DOE. Consolidating cleanup programs under a single agency will allow DOE to consider the full range of cleanup responsibilities in prioritizing work each fiscal year.

- $118M for Departmental Administration (DA) to fund 13 management and mission support organizations that have enterprise-wide responsibility for administration, accounting, budgeting, contract and project management, congressional and intergovernmental liaison, energy policy, information management, life-cycle asset management, legal services, workforce diversity and equal employment opportunity, ombudsman services, small business advocacy, sustainability, technology transition activities and public affairs.

  The DA appropriation also budgets for estimated Strategic Partnership Projects which includes expenses and collections resulting in a net offset, and receives Miscellaneous Revenues from other sources. Additionally, the DA offices receive funding from the Other Defense Activities (ODA) appropriation, Defense-Related Administrative Support (DRAS), which is used to offset expenses that support defense-related administrative activities at DOE.

[2] Amounts for FY 2019 do not reflect the transfer of funds from Naval Reactors to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor.

- $36M for International Affairs (IA) is requested as a separate appropriation and is not included as part of the Departmental Administrative (DA) account to better reflect its purpose and objectives.

- $54M for Office of the Inspector General to review the integrity, economy, and efficiency of DOE programs and operations, including the National Nuclear Security Administration and the Federal Energy Regulatory Commission.

- -$448M in Savings and Receipts which includes a -$287M cancellation of ARPA-E unobligated balances, -$16M in net savings from Fees and Recoveries in Excess of Annual Appropriations, -$15M in receipts from Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt, and -$130M in receipts from the Sale of the Northeast Gas Reserve.

THIS PAGE INTENTIONALLY LEFT BLANK

($K)

Department of Energy Budget by Appropriation	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted $	FY 2020 Request vs FY 2019 Enacted %
Energy and Water Development, and Related Agencies					
Energy Programs					
Energy Efficiency and Renewable Energy	2,321,778	2,379,000	343,000	-2,036,000	-85.6%
Electricity Delivery and Energy Reliability	261,329	0	0	0	N/A
Electricity	0	156,000	182,500	+26,500	+17.0%
Cybersecurity, Energy Security, and Emergency Response	0	120,000	156,500	+36,500	+30.4%
Nuclear Energy	1,205,056	1,326,090	824,000	-502,090	-37.9%
Fossil Energy Programs					
Fossil Energy Research and Development	726,817	740,000	562,000	-178,000	-24.1%
Naval Petroleum and Oil Shale Reserves	4,900	10,000	14,000	+4,000	+40.0%
Strategic Petroleum Reserve	260,716	235,000	174,000	-61,000	-26.0%
Strategic Petroleum Account	8,400	10,000	27,000	+17,000	+170.0%
Northeast Home Heating Oil Reserve	6,500	10,000	0	-10,000	-100.0%
Total, Fossil Energy Programs	**1,007,333**	**1,005,000**	**777,000**	**-228,000**	**-22.7%**
Uranium Enrichment Decontamination and Decommissioning (D&D) Fund	840,000	841,129	715,112	-126,017	-15.0%
Energy Information Administration	125,000	125,000	118,000	-7,000	-5.6%
Non-Defense Environmental Cleanup	298,400	310,000	247,480	-62,520	-20.2%
Science	6,259,903	6,585,000	5,545,972	-1,039,028	-15.8%
Advanced Research Projects Agency - Energy	353,314	366,000	-287,000	-653,000	-178.4%
Nuclear Waste Disposal (26M in DNWF 050)	0	0	90,000	+90,000	N/A
Departmental Administration	189,652	165,858	117,545	-48,313	-29.1%
Indian Energy Policy and Programs	0	18,000	8,000	-10,000	-55.6%
Inspector General	49,000	51,330	54,215	+2,885	+5.6%
International Affairs	0	0	36,100	+36,100	N/A
Title 17 - Innovative Technology Loan Guarantee Program	30,892	13,000	-160,659	-173,659	-1,335.8%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	5,000	0	-5,000	-100.0%
Tribal Energy Loan Guarantee Program	1,000	1,000	-8,500	-9,500	-950.0%
Total, Energy Programs	**12,947,657**	**13,467,407**	**8,759,265**	**-4,708,142**	**-35.0%**
Atomic Energy Defense Activities					
National Nuclear Security Administration					
Federal Salaries and Expenses	407,595	410,000	434,699	+24,699	+6.0%
Weapons Activities	10,642,138	11,100,000	12,408,603	+1,308,603	+11.8%
Defense Nuclear Nonproliferation	1,999,219	1,930,000	1,993,302	+63,302	+3.3%
Naval Reactors	1,620,000	1,788,618	1,648,396	-140,222	-7.8%
Total, National Nuclear Security Administration	**14,668,952**	**15,228,618**	**16,485,000**	**+1,256,382**	**+8.3%**
Environmental and Other Defense Activities					
Defense Environmental Cleanup	5,988,048	6,024,000	5,506,501	-517,499	-8.6%
Other Defense Activities	840,000	860,292	1,035,339	+175,047	+20.3%
Defense Nuclear Waste Disposal (90M in 270 Energy)	0	0	26,000	+26,000	N/A
Total, Environmental and Other Defense Activities	**6,828,048**	**6,884,292**	**6,567,840**	**-316,452**	**-4.6%**
Total, Atomic Energy Defense Activities	**21,497,000**	**22,112,910**	**23,052,840**	**+939,930**	**+4.3%**
Power Marketing Administrations					
Southeastern Power Administration	0	0	0	0	N/A
Southwestern Power Administration	11,400	10,400	10,400	0	N/A
Western Area Power Administration	93,372	89,372	89,196	-176	-0.2%
Falcon and Amistad Operating and Maintenance Fund	228	228	228	0	N/A
Colorado River Basins Power Marketing Fund	-23,000	-23,000	-21,400	+1,600	+7.0%
Total, Power Marketing Administrations	**82,000**	**77,000**	**78,424**	**+1,424**	**+1.8%**
Federal Energy Regulatory Commission (FERC)	**0**	**0**	**0**	**0**	**N/A**
Subtotal, Energy and Water Development, and Related Agencies	**34,526,657**	**35,657,317**	**31,890,529**	**-3,766,788**	**-10.6%**
Excess Fees and Recoveries, FERC	-9,000	-16,000	-16,000	0	N/A
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	-35,000	-44,000	-15,000	+29,000	+65.9%
Sale of Northeast Gas Reserve	0	0	-130,000	-130,000	N/A
Sale of Northeast Home Heating Oil Reserve	0	0	-27,000	-27,000	N/A
Total, Funding by Appropriation	**34,482,657**	**35,597,317**	**31,702,529**	**-3,894,788**	**-10.9%**

FUNDING BY ORGANIZATION

($K)

Department of Energy Budget by Organization	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted $	FY 2020 Request vs FY 2019 Enacted %
Under Secretary for Nuclear Security and National Nuclear Security Administration					
National Nuclear Security Administration					
Federal Salaries and Expenses	407,595	410,000	434,699	+24,699	+6.0%
Weapons Activities	10,642,138	11,100,000	12,408,603	+1,308,603	+11.8%
Defense Nuclear Nonproliferation	1,999,219	1,930,000	1,993,302	+63,302	+3.3%
Naval Reactors	1,620,000	1,788,618	1,648,396	-140,222	-7.8%
Total, Under Secretary for Nuclear Security and National Nuclear Security	**14,668,952**	**15,228,618**	**16,485,000**	**+1,256,382**	**+8.3%**
Under Secretary for Energy					
Energy Programs					
Energy Efficiency and Renewable Energy	2,321,778	2,379,000	343,000	-2,036,000	-85.6%
Electricity Delivery and Energy Reliability	261,329	0	0	0	N/A
Office of Electricity	0	156,000	182,500	+26,500	+17.0%
Power Marketing Administrations	82,000	77,000	78,424	+1,424	+1.8%
Office of Cybersecurity, Energy Security, and Emergency Response	0	120,000	156,500	+36,500	+30.4%
Petroleum Reserves	280,516	265,000	215,000	-50,000	-18.9%
Fossil Energy Research and Development	726,817	740,000	562,000	-178,000	-24.1%
Nuclear Energy	1,205,056	1,326,090	824,000	-502,090	-37.9%
Yucca Mountain and Interim Storage	0	0	116,000	+116,000	N/A
Energy Policy and Systems Analysis	10,432	0	0	0	N/A
Office of Indian Energy	18,000	0	0	0	N/A
Office of Indian Energy Policy and Programs	0	18,000	8,000	-10,000	-55.6%
Office of Policy	0	2,510	8,000	+5,490	+218.7%
Project Management Oversight Assessment	15,192	15,005	14,255	-750	-5.0%
Environment, Health, Safety and Security Mission Support	198,946	202,839	212,509	+9,670	+4.8%
Credit Programs					
Title 17 - Innovative Technology Loan Guarantee Program	30,892	13,000	-160,659	-173,659	-1,335.8%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	5,000	0	-5,000	-100.0%
Tribal Energy Loan Guarantee Program	1,000	1,000	-8,500	-9,500	-950.0%
Total, Credit Programs	**36,892**	**19,000**	**-169,159**	**-188,159**	**-990.3%**
Other Energy Programs					
Advanced Research Projects Agency - Energy	353,314	366,000	-287,000	-653,000	-178.4%
Energy Information Administration	125,000	125,000	118,000	-7,000	-5.6%
Total, Under Secretary for Energy	**5,635,272**	**5,811,444**	**2,382,029**	**-3,429,415**	**-59.0%**
Under Secretary for Science					
Science	6,259,903	6,585,000	5,545,972	-1,039,028	-15.8%
Environmental Management	7,126,448	7,175,129	6,469,093	-706,036	-9.8%
Office of Legacy Management	154,606	158,877	303,029	+144,152	+90.7%
Office of Technology Transitions	6,876	8,505	9,080	+575	+6.8%
Total, Under Secretary for Science	**13,547,833**	**13,927,511**	**12,327,174**	**-1,600,337**	**-11.5%**
Other Department Offices					
Departmental Administration (Direct Reports)					
Chief Information Officer	126,274	131,624	124,554	-7,070	-5.4%
Management	54,745	55,385	54,358	-1,027	-1.9%
Chief Human Capital Officer	25,513	26,125	24,316	-1,809	-6.9%
Economic Impact and Diversity	10,169	10,169	9,494	-675	-6.6%
Office of the Secretary	5,300	5,395	5,119	-276	-5.1%
Chief Financial Officer	48,484	48,912	52,000	+3,088	+6.3%
Congressional and Intergovernmental Affairs	6,200	4,200	5,895	+1,695	+40.4%
Public Affairs	6,589	6,594	6,260	-334	-5.1%
General Counsel	33,000	33,075	33,075	0	N/A
International Affairs	18,878	22,878	0	-22,878	-100.0%
Office of Small and Disadvantaged Business Utilization	3,000	3,170	3,609	+439	+13.8%
Strategic Partnership Projects and Revenues	-56,000	-56,000	-53,378	+2,622	+4.7%
Total, Departmental Administration	**282,152**	**291,527**	**265,302**	**-26,225**	**-9.0%**
Other Defense Activities (Direct Reports)					
Office of Enterprise Assessments	74,931	76,770	81,279	+4,509	+5.9%
Specialized Security Activities	262,912	266,378	254,578	-11,800	-4.4%
Hearings and Appeals	5,605	3,739	4,852	+1,113	+29.8%
Total, Other Defense Activities	**343,448**	**346,887**	**340,709**	**-6,178**	**-1.8%**
Inspector General	49,000	51,330	54,215	+2,885	+5.6%
International Affairs	0	0	36,100	+36,100	N/A
Total, Other Department Offices	**674,600**	**689,744**	**696,326**	**+6,582**	**+1.0%**
Federal Energy Regulatory Commission	-9,000	-16,000	-16,000	0	N/A
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	-35,000	-44,000	-15,000	+29,000	+65.9%
Sale of Northeast Gas Reserve	0	0	-130,000	-130,000	N/A
Sale of Northeast Home Heating Oil Reserve	0	0	-27,000	-27,000	N/A
Total, Funding by Organization	**34,482,657**	**35,597,317**	**31,702,529**	**-3,894,788**	**-10.9%**

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Energy Efficiency and Renewable Energy					
Sustainable Transportation					
Vehicle Technologies	337,500	344,000	73,400	-270,600	-78.7%
Bioenergy Technologies	221,545	226,000	40,000	-186,000	-82.3%
Hydrogen and Fuel Cell Technologies	115,000	120,000	44,000	-76,000	-63.3%
Total, Sustainable Transportation	**674,045**	**690,000**	**157,400**	**-532,600**	**-77.2%**
Renewable Energy					
Solar Energy	241,600	246,500	67,000	-179,500	-72.8%
Wind Energy	92,000	92,000	23,700	-68,300	-74.2%
Water Power	105,000	105,000	45,000	-60,000	-57.1%
Geothermal Technologies	80,906	84,000	28,000	-56,000	-66.7%
Total, Renewable Energy	**519,506**	**527,500**	**163,700**	**-363,800**	**-69.0%**
Energy Efficiency					
Advanced Manufacturing	305,000	320,000	80,500	-239,500	-74.8%
Federal Energy Management Program	27,000	30,000	8,400	-21,600	-72.0%
Building Technologies	220,727	226,000	57,000	-169,000	-74.8%
Weatherization and Intergovernmental Programs					
Weatherization Assistance Program	248,000	254,000	0	-254,000	-100.0%
Training and Technical Assistance	3,000	3,000	0	-3,000	-100.0%
State Energy Program	55,000	55,000	0	-55,000	-100.0%
Total, Weatherization and Intergovernmental Programs	**306,000**	**312,000**	**0**	**-312,000**	**-100.0%**
Total, Energy Efficiency	**858,727**	**888,000**	**145,900**	**-742,100**	**-83.6%**
Corporate Support Programs					
Facilities and Infrastructure (NREL)	92,000	97,000	107,000	+10,000	+10.3%
Program Direction	162,500	162,500	122,000	-40,500	-24.9%
Strategic Programs	15,000	14,000	0	-14,000	-100.0%
Total, Corporate Support Programs	**269,500**	**273,500**	**229,000**	**-44,500**	**-16.3%**
Subtotal, Energy Efficiency and Renewable Energy	**2,321,778**	**2,379,000**	**696,000**	**-1,683,000**	**-70.7%**
Use of Prior Year Balances	0	0	-353,000	-353,000	N/A
Total, Energy Efficiency and Renewable Energy	**2,321,778**	**2,379,000**	**343,000**	**-2,036,000**	**-85.6%**

Appropriation Overview

The **Office of Energy Efficiency and Renewable Energy (EERE)** invests in research and development (R&D) as part of the Department of Energy's (DOE's) broad portfolio approach to addressing our Nation's energy and environmental challenges. The Budget focuses DOE resources toward early-stage R&D, where the Federal role is strongest, and reflects an increased reliance on the private sector to fund later-stage research, development, and commercialization of energy technologies. It emphasizes energy technologies best positioned to support American energy independence and domestic job-growth in the near to mid-term, while maintaining proper stewardship of taxpayer dollars. The budget also focuses on conducting research that can facilitate streamlining of siting and permitting of EERE-related technology deployment. The FY 2020 Budget provides $696 million to maintain America's leadership in transformative science and emerging energy technologies in sustainable transportation, renewable power, and energy efficiency.

EERE programs will focus on research activities, which industry does not have the technical capability to undertake, or which are too far from market realization to merit sufficient industry focus and critical mass. Knowledge generated by EERE early-stage R&D supports U.S. industries, businesses, and entrepreneurs as they develop and deploy innovative energy technologies, and increases the competitive edge needed to excel in the rapidly changing global energy economy. Industry deployment of these technologies creates jobs, reduces U.S. reliance on foreign resources, increases energy affordability,

improves energy security, supports environmental stewardship, and offers Americans a broader range of energy choices. The shift away from later-stage development and deployment activities and the increased focus on early-stage R&D provide an opportunity to move toward a more efficient organizational structure. In keeping with the direction to generate efficiencies and reduce the cost of government, and in alignment with reductions in technology program budgets, DOE will reduce EERE Full-Time Equivalents by approximately 26 percent from the planned FY 2019 level. The specific reduction will be adjusted as needed, dependent on the timing of appropriations, in order to fully account for associated severance payments. Remaining staff will ensure continuity of the essential oversight activities for EERE's project portfolio and maintain proper stewardship of taxpayer dollars.

EERE's budget request includes $105M for the Advanced Energy Storage Initiative, which takes a holistic approach to energy storage. The Initiative is focused on developing technologies to create more flexible generation, and to increase the reliability and resilience of the U.S. electric grid.

Built on and incorporating the EERE FY19 Beyond Batteries Initiative, the Advanced Energy Storage Initiative will drive improvements in bi-directional electrical energy storage and other technologies to increase the flexibility of energy supply and demand.

The Initiative will be coordinated across the Department, including the Offices of Electricity (OE), Fossil Energy (FE), and Nuclear Energy (NE). Existing EERE, OE, FE, and NE activities create a foundation, including batteries, pumped storage, controllable loads, distributed energy resource management, microgrids, power system planning and operations, hybrid systems, power plant dispatchability, and others.

On this foundation, the Advanced Energy Storage Initiative will build an integrated DOE R&D strategy and establish aggressive, achievable, and comparable goals for cost-competitive energy storage services and applications.

EERE's budget request also includes an expansion of the diverse capabilities of the National Wind Technology Center (NWTC) campus at the National Renewable Energy Laboratory. The mission of the NWTC will expand to support a fully integrated, large-scale experimental research platform, which includes building an Enhanced Grid/Energy Systems Control Center and a High-Speed Data Link that connects the NWTC campus to the Energy Systems Integration Facility (ESIF) at NREL's main campus and to other National Laboratories. As part of the expansion of the NWTC, funding also supports a Beyond Megawatt Scale Extreme Fast Charging Station to research, integrate, and evaluate fast charging station impacts on the grid. These investments support research for DOE's Grid Modernization Initiative, which includes reliably integrating an increasing amount of variable generation into the electric grid. These expanded capabilities will allow DOE to test a suite of technologies supported under the Advanced Energy Storage Initiative and leverage the NWTC's future power capacity of 19.9MW with the capabilities of the ESIF.

Program Highlights

Sustainable Transportation

- **Vehicle Technologies**
  FY 2020 funding supports early-stage research needed for more affordable, secure, and reliable transportation of people and goods across America. The program will explore new battery materials and cell technologies that reduce America's dependence on foreign sources of critical materials, improve high-power, fast-charging methods, and develop innovative chemistries beyond lithium ion technology. This work supports the Department's Advanced Energy Storage Initiative and has the potential to reduce electric vehicle battery cost by more than half, to less than $100/kWh, increase range to 300 miles, and decrease charge time to 15 minutes or less. FY 2020 research will focus on pathways to expand mobility options and improve the affordability of the transportation system, leading to greater energy productivity in moving people and goods. This work will include the application of new computational models and simulation capabilities to create and test new theories that use vehicle connectivity and automation to improve energy efficiency including vehicle autonomy, big data tools, machine/deep-learning, and artificial intelligence and increase transportation choices at both the individual and system level. FY 2020 funds will also support advanced combustion and fuels research to increase engine efficiency and improve passenger vehicle fuel economy by 35 percent by 2030, from a 2015 baseline of 36 miles per gallon. Work will include natural gas engine efficiency and fuel storage capacity research. The FY2020 request also supports research of novel approaches to building lightweight,

multi-material structures and research of new, high-performance materials needed for the next generation of high-efficiency vehicle engines.

- **Bioenergy Technologies**
  FY 2020 funding supports early-stage R&D that bolsters the body of knowledge to support industry efforts to develop and deploy high-performing drop-in biofuels at $3 per gallon gasoline equivalent, which includes high-value co-production of renewable chemicals and materials. Domestically-produced renewable biomass, together with waste streams such as municipal solid waste, and their subsequent conversion to bioenergy and co-products, offers an opportunity to create American jobs across the supply chain, boost economic growth, and encourage investment across the Nation while reducing U.S. exposure to foreign oil imports. The program's early-stage, laboratory-based R&D emphasizes advanced technologies to produce renewable-gasoline, -diesel, and -jet fuels from non-food sources. Consortium-supported research focus areas include: (1) detailed understanding and optimization of the physics and chemistry of feedstocks and preprocessing steps necessary for high conversion rates; (2) biological development and molecular characterization of high performing algal strains; and (3) development of engineered organisms and novel catalysts to drive conversion efficiency. In collaboration with the Vehicle Technologies Program, Bioenergy will explore the co-optimization of fuels and engines to evaluate the most promising biofuel candidates to support fuel economy, emissions reduction, and efficiency targets for advanced compression ignition engines.

- **Hydrogen and Fuel Cell Technologies**
  FY 2020 funding supports early-stage R&D to investigate novel hydrogen and fuel cell technologies to support American energy independence and domestic job growth through industry development and deployment. To be cost competitive with gasoline-powered internal combustion engines on a cents-per-mile driven basis, the cost of hydrogen delivered from domestic resources needs to be less than $4/gge (untaxed), and the cost of a durable fuel cell system needs to be less than $40/kW. In FY 2020, research will emphasize the acceleration of material breakthroughs by National Laboratory consortia that bring together world-class capabilities from multiple laboratories, while leveraging the results of ongoing projects with university and industry partners. Key areas of research include: high performance durable catalysts, membranes and electrodes; materials for hydrogen production, storage, and transmission; and understanding systems integration and infrastructure necessary to accomplish H2@Scale — a vision of cost-competitive, domestically sourced and produced hydrogen for use across multiple sectors.

Renewable Power

- **Solar Energy**
  FY 2020 funding supports the DOE in improving the affordability, reliability, and performance of solar technologies on the grid. Funding will support early-stage R&D at the National Laboratories, in partnership with academia and industry, with a focus on increasing the reliability and decreasing the cost of next-generation photovoltaics and concentrating solar power technologies toward 2030 cost targets of $0.03/kWh and $0.05/kWh, respectively. In addition, the program will support the Advanced Energy Storage Initiative and advance the state of knowledge necessary for industry to more effectively integrate solar into the electric grid, improving solar energy's ability to contribute to grid reliability, resilience, and security. Key areas of research include: PV efficiency and energy yield, next generation concentrating solar power, energy storage integration, material durability, power electronics, microgrid integration, and resilience. Funding will also support analytics and modeling of power system integrity and potential cybersecurity issues related to integrating increasing amounts of solar power on the electric grid. The program will also support an additional round of the American-Made Solar Prize to increase U.S. competitiveness in solar energy manufacturing.

- **Wind Energy**
  FY 2020 funding emphasizes fundamental, early-stage R&D, and related testing that builds the knowledge base upon which industry can develop and deploy novel technologies. FY 2020 activities will focus on improving the performance and reliability of next-generation wind plants by applying high-performance computing to investigate systems-level interactions influenced by atmospheric conditions, variable terrain, and machine-to-machine wake interactions for offshore, land-based, and distributed wind applications. Continuing R&D will focus on controls, sensors, algorithms, materials, and manufacturing to lower wind energy costs and improve operational performance. Fundamental R&D will target U.S.-specific offshore wind technology barriers, including advanced substructure technology, reduction of installation costs and risks, technology to reduce on-site O&M, and design standards development for the extreme

marine conditions unique to U.S. waters. Funding will continue to advance R&D and manufacturing improvements that directly reduce distributed wind LCOE and maximize the value and resiliency of microgrids utilizing wind energy. Funding will address wind/radar challenges; develop technical solutions to reduce environmental compliance costs, and support development of a robust domestic wind energy workforce. Funding for the National Wind Technology Center will be moved to Facilities and Infrastructure, consistent with the expanded scope of activities noted above.

- **Water Power**
  FY 2020 funding supports early-stage R&D exploring novel concepts and approaches to capturing hydropower and marine hydrokinetic energy resources. The program invests in hydropower technology R&D for innovative standardized and modular approaches to hydropower development that can lower overall project costs versus traditional projects at greenfield sites and non-powered dams. The program supports the Advanced Energy Storage Initiative and continues its focus on hydropower and PSH's roles in grid reliability and resiliency by continuing to support innovative PSH technologies and conducting new research to evaluate and improve the flexibility and grid services provided by hydropower and/or PSH. It will also support the development of innovative environmental mitigation technologies and new research to inform licensing studies and requirements facilitating reduced time, cost, and uncertainty in hydropower licensing. In marine and hydrokinetics (MHK), the program will support R&D to improve controls and power take-offs for early-stage wave, tidal, and ocean current technologies, ultimately leading to reduced costs and increased competitiveness of marine energy devices. Through its partnerships with the Navy and with university-National Laboratory collaborations, the program will validate reliability of marine energy technologies and the value of integrating energy from prototype devices into the electric grid. Monitoring of open water tests and continued analysis and dissemination of the results of new research is also supported to reduce perceived environmental risk and the time associated with device permitting.

- **Geothermal Technologies**
  FY 2020 funding supports Geothermal Technologies' early-stage R&D. Within Enhanced Geothermal Systems (EGS), the program will continue implementation of the Frontier Observatory for Research in Geothermal Energy (FORGE) to advance Phase 3 field operations at the FORGE site through the end of FY 2024. Prior to testing in the high-value main injection production pair sites at the FORGE, in FY 2020 the EGS subprogram will identify "Wells of Opportunity" and conduct high-risk tests of wellbore stimulation, zonal isolation, and subsurface interrogation technologies in available unused geothermal wells across the U.S. The Hydrothermal subprogram will continue to conduct subsurface R&D in FY 2020 with a focus on exploration topics, starting with research in subsurface imaging, particularly for current and pre-existing subsurface volcanic terrain. The program contributes to the Advanced Energy Storage Initiative through research on more flexible geothermal systems. The program will issue a funding opportunity to continue Reservoir Thermal Energy Storage R&D including deep direct use (DDU) engineering, design and systems research that may also include innovative ground source heating and cooling applications. Additionally, the program will partner with the U.S. Geological Survey (USGS) to conduct a national-scale comparative analysis to develop quantitative models for pre-assessment of Reservoir Thermal Energy Storage. Combined efforts will strengthen the body of knowledge necessary to support industry efforts to achieve a cost target of 20.8 cents/kWh by 2022 for newly developed Enhanced Geothermal Systems, and support enhanced grid reliability and resiliency through geothermal power to be operated flexibly and provide essential grid reliability service energy contributions.

Energy Efficiency

- **Advanced Manufacturing**
  FY 2020 funding supports early-stage applied R&D focused on advancing and creating new understanding of underlying technologies, materials, and processes relevant to the productive use of energy in manufacturing, as well as the competitive manufacturing of energy-related products. The budget includes funding for the Harsh Environment Materials Initiative, a new cross-cutting activity with the Offices of Fossil Energy and Nuclear energy to exploit synergies in materials and component manufacturing research for thermoelectric power plants. Specifically, the coordinated effort will align research on novel materials, such as for harsh and high temperature environments, integrated sensors, and manufacturing technologies. By fostering collaboration between National Laboratories, universities, and companies (for-profit and not-for-profit), this Budget Request will enhance the foundational knowledge base in materials and manufacturing processes, focusing on research challenges that

present a significant degree of scientific or technical uncertainty and are beyond the horizon in terms of commercialization, making it unlikely that industry will pursue independently.

- **Federal Energy Management Program**
  FY 2020 funding supports Federal Energy Management Program's core activities of tracking agencies' energy management performance and resources for facility optimization and resilient, secure portfolio planning that leverages performance contracting. FY 2020 funds will support maintained resources for energy projects and energy savings, including best practices for measurement and verification, through the provision of technical assistance, energy-related contracting tools and skills training.

- **Building Technologies**
  FY 2020 funding supports early-stage R&D of innovative building energy technologies such as lighting, space conditioning, refrigeration, windows, and envelope and their effective integration into smart, efficient, resilient, grid-interactive, and secure building systems. In support of the Advanced Energy Storage Initiative, particular focus will be placed on building system interaction with the grid in terms of controllable loads and thermal energy storage technologies. The goal of the Buildings program is to overcome the high degree of fragmentation across the diverse buildings industry, spanning construction to appliance and equipment manufacturing. Building Technologies' research also focuses on developing the physics-based algorithms for improved energy modeling and system controls required to better predict and manage energy efficient appliance/equipment, system, and whole-building energy usage. Additionally, Building Technologies' early stage R&D on cybersecure advanced sensors and controls will help strengthen the body of knowledge to support industry efforts to develop and deploy "smart" buildings capable of interacting with the power grid securely, in new and increasingly adaptive manners, to help with overall electric system efficiency and resilience. Finally, the program supports DOE working with industry and stakeholders to meet requirements for statutorily-mandated efficiency standards and building energy codes determinations.

- **Weatherization and Intergovernmental Programs**
  No funding is requested in FY 2020 for the Weatherization Assistance Program or the State Energy Program due to a departmental shift in focus away from deployment activities and towards early-stage R&D. Activities in FY 2020 will focus on completing work activities associated with existing financial and technical assistance awards and initiatives with states and local governments and stakeholder organizations, closing out awards and agreements as they come to the end of their periods of performance, and providing resources and institutional knowledge to state and local entities as practicable.

Corporate Support

- **Facilities and Infrastructure (F&I) at the National Renewable Energy Laboratory**
  FY 2020 funding focuses on sustaining NREL's world-class R&D environment by maintaining and, where necessary, upgrading its equipment and facilities. NREL facilities are under increasing demand by government and industry R&D activities. This request supports the third year of a four-year refresh/upgrade of the High Performance Computer (HPC) at the ESIF. Simulations conducted on the HPC have led to significant advances in transforming energy technologies. However, demand for computing from R&D efforts has saturated the current HPC capabilities. In FY 2018, HPC cycle demand was double current capacity resulting in rationing. The improved capacity provided by the refresh/upgrade enables the HPC to continue to provide enhanced computational capability for increasingly complex, specific energy technology issues across the portfolio of research topics that EERE programs address. EERE's budget request also includes expansion of the diverse capabilities of the National Wind Technology Center (NWTC) campus at the National Renewable Energy Laboratory.

($K)

	FY 2018 Enacted[1]	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Electricity					
Transmission Reliability and Resilience	39,000	39,000	70,500	+31,500	+80.8%
Resilient Distribution Systems	38,000	40,000	27,900	-12,100	-30.3%
Energy Storage	41,000	46,000	48,500	+2,500	+5.4%
Transformer Resilience and Advanced Components	7,000	7,000	9,000	+2,000	+28.6%
Transmission Permitting and Technical Assistance	7,000	7,000	7,000	0	N/A
Supplemental Hurricane Funding[2]	10,100	0	0	0	N/A
Program Direction	17,000	17,000	19,600	+2,600	+15.3%
Total, Electricity	**159,100**	**156,000**	**182,500**	**+26,500**	**+17.0%**

[1]The FY 2019 appropriation split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow a comparison with FY 2019 and 2020, the comparable amounts for FY 2018 exclude amounts for the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs, and a portion of Program Direction funding, equivalent to what would have been in CESER had the current structure been in place in FY 2018.

[2]P.L. 115–123, Division B, Subdivision 1, the Further Additional Supplemental Appropriations Act for Disaster Relief Requirements Act, 2018, provided additional funding for expenses related to the consequences of Hurricanes Harvey, Irma, and Maria as an emergency requirement pursuant to the Balanced Budget and Emergency Deficit Control Act of 1985.

Appropriation Overview

The **Office of Electricity (OE)** leads the Department's efforts to strengthen, transform, and improve energy infrastructure so that consumers have access to secure and resilient sources of energy. OE provides solutions to market, institutional, and operational failures that go beyond any one utility's ability to solve.[a] To accomplish this critical mission, OE works with private industry and Federal, State, tribal, territorial, and regional governments on a variety of initiatives to modernize the electric grid.

Grid modernization is critical to achieving public policy objectives, sustaining economic growth, supporting environmental stewardship, and mitigating risks for the Nation. The goal for the future grid is to deliver reliable, affordable, and clean electricity to consumers where, when, and how needed.

Within the next decade, proactive, coordinated, and innovative steps are needed to address four critical challenges:

- Increasing threats and risks to the security of energy infrastructure
- Changes in demand driven by population growth, adoption of more energy efficient technologies, dynamic economic conditions, and broader electrification
- Changes in the supply mix and location (centralized, distributed, and off-shore) of the Nation's generation portfolio
- Increasing variability and uncertainty from both supply and demand, including integration of variable renewables, more active consumer participation, and accommodating new technologies and techniques

Due to the critical role the electric grid plays across Federal, State, tribal, territorial, and regional jurisdictions, OE programs work in an integrated manner in partnership with industry and other stakeholders, as well as other DOE offices, to enhance

[a] Examples include wide-area visibility, identified from the 2003 Northeast blackout, and faster modeling and analysis, identified in the 2011 Southwest blackout.

the resilience, security, reliability, flexibility, affordability, and efficiency of the U.S. electric transmission and distribution systems.

Timely action is needed to perform the research and development that facilitates industry in deploying a reliable electric power grid that supports the vitality of other critical sectors that depend on electricity, such as telecommunications, banking and finance, water, and public health and safety. A reliable and resilient power grid is critical to U.S. economic competitiveness and leadership.

The investment proposed for FY 2020 continues to support OE's mission of security and resilience through four key priorities:

- North American Energy Resiliency Model: Working with the national labs and relevant stakeholders, develop an integrated North American Energy Resiliency Model (NAERM) to conduct planning and contingency analysis to address vulnerabilities in the North American energy system

- Megawatt Scale Grid Storage: pursue megawatt-scale storage capable of supporting voltage and frequency regulation, ramping, and energy management for bulk and distribution power systems—OE's Energy Storage program request supports grid-related Advanced Energy Storage Initiative (AESI) objectives and other OE R&D efforts are also complementary to AESI goals

- Revolutionize Sensing Technology Utilization: pursue integration of high-fidelity, low-cost sensing technology for predictive and correlation modeling for electricity and interdependencies with oil and natural gas (ONG) systems

- Transmission: pursue electricity-related policy issues by carrying out statutory and executive requirements, while also providing policy design and analysis expertise to Federal, State, tribal, territorial, and regional entities

NAERM will provide unique and ground-breaking national-scale energy planning and real-time situational awareness capabilities for rigorous and quantitative assessment, prediction, and improvement to ensure reliable and resilient energy delivery across multiple sectors while considering a range of large-scale, emerging threats.[b] DOE will lead this initiative in order to ensure a sustained and controlled analytic capability supporting its critical infrastructure protection responsibilities for energy sector under Presidential Policy Directive 21 (Critical Infrastructure Security and Resilience) and the FAST Act (Public Law 114–94).

The United States is increasingly experiencing threats, natural and man-made. The need to proactively plan and prepare for events that threaten this Nation's well-being and security necessitates an ambitious span of scope. NAERM will enable prediction of threat impacts, evaluation and identification of effective mitigation strategies, and black-start planning, benefiting the United States by advancing energy and economic security. NAERM will be developed in phases to address long-term energy planning with offline data, energy planning and operational studies with real-time data streams, national-level situational awareness with real-time data streams for both infrastructure and threats, and then advanced analytic and decision support capabilities to anticipate threats and mitigate their impacts in real-time. By the end of the final phase, NAERM will be a first-of-its-kind capability providing an operational situational awareness tool capable of monitoring the power system, predicting potential threat consequences, and mitigating those consequences to provide capabilities to operate-through adverse events.

Major power system outages are often caused in part by a lack of adequate situational awareness of grid conditions. To address this problem, and to provide utilities with new tools and critical information to mitigate and respond to potential issues and threats, high-fidelity, fast acting sensor technologies will be developed and integrated into the electric power system. Along with advances in data analytics, these sensor technologies will enable greater speed, accuracy, and precision in determining the state of the power system. This will meet needs for managing grid assets and operations with their

[b] Resilient systems (versus reliable) anticipate, withstand, and recover critical loss-of-supply resulting from low-probability, high-impact threats. Threats include, for example, natural disasters, coordinated cyber-physical attacks, and electromagnetic pulses due to nuclear detonation.

increased complexity, as well as monitoring and managing interconnected and interdependent effects among the Nation's critical infrastructures—all under increasing levels of threat conditions.

Program Highlights

- **Transmission Reliability and Resilience** is focused on ensuring the reliability and resilience of the U.S. electric grid through early-stage and foundational R&D on measurement and control of the electricity system and risk assessment to address challenges across integrated energy systems. A critical aspect of the request is beginning the full development of a dynamic integrated NAERM to allow the United States to conduct planning and contingency analyses that address vulnerabilities in the North American energy system. Building on lessons learned from the FY 2018 Puerto Rico work of creating a near-real-time model and efforts seeded in FY 2019, the FY 2020 request supports assessment of cross-infrastructure interdependencies and contingencies in the North American energy system. A Sensors and Data Analytics activity is also proposed to be established to develop and integrate high-fidelity, fast-acting sensing technologies, and advanced data analytics, to revolutionize their use in electric transmission systems for improved diagnosis, prediction, and determination of action during normal and extreme-event conditions.

- **Resilient Distribution Systems** focuses on the development of innovative technologies, tools, and techniques to modernize the distribution portion of the electric delivery system. The reduction from the FY 2019 appropriation is due to two activities that were fully funded in FY 2019: sensing intelligent machines and advanced low-cost distribution sensors.

- **Energy Storage** is designed to develop new and advanced technologies that will ensure the stability, reliability, and resilience of electricity infrastructure. The request supports the development of advanced power electronic architectures and topologies to address stranded energy, improve battery failure diagnostics, and integrated highly accurate state-of-charge and state-of-health monitoring of energy storage systems. The request also supports design and construction planning for an OE Grid Storage Launchpad (GSL) project aimed at accelerating materials development, testing, and independent evaluation of battery materials and battery systems for grid applications.

- **Transformer Resilience and Advanced Components** supports modernization, hardening, and resilience of the grid by addressing the unique challenges facing transformers and other critical grid components responsible for carrying and controlling electricity from where it is generated to where it is needed. The request builds on material research and design innovations for next-generation grid hardware, moving towards prototypes for technologies and concepts related to solid-state power substations and advance conductors.

- **Transmission Permitting and Technical Assistance** promotes a secure and resilient electricity system through regulatory and policy solutions. TPTA evaluates existing laws, policies, and regulations to better understand the regulatory landscapes, and provides technical assistance to Federal, State, tribal, territorial, and regional entities in their efforts to address the changing dynamics and uncertainties in the energy environment. TPTA also implements a number of legal authorities and seeks to improve transmission infrastructure by facilitating better coordination between Federal agencies for transmission lines that require multiple Federal authorizations and by permitting transmission facilities crossing the U.S international border. In FY 2020, TPTA will provide grid resilience tools and analyses to support State and regional decision-makers and institutional support for resilience infrastructure investments.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Power Marketing Administrations					
Southeastern Power Administration					
Southeastern Power Administration	72,449	75,324	87,016	+11,692	+15.5%
Less Alternative Financing/Offsetting Collections	-72,449	-75,324	-87,016	-11,692	-15.5%
Total, Southeastern Power Administration	**0**	**0**	**0**	**0**	**N/A**
Southwestern Power Administration					
Southwestern Power Administration	112,947	126,876	156,863	+29,987	+23.6%
Less Alternative Financing/Offsetting Collections	-87,347	-116,476	-146,463	-29,987	-25.7%
Use of Prior Year Balances	-14,200	0	0	0	N/A
Total, Southwestern Power Administration	**11,400**	**10,400**	**10,400**	**0**	**N/A**
Western Area Power Administration					
Western Area Power Administration (CROM)					
Western Area Power Administration (CROM)	858,473	834,567	915,804	+81,237	+9.7%
Less Alternative Financing/Offsetting Collections (CROM)	-721,248	-745,195	-821,432	-76,237	-10.2%
Rescission of Prior Year Balances	0	0	-176	-176	N/A
Use of Prior Year Balances	-43,853	0	-5,000	-5,000	N/A
Total, Western Area Power Administration (CROM)	**93,372**	**89,372**	**89,196**	**-176**	**-0.2%**
Falcon and Amistad O&M Fund					
Operation and Maintenance	5,048	4,440	5,647	+1,207	+27.2%
Less Alternative Financing/Offsetting Collections	-4,820	-1,712	-4,119	-2,407	-140.6%
Use of Prior Year Balances	0	-2,500	-1,300	+1,200	+48.0%
Total, Falcon and Amistad O&M Fund	**228**	**228**	**228**	**0**	**N/A**
Colorado River Basins Power Marketing Fund					
Spending Authority from Offsetting Collections	185,396	220,337	220,244	-93	-0.0%
Offsetting Collections	-208,396	-243,337	-241,644	+1,693	+0.7%
Total, Colorado River Basins Power Marketing Fund	**-23,000**	**-23,000**	**-21,400**	**+1,600**	**+7.0%**
Total, Western Area Power Administration	**70,600**	**66,600**	**68,024**	**+1,424**	**+2.1%**
Total, Power Marketing Administrations	**82,000**	**77,000**	**78,424**	**+1,424**	**+1.8%**

Appropriations Overview

The four **Power Marketing Administrations (PMAs)** sell electricity primarily generated by federally owned hydropower projects. Preference in the sale of power is given to public entities and electric cooperatives. Revenues from the sale of Federal power and transmission services are used to repay all related power costs.

The President's budget request includes a proposal to authorize the Federal government to sell the transmission assets of Southwestern Power Administration, Western Area Power Administration, and Bonneville Power Administration. The budget also includes a legislative proposal for all four of the PMAs to change statutory rate structure requirements from cost recovery to a market based structure that takes into consideration rates charged by comparable utilities and which could result in faster recoupment of the taxpayer investment.

Program Highlights

- **Southeastern Power Administration**
  Southeastern markets and delivers all available Federal hydroelectric power from 22 U.S. Army Corps of Engineers (Corps) multipurpose projects to preference customers in an eleven-state area in the southeastern United States. Southeastern does not own or operate any transmission facilities, and contracts with regional utilities that own electric

transmission systems to deliver the Federal hydropower to Southeastern's customers. Southeastern's use of receipts and alternative financing offsets its appropriations resulting in a net-zero balance for the program.

- **Southwestern Power Administration**
  Southwestern markets and delivers Federal hydroelectric power from 24 Corps multipurpose projects to preference customers in a six-state area and participates with other water resource users in an effort to balance diverse interests with power needs. To deliver power to its customers, Southwestern maintains 1,380 miles of high-voltage transmission lines, 26 substations/switchyards, and 51 microwave and VHF radio sites. To operate its program, maintain the infrastructure, and modernize systems to preserve the reliability, efficiency, and use of Federal assets, Southwestern utilizes appropriations, discretionary offsetting collections from Federal power receipts, and alternative financing. Of these funding sources, 93.3% is derived from use of receipts and alternative financing, resulting in a net appropriation of only 6.7%.

- **Western Area Power Administration**
  Western Area Power Administration (WAPA) markets and transmits Federal power to a 1.3-million-square-mile service area in 15 central and western states from 57 Federally-owned hydroelectric power plants operated by the Bureau of Reclamation (the Bureau), the Army Corps of Engineers (the Corps), and the International Boundary and Water Commission. It also markets a portion of the power from the Navajo Generating Station coal-fired plant near Page, Arizona. WAPA's construction program, conducted in close coordination with preference customers, continues to emphasize replacement, upgrade, and modernization of the electric system infrastructure to bring continued reliability, improved connectivity, and increase flexibility and capability to the power grid. Through extensive partnering efforts, WAPA has obtained significant stakeholder and customer participation in financing much of the construction program. Through transparency WAPA demonstrates the value of its efficient operations that preference customers enjoy. WAPA will continue to make significant efforts to be open, transparent and inclusive of customers and stakeholders in its operational choices and capital planning efforts. WAPA is strengthening its Asset and Risk Management to further ensure capital investments are sufficient and wisely deployed for our Nation and for our customers.

  The President's budget request includes a proposal to repeal the borrowing authority managed by WAPA's Transmission Infrastructure Program (TIP). Separate from the CROM construction program, TIP offers development assistance and debt financing options to deliver or facilitate the delivery of renewable energy resources.

- **Bonneville Power Administration**
  Bonneville operates under a business-type budget under the Government Corporation Control Act, 31 U.S.C 9101-10 and on the basis of the self-financing authority provided by the Federal Columbia River Transmission System Act of 1974 (Transmission Act) (Public Law 93-454).

  Bonneville is responsible for meeting the net firm power requirements of its requesting customers through a variety of means, including energy conservation programs, acquisition of renewable and other resources, and power exchanges with utilities both in and outside the region.

  Bonneville provides electric power, transmission, and energy services to a 300,000-square-mile service area in eight states in the Pacific Northwest. Bonneville wholesales the power produced at 31 Federal projects operated by the Corps and the Bureau and from certain non-Federal generating facilities. From these revenues, Bonneville funds the expense portion of its budget and the power operations and maintenance costs of the Bureau and the Corps in the Federal Columbia River Power System (FCRPS). The capital portion of the budget is funded mostly through borrowing from the U.S. Treasury at market rates for similar projects and with some non-Federal financing.

  Bonneville is self-financed and receives no direct annual appropriations from Congress. In FY 2020, estimated total requirements of all Bonneville programs of $4,148 million include estimated budget obligations of $3,740 and estimated capital transfers of $408 million. Estimated obligations include operating expenses of $2,867 million, capital investments of $787 million, and $86 million in projects funded in advance. These investments provide electric utility and general plant requirements associated with the FCRPS's transmission services, capital equipment, hydroelectric projects, conservation, and capital investments to mitigate impacts on the environment, fish, and wildlife.

($K)

	FY 2018 Enacted[1]	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Cybersecurity, Energy Security, and Emergency Response (CESER)					
Cybersecurity for Energy Delivery Systems	75,829	89,500	75,000	-14,500	-16.2%
Infrastructure Security and Energy Restoration	12,000	19,000	70,000	+51,000	+268.4%
Supplemental Hurricane Funding[2]	2,900	0	0	0	N/A
Program Direction	11,500	11,500	11,500	0	N/A
Total, Cybersecurity, Energy Security, and Emergency Response	**102,229**	**120,000**	**156,500**	**+36,500**	**+30.4%**

[1]The FY 2019 appropriation split the Electricity Delivery and Energy Reliability appropriation into two appropriations: Electricity Delivery and Cybersecurity, Energy Security, and Emergency Response (CESER). To allow a comparison with FY 2019 and 2020, the comparable amounts for FY 2018 include amounts for the Cybersecurity for Energy Delivery Systems and Infrastructure Security and Energy Restoration programs, and a portion of Program Direction funding, equivalent to what would have been in CESER had the current structure been in place in FY 2018.

[2]P.L. 115–123, Division B, Subdivision 1, the Further Additional Supplemental Appropriations Act for Disaster Relief Requirements Act, 2018, provided additional funding for expenses related to the consequences of Hurricanes Harvey, Irma, and Maria as an emergency requirement pursuant to the Balanced Budget and Emergency Deficit Control Act of 1985.

Appropriation Overview

Cybersecurity, Energy Security, and Emergency Response (CESER) leads the Department's efforts to secure U.S. energy infrastructure against all hazards, reduce the risks of and impacts from cyber events and other disruptive events, and assist with restoration activities. CESER is the Office responsible for DOE's responsibilities as lead agency for Emergency Support Function #12 (Energy), or ESF #12, under the National Response Framework, and is the Energy Sector-Specific Agency for national efforts to enhance the preparedness, resiliency, and recovery of the U.S. energy infrastructure from all threats and hazards.

Due to the critical role the electric grid plays across Federal, state, and local jurisdictions, CESER programs work in an integrated manner in partnership with industry and other stakeholders, as well as other DOE offices, to enhance the resilience (the ability to withstand and quickly recover from disruptions and maintain critical function) and security (the ability to reduce risks in the protection system assets and critical functions from unauthorized and undesirable actors) of the U.S. energy infrastructure. Reliable and resilient energy infrastructure is critical to U.S. economic competiveness, innovation, and leadership.

Within the appropriation, CESER funds:

- Research and Development (R&D) to deliver game-changing tools and technologies that help utilities secure and reduce risks to today's energy infrastructure from advanced cyber threats and design next-generation future systems that are built from inception to automatically detect, reject, and withstand cyber incidents, regardless of the threat.

- Public and private-sector partnership to strengthen the energy sector's cybersecurity posture, leveraging DOE-supported tools, guidelines, outreach, training, and technical assistance.

- Emergency Preparedness and Response, supporting the energy sector, to pursue enhancements to national efforts, in cooperation with public and private-sector stakeholders, for preparedness, and resilience, and recovery of U.S. energy infrastructure from all threats and hazards.

Program Highlights

- **Cybersecurity for Energy Delivery Systems** seeks to accelerate and expand efforts to strengthen the energy infrastructure against cyber threats and mitigate vulnerabilities. Working closely with the energy sector and our government partners, the request focuses on enhancing the speed and effectiveness of threat and vulnerability information sharing, including bi-directional machine-to-machine information sharing, and accelerating game-changing R&D to mitigate cyber incidents in today's systems and to develop next-generation resilient energy delivery systems while developing analyses to quantify the resulting relative risk reduction. For instance, research could accelerate

development of artificial intelligence (AI) techniques for critical energy delivery infrastructure, such as machine learning using data generated by the underlying physical process of energy delivery as well as data generated by the cyber-systems that control that physical process, to provide for an automatic response to cyber-attack. Such AI techniques might allow for energy delivery systems or components, such as generation plants, to automatically adapt operations and survive a cyber-attack that would otherwise disrupt energy delivery. The reduction from the FY 2019 appropriation is due to moving funding for the energy delivery system testing and analysis laboratory from Cybersecurity and Energy Delivery Systems (CEDS) to Infrastructure Security and Energy Restoration (ISER) for operationalizing the results of R&D initiatives. The CEDS request includes a $10,000,000 increase for an Advanced Threat Mitigation initiative to detect and mitigate high-risk threats faster by dramatically improving the speed and effectiveness of public-private information sharing and a $10,000,000 increase to demonstrate and refine prototype cybersecurity solutions to reduce cyber-risk for energy sector entities that provide power to military and government installations. This initiative will support the Cyber Analytics Tools and Techniques (CATT™) program, which is designed to provide the energy sector with situational awareness and actionable information to support discovery and mitigation of advance cyber threats to the U.S. energy infrastructure enriched with classified threat information and unique analytical tradecraft owned by the U.S. Government. These increases are offset by reductions in two activities that were fully funded in FY 2019: DarkNet and Automated System R&D.

- **Infrastructure Security and Energy Restoration** coordinates a national effort to secure U.S. energy infrastructure against all hazards, reduce impacts from disruptive events, and assist industry with restoration activities. ISER delivers critical capabilities including energy sector emergency response and recovery (including emergency response of a cyber nature); near-real-time situational awareness and information sharing about the status of the energy systems to improve risk management; analysis of evolving threats and hazards to energy infrastructure; and technical assistance that incorporates exercises in order to strengthen Federal, regional, State, local, tribal, and territorial (SLTT) abilities to work together to prepare for and mitigate the effects of an energy sector emergency. By working with the SLTT energy community to plan and develop mitigations, the Nation's energy systems will become more secure and resilient. The ISER request includes $30,000,000 to establish a national physical energy system and component testing capability designed specifically to look at the vulnerabilities of the energy sector from threats such as electromagnetic pulses (EMP) and geomagnetic disturbances (GMD) and $15,000,000 to support an energy delivery system testing and analysis laboratory that was previously funded in CEDS.

($K)

	FY 2018 Enacted[1]	FY 2019 Enacted	FY 2020 Request[2]	FY 2020 Request vs FY 2019 Enacted	
				$	%
Fossil Energy Petroleum Reserves					
Naval Petroleum and Oil Shale Reserves					
Production Operations	18,200	8,000	12,000	+4,000	+50.0%
Management	2,000	2,000	2,000	0	N/A
Use of Prior Year Balances	-15,300	0	0	0	N/A
Total, Naval Petroleum and Oil Shale Reserves	**4,900**	**10,000**	**14,000**	**+4,000**	**+40.0%**
Strategic Petroleum Reserve					
Facilities Development and Operations	194,914	180,026	148,980	-31,046	-17.2%
Management for SPR Operations	28,086	25,974	25,020	-954	-3.7%
Northeast Gasoline Supply Reserve	29,000	29,000	0	-29,000	-100.0%
Supplemental Hurricane Funding	8,716	0	0	0	N/A
Total, Strategic Petroleum Reserve	**260,716**	**235,000**	**174,000**	**-61,000**	**-26.0%**
Northeast Home Heating Oil Reserve					
Northeast Home Heating Oil Reserve	10,000	10,000	0	-10,000	-100.0%
Use of Prior Year Balances	-3,500	0	0	0	N/A
Total, Northeast Home Heating Oil Reserve	**6,500**	**10,000**	**0**	**-10,000**	**-100.0%**
SPR Petroleum Account					
SPR Petroleum Account	11,400	10,000	0	-10,000	-100.0%
Use of Prior Year Balances	-3,000	0	0	0	N/A
Total, SPR Petroleum Accounts	**8,400**	**10,000**	**0**	**-10,000**	**-100.0%**
Total, Fossil Energy Petroleum Reserves	**280,516**	**265,000**	**188,000**	**-77,000**	**-29.1%**
Energy Security and Infrastructure Modernization Fund	**350,000**	**300,000**	**450,000**	**+150,000**	**+50.0%**

[1] New FY 2018 budget authority was supplemented with the use of prior-year balances.

[2] The FY 2020 budget request does not include a request for direct appropriations; instead, the Department is requesting authorization to deposit up to $27 million in proceeds from the sale of one-million barrels of refined petroleum product (gasoline blendstock) from the Strategic Petroleum Reserve.

Appropriation Overview

Fossil Energy Petroleum Reserves consists of three energy security programs, one SPR modernization program, and post-sale remediation activities at Naval Petroleum Reserve No. 1 and 3. The Strategic Petroleum Reserve storage sites are located at four government-owned Gulf Coast locations with oversight from the Project Management office in Harahan, Louisiana, along with Headquarters personnel in Washington, D.C. Both the Northeast Home Heating Oil Reserve (NEHHOR) and the Northeast Gasoline Supply Reserve (NGSR) consist of Government-owned refined petroleum products stored in leased commercial storage in terminals in the Northeast. Legacy environmental clean-up/remediation continues at the previously-sold Naval Petroleum Reserve No. 1 (Elk Hills, California) and landfill remediation and closure continues as part of post-sale activities at Naval Petroleum Reserve No. 3 (Casper, Wyoming).

Program Highlights

- **Strategic Petroleum Reserve**
  The Strategic Petroleum Reserve (SPR) provides strategic and economic security against foreign and domestic disruptions in oil supplies via an emergency stockpile of crude oil. The program fulfills United States' obligations under the International Energy Program, which avails the United States of International Energy Agency assistance through its coordinated energy emergency response plans, and provides a deterrent against energy supply disruptions. The FY 2020 budget will support the SPR's operational readiness and drawdown capabilities of 4.21 MB/d. Program will perform cavern wellbore testing and remediation activities to ensure the availability of the SPR's crude oil inventory.

Northeast Gasoline Supply Reserve: Consistent with previous years, the Budget proposes to disestablish the Northeast Gasoline Supply Reserve (NGSR) by allowing current commercial storage contracts to expire and selling the refined product currently held in the reserve. The NGSR has not been utilized since its establishment, and is not considered to be cost efficient or operationally effective.

- **SPR Petroleum Account**
  The SPR Petroleum Account funds SPR petroleum acquisition, transportation, and drawdown activities. The Department is requesting authorization to deposit into the SPR Petroleum Account up to $27 million in proceeds from the sale of one-million barrels of refined petroleum product (gasoline blendstock) from the Strategic Petroleum Reserve's NGSR. Proceeds will be used as a source of funding for drawdown costs related to Congressionally-directed, multi-year sales of crude oil from the SPR.

- **Naval Petroleum and Oil Shale Reserves**
  Following the 1998 sale of the government's interests in NPR-1 (Elk Hills, CA), environmental cleanup/remediation activities under the Corrective Action Consent Agreement with the State of California Department of Toxic Substances Control (DTSC) began. Of the 131 AOCs for which DOE is responsible for environmental cleanup, as of December 10, 2018, 84 AOCs have received NFA certification from California's DTSC, and 6 AOCs are under DTSC review for NFA certification. The remaining 41 AOCs require remediation. The FY 2020 request includes funding that supports remediation of 5 AOCs and 6 sub-AOCs.

- **Northeast Home Heating Oil Reserve**
  The Budget proposes to disestablish the Northeast Home Heating Oil Reserve (NEHHOR) in FY 2020, as the NEHHOR has never been utilized for its design purpose and costs roughly $10 million per year to operate and maintain. Specifically, the Budget directs the Secretary to draw down and sell all one million barrels of petroleum distillate from the NEHHOR in FY 2020, and all proceeds from the sale shall be deposited into the general fund of the Treasury for deficit reduction. Upon completion of the sale, the NEHHOR will be closed as the current commercial storage contracts expire in March 2020. The Budget finds that regional petroleum reserves have not been effective at carrying out their intended missions.

- **Energy Security and Infrastructure Modernization Fund (ESIM)**
  The Energy Security and Infrastructure Modernization Fund was established in Section 404 of the Bipartisan Budget Act of 2015 to finance modernization of the Strategic Petroleum Reserve (SPR). Sales of SPR crude oil will support Life Extension Phase II investments needed to ensure the SPR can maintain its operational readiness capability, meet its mission requirements, and operate in an environmentally responsible manner. The FY 2020 budget increment concludes the four-year (2017 - 2020) financing structure of multi-year oil sales that support an effective modernization program for the SPR.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Fossil Energy Research and Development					
Carbon Capture and Storage and Power Systems					
Carbon Capture	100,671	100,671	0	-100,671	-100.0%
Carbon Storage	98,096	98,096	0	-98,096	-100.0%
Advanced Energy Systems	112,000	129,683	0	-129,683	-100.0%
Cross-cutting Research	58,350	56,350	0	-56,350	-100.0%
NETL Coal Research and Development	53,000	54,000	0	-54,000	-100.0%
STEP (Supercritical CO2)	24,000	22,430	0	-22,430	-100.0%
Transformational Coal Pilots	35,000	25,000	0	-25,000	-100.0%
Subtotal, Carbon Capture and Storage and Power Systems	**481,117**	**486,230**	**0**	**-486,230**	**-100.0%**
Advanced Coal Energy Systems and CCUS					
Advanced Energy Systems	0	0	220,300	+220,300	N/A
Crosscutting Research	0	0	60,325	+60,325	N/A
Carbon Capture, Utilization and Storage	0	0	68,800	+68,800	N/A
NETL Coal Research and Development	0	0	38,000	+38,000	N/A
Subtotal, Advanced Coal Energy Systems and CCUS	**0**	**0**	**387,425**	**+387,425**	**N/A**
Natural Gas Technologies	50,000	51,000	10,730	-40,270	-79.0%
Unconventional Fossil Energy Technologies from Petroleum - Oil Technologies	40,000	46,000	19,000	-27,000	-58.7%
Program Direction	60,000	61,070	61,045	-25	-0.0%
Special Recruitment Programs	700	700	700	0	N/A
NETL Infrastructure	45,000	45,000	43,100	-1,900	-4.2%
NETL Research and Operations	50,000	50,000	40,000	-10,000	-20.0%
Total, Fossil Energy Research and Development	**726,817**	**740,000**	**562,000**	**-178,000**	**-24.1%**

Appropriation Overview

The **Fossil Energy Research and Development (FER&D)** program conducts research that supports the clean, affordable and efficient use of domestic fossil energy resources. The program funds early-stage R&D with academia, National Laboratories, and the private sector to generate knowledge that industry can use to develop new products and processes. Funding is also provided to support competitive awards with industry, National Laboratories and academia focused on innovative early-stage R&D to improve the reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. Program activities, including National Energy Technology Laboratory (NETL) R&D, support early-stage R&D focused on: 1) novel fossil-fueled power systems and components that improve the reliability and efficiency of new and existing units; 2) advanced materials and computational systems; 3) utilization of coal and CO_2 for the production of critical materials and products; 4) transformational CO_2 capture technologies applicable to both new and existing fossil-fueled facilities; and 5) CO_2 storage, with emphasis on storage in depleted oil and gas fields; offshore geologic reservoirs; and addressing injection challenges across all reservoir types. The program will also conduct early-stage research to generate new understanding of shale geology and fracture dynamics to enable industry to further develop unconventional oil and natural gas resources. In addition, FER&D will conduct work focused on characterizing gas hydrates and will explore new concepts for novel technologies that could improve the reliability and operational efficiency of natural gas transmission, distribution, and storage facilities.

The FY 2020 Budget proposes a restructure of the Advanced Energy Systems (AES), Crosscutting Research, and Carbon Capture and Storage programs within the FER&D Program. This restructure improves the alignment of the budget structure to the research focus areas, repositioning the Department to more effectively enable industry to commercialize and deploy advanced technologies necessary to support a secure and reliable power grid. FER&D will support early-stage research in materials, sensors, and processes to expand the knowledge base upon which industry can improve the efficiency, flexibility, and resilience of the existing fleet of coal fired power plants. The restructure also focuses funding on early-stage research that enables the next generation of high efficiency and low emission coal fired power plants that can directly compete with other sources of electricity in the market and provide low cost reliable and interminable power. To ensure that investments across the Department are efficiently leveraged and coordinated,

the FY 2020 Budget Request also includes two intra-Departmental initiatives: the Harsh Environment Materials Initiative, which aligns shared R&D across the Offices of Fossil Energy, Nuclear Energy, and Energy Efficiency and Renewable Energy in materials, sensors, and advanced manufacturing related to small modular technologies; and the Advanced Energy Storage Initiative, which aligns shared R&D across the Offices of Fossil Energy, Electricity, and Energy Efficiency and Renewable Energy in energy storage. Further details can be found in the Crosscutting Research section.

Program Highlights

Advanced Coal Energy Systems & CCUS

The Advanced Energy Systems and CCUS budget request is focused on solving the nation's most pressing fossil energy challenges:

- Advancing the Coal FIRST (Flexible, Integrated, Resilient, Small, Transformative) initiative: R&D on technologies for coal plants of the future that are highly efficient and flexible, with near-zero emissions;
- Improving the performance, reliability, and efficiency of the existing coal-fired fleet;
- Reducing the cost and risk of carbon capture for commercial deployment; and
- Creating new market opportunities for coal.

- **Advanced Energy Systems**

  The mission of the Advanced Energy Systems (AES) subprogram is to increase the availability, efficiency, and reliability of fossil energy power systems and to fund early-stage research to advance technologies that represent a new way to convert energy to enable a step change in performance, efficiency, and the cost of electricity for next generation power plants while maintaining environmental standards through early-stage R&D. The subprogram comprises seven activities: 1) Advanced Gasification Systems, 2) Advanced Turbines, 3) Solid Oxide Fuel Cells, 4) Advanced Sensors and Controls and Other Novel Concepts, 5) Advanced Coal Processing 6) Power Generation Efficiency, and 7) Advanced Energy Materials. While the primary focus is on coal-based power systems, improvements to these technologies will result in spillover benefits that can reduce the cost of converting other carbon-based fuels, such as natural gas, biomass, or petroleum coke into power and other useful products in an environmentally-acceptable manner. Funding is also provided to support competitive awards with industry, National Laboratories, and academia. Goals of the program include: by the end of FY 2022, develop three technologies that, verified through modeling, improve the average heat rate (i.e., efficiency) of a typical plant in the existing fleet by 5 percent from the 2017 baseline of 30 percent. By the end of FY 2023, advance at least two engineering studies of advanced high efficiency, low emission (HELE) coal fired systems that have flexible operating capacity to meet baseload and load following requirements needed for the evolving grid. These studies will inform industry or other entities seeking to develop and deploy an advanced coal energy system.

- **Crosscutting Research**

  The Crosscutting Research subprogram supports innovative early-stage R&D for improving reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. The program bridges basic and applied research by targeting concepts with the greatest potential for transformational breakthroughs. As such, the program focuses on advancing early-stage research in areas such materials, rare earth recovery from coal and coal byproducts, fluid dynamics, and fuel preparation characteristics (i.e., coal particle sizing and drying). The program also aims to obtain new knowledge regarding plant phenomena and operation that can be incorporated into a new generation of plant control technologies. Crosscutting Research is focused on six activities and associated sub-activities: 1) Critical Minerals; 2) Water Management R&D; 3) Modeling, Simulation and Analysis; 4) Harsh Environment Materials Initiative; 5) Advanced Energy Storage Initiative and 6) University Training and Research (e.g., funding for: University Coal Research, and Historically Black Colleges and Universities and other Minority-Serving Institutions, and the University Turbine Systems Research.

- **Carbon Capture, Utilization & Storage**

  The Carbon Capture subprogram is focused on early-stage research and development on post-combustion and pre-combustion CO_2 capture, novel compression technologies for new and existing fossil fuel-fired power plants and CO_2 utilization technologies to convert $CO_2$to valuable products and commodities. Significant improvements are required to reduce parasitic energy load, and lower capital costs that can support the market potential for large quantities of CO_2 for economic utilization in Enhanced Oil Recovery (EOR) operations and conversion to high-value products. Low cost CO_2 can strengthen U.S. energy security by enabling the production of up to 60 billion barrels of stranded oil that is uneconomic with current recovery practices and current market prices for CO_2. The Carbon Utilization subprogram focuses on using captured/concentrated CO_2

and/or carbon-containing substances, or directly using CO_2 from flue gas or mixed gas streams, and converting it into valuable products. Critical challenges identified in the utilization focus area include the cost-effective use of CO_2 and other carbon-containing substances as a feedstock for chemical synthesis, or its integration into pre-existing products. The Carbon Storage subprogram is focused on development of technologies for the safe and permanent geologic storage of captured CO_2. The subprogram is focused on early-stage R&D in five primary storage types—saline formations, oil and natural gas reservoirs, un-mineable coal seams, basalts, and organic shales—and in geologic reservoirs across eleven different geologic storage depositional classes. Coupled simulation tools, characterization methods, and monitoring technologies developed and validated through the Carbon Storage subprogram will improve storage efficiency, reduce overall cost, decrease subsurface uncertainties, and identify ways to ensure that operations are safe, economically viable, and environmentally benign.

- **NETL Coal Research and Development**
  The NETL Coal R&D program funds all NETL in-house research efforts. In addition to supporting research capabilities in the areas of computational engineering, material engineering and manufacturing, and geological systems, this program funds collaboration activities with universities, other National Laboratories, state and local governments, and industry. NETL will leverage funding and will explore collaborative models for partnerships with other laboratories, industry, and academia in accordance with laws, regulations, and policies. This program also encompasses strategic energy analysis and research data management activities.

- **STEP (Supercritical CO2)**
  STEP is a pilot test facility that is intended to be available for industry- led projects. Through competitively awarded funding opportunity announcements, the program will support advances in the next generation of lower cost, higher performance recuperators as well as the next generation turbine components such as seals, bearings, and rotors needed to improve efficiency, reduce cost, and increase durability of power systems that use supercritical CO_2 as a working fluid.

- **Transformational Coal Pilots**
  No funding is requested in FY 2020. Prior year funding will be used to award up to 4 full front end engineering and design (FEED) studies that will proceed into a down-select to 2 large pilots, in accordance with Congressional directives.

Oil and Natural Gas

- **Natural Gas Technologies**
  The Natural Gas Technologies program addresses critical and emergent issues pertaining to the safe and environmentally sustainable supply of domestic natural gas. Specifically, the program's mission is to promote our Nation's energy independence through early-stage research and development that enables the prudent development, distribution, and storage of natural gas resources. The program is comprised of two subprograms: 1) Natural Gas Infrastructure Research and 2) Gas Hydrates. Given the importance of natural gas in our energy system, it is critical to ensure the safety and reliability of related infrastructure to protect energy reliability, public health, and the environment. To that end, the Natural Gas Infrastructure Research subprogram conducts early-stage R&D on technologies that industry could advance to improve the reliability and operational efficiency of natural gas transmission, distribution, and storage facilities. In addition, while shale gas has been discovered in sufficient quantities to now support and warrant U.S. liquefied natural gas (LNG) exports, the most plentiful supplies of natural gas throughout the world may in fact be the methane molecules trapped in ice-like structures called hydrates. The Gas Hydrates subprogram supports unique early-stage research to evaluate the occurrence, nature, and behavior of the potentially enormous naturally-occurring gas hydrate resources within the U.S. and territorial waters, with particular focus on the Arctic and Gulf of Mexico regions.

- **Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies**
  The mission of the Unconventional Fossil Energy Technologies from Petroleum – Oil Technologies program is to advance open information and technologies that will better assure sustainable and responsible development of domestic unconventional fossil energy resources, including tight and shale oil and natural gas. The prudent development of these natural resources is essential to ensuring the Nation's continued energy resilience and security. The Unconventional Fossil Energy Technologies Program is aligned with Administration priorities of enhancing domestic energy production and U.S. energy security.

National Energy Technology Laboratory

- **NETL Research and Operations**
  The NETL Research and Operations program funds NETL's science and technology development and commercialization functions, including technical program management and strategic scientific planning and partnerships. Specifically, funding supports the NETL staff of engineers, and technical project managers who conduct extramural research activities for FER&D programs, including salaries and benefits, travel, and other employee costs. This request also supports the variable operating costs of NETL's research sites.

- **NETL Infrastructure**
  The NETL Infrastructure program supports the fixed costs of NETL's facility and major equipment footprint in three geographic locations -- Morgantown, WV; Pittsburgh, PA; and Albany, OR. The program is comprised of the following subprograms: (1) High Performance Computer; (2) Laboratory and Site-wide Facilities; (3) Safeguards and Security; and (4) Environmental Restoration. As of November 2018, Joule, NETL's high performance computer, is the 52nd fastest in the world and the 23rd fastest in the United States. A subsequent lease is planned at the expiration of the current one.

- **Program Direction**
  Program Direction provides the funding for all headquarters personnel and operational expenses for FER&D. Also included is the Import/Export Authorization program, which will continue regulatory reviews and oversight of the transmission of natural gas across the U.S. borders. Program Direction at NETL continues to include functions that are necessary for the performance of NETL activities, such as legal, finance, and procurement. Each of these elements also fund the DOE-wide Human Resources Shared Services Center and the FE program office contributes to the DOE Working Capital Fund.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Nuclear Energy					
Integrated University Program	5,000	5,000	0	-5,000	-100.0%
STEP R&D	5,000	5,000	0	-5,000	-100.0%
SMR Licensing Technical Support					
Reactor Concepts RD&D	237,000	323,500	215,150	-108,350	-33.5%
Fuel Cycle R&D	260,056	263,915	90,000	-173,915	-65.9%
Nuclear Energy Enabling Technologies	159,000	152,585	98,450	-54,135	-35.5%
Radiological Facilities Management	29,000	29,000	9,000	-20,000	-69.0%
Idaho Facilities Management	294,000	318,000	209,242	-108,758	-34.2%
Idaho Sitewide Safeguards and Security	133,000	146,090	137,808	-8,282	-5.7%
International Nuclear Energy Cooperation	3,000	3,000	0	-3,000	-100.0%
Program Direction	80,000	80,000	64,350	-15,650	-19.6%
Total, Nuclear Energy	**1,205,056**	**1,326,090**	**824,000**	**-502,090**	**-37.9%**

Appropriation Overview

Nuclear Energy (NE) supports the diverse civilian nuclear energy programs of the U.S. Government, leading Federal efforts to research and develop nuclear energy technologies, including generation, safety, and security technologies, to help unleash an era of energy dominance through strategic support for innovation.

Program Highlights

- **Reactor Concepts Research, Development and Demonstration**
  FY 2020 activities will include cost-shared efforts to extend the life of the existing commercial nuclear reactor fleet through early-stage research in the areas of materials aging and degradation, safety margin characterization, safety technologies, and instrumentation and controls; and early-stage research into advanced reactor technologies, such as fast reactor technologies and high temperature reactor technologies for the production of electricity and high temperature process heat to improve the economic competitiveness and safety of nuclear energy as a resource capable of meeting the Nation's energy, environmental and energy security goals. In FY 2020, the Versatile Advanced Test Reactor subprogram accelerates as the Department anticipates a decision in FY 2021 on whether to proceed to design activities.

- **Fuel Cycle Research and Development**
  The FY 2020 Budget Request supports progress towards developing one or more light water reactor fuel concepts with significantly enhanced accident tolerance, and the investigation of technologies for providing high assay low enriched uranium (HALEU) feedstock for advanced reactor fuels.

- **Nuclear Energy Enabling Technologies**
  The FY 2020 Budget Request supports early-stage R&D and strategic investments in research capabilities to develop innovative and crosscutting nuclear energy technologies. This program funds high-priority early-stage R&D on advanced manufacturing methods, fabrication, and instrumentation technologies that includes strong investments in modeling and simulation tools, and provides access to unique nuclear energy research capabilities through its Nuclear Science User Facilities (NSUF). Collectively, Nuclear Energy Enabling Technologies sponsored activities support the goals, objectives, and activities of the Gateway for Accelerated Innovation in Nuclear (GAIN) initiative to make these technology advancements accessible to U.S. industry through private-public partnerships. The FY 2020 Budget Request also supports activities in the Transformational Challenge Reactor subprogram designed to enhance the development of breakthrough technologies using additive manufacturing techniques.

- **Radiological Facilities Management**
  The FY 2020 Budget Request supports the provision of fresh reactor fuel to, and removal of used fuel from, 25 operating university research reactors to support their continued operation. This provides continued test reactor capability to universities, coupled with research, development, and educational opportunities in support of U.S. nuclear energy initiatives.

- **Idaho Facilities Management and Idaho Sitewide Safeguards and Security**
  The Idaho Facilities Management program continues investments at the Advanced Test Reactor (ATR) and Advanced Test Reactor Critical Facility (ATRC) to improve reliability and availability of the ATR, and continue operations at the Transient Reactor Test Facility (TREAT). The Idaho Sitewide Safeguards and Security program will increase the workforce and focus on continued implementation of infrastructure investments, capital improvements, emerging technology investments, and enhanced cybersecurity program capabilities to adequately secure site assets.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Yucca Mountain and Interim Storage					
Defense Nuclear Waste Disposal					
Yucca Mountain and Interim Storage	0	0	26,000	+26,000	N/A
Nuclear Waste Disposal					
Yucca Mountain and Interim Storage	0	0	90,000	+90,000	N/A
Total, Yucca Mountain and Interim Storage	**0**	**0**	**116,000**	**+116,000**	**N/A**

Appropriation Overview

The mission of the Yucca Mountain and Interim Storage program is to accelerate progress on fulfilling the Federal Government's obligations to address nuclear waste, enhance national security, and reduce future taxpayer burden. The FY 2020 Budget Request proposes funding from two separate appropriation accounts, Nuclear Waste Disposal ($90 million) and Defense Nuclear Waste Disposal ($26 million).

Program Highlights

- **Yucca Mountain and Interim Storage Programs**

  The **Yucca Mountain and Interim Storage** FY 2020 Budget Request is dedicated to resuming regulatory activities concerning Yucca Mountain and initiating a robust interim storage program. This Budget Request supports functions necessary to execute regulatory activities, including legal support to represent the Department, as well as, responding to litigation and other legal matters. It also provides for technical and scientific work necessary to support and respond to any challenges in the regulatory process. In addition, it provides for related document management activities.

  The FY 2020 Budget Request includes funding to develop and implement a robust interim storage capability enabling near-term consolidation of nuclear waste.

- **Program Direction**

  The Program Direction budget is structured to support both regulatory activities and interim storage. Program Direction supports a variety of activities, including the salaries of Federal Employees working in furtherance of the Nuclear Waste Policy Act (NWPA).

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Office of Indian Energy Policy and Programs					
Departmental Administration					
Office of Indian Energy Policy and Programs	18,000	0	0	0	N/A
Office of Indian Energy Policy and Programs					
Indian Energy Policy and Programs	0	13,200	4,479	-8,721	-66.1%
Program Direction	0	4,800	3,521	-1,279	-26.6%
Total, Office of Indian Energy Policy and Programs	**18,000**	**18,000**	**8,000**	**-10,000**	**-55.6%**

Appropriation Overview

The **Office of Indian Energy Policy and Program's (IE)** financial and technical assistance are critical to advancing electrification and energy development and deployment on Indian lands, reducing energy costs, and assisting economic development in tribal communities where unemployment and poverty rates far exceed national averages. This assistance is intended to overcome barriers to deploying energy generation projects (used for heat and electric power), as well as energy efficiency projects that result in reduced or stabilized energy costs.

Technical Assistance overcomes barriers to project development and builds knowledge and skills necessary to implement energy projects on tribal land. It is available in the following areas: energy efficiency, energy development, electrification, resilience and cost reduction, and human capital building activities that support tribal self-determination, self-sufficiency, and energy security.

The Financial Assistance program will support funding opportunities toward energy development and electrification in Indian Country.

Program Highlights

Since 2010, DOE's Office of Indian Energy invested more than $62.5 million in nearly 160 tribal energy projects implemented across the contiguous 48 states and in Alaska. These projects, valued at over $130 million, are leveraged by over $68 million in recipient cost share.

From 2010-2017, DOE invested $25 million in 43 deployment (hardware installation) projects valued at more than $70 million, resulted in tangible results, including:

- Installed 18.5 MW of new generation on tribal lands
- Electricity bills reduced for more than 2,500 tribal government and community buildings and more than 29,000 tribal members
- Every $1 in DOE funding will result in $7.22 savings for those tribe[a]
- Average annual savings of $10M and lifetime savings of a $500 million dollars

In 2018, DOE announced the selection of an additional 15 projects for award negotiations valued at $25 million to be leveraged with DOE investment of $9 million. These 15 hardware installation projects will result in an additional 10 MW of new generation for more than 900 tribal buildings and homes across the nation, saving those communities more than $1.5 million each year.

[a] [(DOE cost share/total project cost) * total savings from all projects]/DOE cost share: [($24,924,255/$70,135,364)* ($507,000,000)]/$24,924,255 (2010-2016 Data)

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Environment, Health, Safety and Security Mission Support					
Environment, Health, Safety and Security Mission Support	130,693	133,839	139,628	+5,789	+4.3%
Program Direction	68,253	69,000	72,881	+3,881	+5.6%
Total, Environment, Health, Safety and Security Mission Support	**198,946**	**202,839**	**212,509**	**+9,670**	**+4.8%**

Appropriation Overview

Environment, Health, Safety and Security (EHSS) funds support implementing DOE's commitment to maintain a safe and secure work environment for all Federal and contractor employees; ensure operations do not adversely affect the environment, health and safety of surrounding communities; and protect national security and other entrusted assets. In particular, they support achieving DOE's mission in a safe, secure, environmentally responsible manner by providing consistent policy, technical assistance, and corporate leadership for environment, health, safety and security program areas.

Program Highlights

Environment, Health and Safety—Funds are used to provide technical and analytical expertise to protect and enhance the safety of all DOE workers, the public, and the environment in support of Departmental missions and goals. EHSS maintains policies and guidance that promote safe, environmentally sustaining work practices in the areas of occupational, facility, nuclear, and radiation safety; environmental protection; and quality assurance. EHSS provides technical assistance to DOE program and site offices and laboratories through activities such as nuclear facility safety bases reviews and corporate-wide services such as accrediting commercial laboratories used by DOE sites for regulatory compliance and employee radiological monitoring programs. EHSS supports Departmental and national preparedness and response efforts associated with radiation emergencies and accidents and domestic and international research on exposures of workers and the public to nuclear, radiological, and other hazardous materials. EHSS provides health and environmental services to the people of the Marshall Islands; and medical screenings for former DOE and DOE-related vendor employees, and supports the Department of Labor in implementation of the Energy Employee Occupational Illness Compensation Program Act.

Security—Funds provide technical security and analytical expertise to develop and assist in the implementation of safeguards and security programs that protect national security assets entrusted to DOE and implement the U.S. Government nuclear weapons-related technology classification and declassification program. EHSS maintains policies and guidance related to physical protection, personnel and information security and nuclear materials accountability, in order to be responsive to national security needs and evolving threats. EHSS provides technical assistance to DOE programs, site offices and laboratories to implement cost effective security measures tailored to the mission. EHSS maintains corporate security-related information management systems to determine the potential for an undue risk to individual sites, DOE, and national security. EHSS provides for the protection of DOE Headquarters facilities and access authorizations for DOE Headquarters personnel.

Program Direction—Funds provide Federal staffing, travel, support services and other resources required for execution of EHSS program activities and provide technical support for liaison activities with the Defense Nuclear Facilities Safety Board.

In FY 2020, the Budget Request proposes to:

- Ensure DOE's EHSS policies are efficient, effective and in compliance with national policies;
- Support cost effective implementation of EHSS requirements, including continued support for implementation of DOE's Design Basis Threat Order;
- Identify and assess effective, safe, and reliable physical security technologies to replace aging and failing systems currently in operation at nuclear facilities and laboratories;
- Continue to improve DOE's safety culture by expanding the safety culture community of interest to share best practices, performing safety culture assessments, and monitoring safety culture performance (including analyzing and monitoring results to improve safe accomplishment of work);

- Manage DOE's classification program to protect national security interests;
- Manage programs that support EHSS excellence and efficiency across the complex (such as the Voluntary Protection Program); and
- Manage programs that promote improvements in EHSS knowledge and capabilities, such as the Nuclear Safety Research and Development Program and international health studies.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Title 17 - Innovative Technology Loan Guarantee Program					
Administrative Operations[1]	33,000	33,000	3,000	-30,000	-90.9%
Loan Guarantee, Offsetting Collections	-2,108	-20,000	-3,000	+17,000	+85.0%
FY 2011 Loan Subsidy Cancellation[2]	0	0	-160,659	-160,659	N/A
Total, Title 17 - Innovative Technology Loan Guarantee Program	**30,892**	**13,000**	**-160,659**	**-173,659**	**-1,335.8%**
ARRA Loan Subsidy Cancellation[3]	0	0	-523,212	-523,212	N/A

[1]The current estimate for offsetting collections in FY 2019 is $20 million and the Congressional estimate for FY 2019 was $15 million. In FY 2018, $24 million of spending authority was derived from offsetting collections received in prior years and $2 million in fees were credited as offsetting collections but not made available.

[2]The FY 2020 Budget proposes to cancel approximately $161M in unobligated credit subsidy balances appropriated by the Department of Defense and Full-Year Continuing Appropriations Act of 2011 (Pub. L. 112-10) for renewable energy or efficient end-use energy technologies under section 1703 of the Energy Policy Act of 2005.

[3]The FY2020 Budget Request proposes to cancel $523 million in remaining, emergency designated, unobligated credit subsidy balances appropriated by the American Reinvestment and Recovery Act of 2009 (Pub. L. 111-5). There are no scoreable savings from this cancelation.

Appropriation Overview

Title 17 - Innovative Technology (Title 17) Loan Guarantee Program, as authorized under Title XVII of the Energy Policy Act of 2005 and executed by the Department of Energy's (DOE) Loan Programs Office (LPO), encourages early commercial use of new or significantly improved technologies in energy projects. Projects supported by Title 17 loan guarantees must avoid, reduce, or sequester air pollutants or anthropogenic emissions of greenhouse gases; employ new or significantly improved technologies compared to commercial technologies in service in the United States at the time the guarantee is issued; and offer a reasonable prospect of repayment of the principal and interest on the guaranteed obligation.

The FY 2020 Budget eliminates the Title 17 Loan Guarantee Program and proposes to cancel the approximately $161 million in remaining credit subsidy and all authority to guarantee loans appropriated in prior appropriations acts. In addition to $3,000,000 in appropriation offset by $3,000,000 in collections, the Loan Programs Office (LPO) will utilize approximately $26 million in unobligated balances carried forward from prior-year appropriations to cover loan portfolio monitoring and administrative expenses; salaries for its full time employees as well as the cost of outside advisors for financial, legal, engineering, credit, and market analyses. In FY 2020, LPO will stop originating loans for the Title 17 Loan Guarantee Program but will continue to monitor the existing portfolio. It is assumed that the recently issued conditional commitment for $3.7 billion in loan guarantees to the owners of the Plant Vogtle Expansion Project will reach financial close in FY 2019. No other projects are assumed to reach financial close prior to FY 2020.

Program Highlights

The FY 2020 Budget Request eliminates the Title 17 Guarantee Program.

- The FY 2020 Budget proposes to permanently cancel the approximate $161 million in remaining credit subsidy and all authority to guarantee loans appropriated in prior appropriations acts, with the exception of projects that reach financial close prior to October 1, 2019.

- In addition to $3,000,000 in appropriation offset by $3,000,000 in collections, the Loan Programs Office (LPO) will utilize approximately $26 million in unobligated balances carried forward from prior-year appropriations to cover loan portfolio monitoring and administrative expenses.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request[1]	FY 2020 Request vs FY 2019 Enacted	
				$	%
Advanced Technology Vehicles Manufacturing Loan Program					
Administrative Expenses	5,000	5,000	0	-5,000	-100.0%
Total, Advanced Technology Vehicles Manufacturing Loan Program	**5,000**	**5,000**	0	**-5,000**	**-100.0%**

[1]The FY 2020 Budget Request proposes to rescind $4.3 billion in remaining unobligated, emergency designated, credit-subsidy balances appropriated by the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act of 2009 (Pub. L. 110-329). There are no scoreable savings for this cancelation.

Appropriation Overview

Advanced Technology Vehicles Manufacturing (ATVM) Loan Program supports the manufacturing of advanced technology vehicles and associated components in the United States. ATVM provides loans to automobile and automobile part manufacturers for the cost of re-equipping, expanding, or establishing manufacturing facilities in the United States to produce advanced technology vehicles or qualified components and for associated engineering integration costs.

The FY 2020 Budget eliminates the ATVM Loan Program and proposes to rescind $4.3 billion in remaining, emergency-designated, appropriated credit subsidy. The FY 2020 Budget proposes utilizing up to $5 million in unobligated, non-emergency designated balances carried forward from prior-year appropriations to cover loan portfolio monitoring and administrative expenses: salaries for its full-time employees as well as the cost of outside advisors for financial, legal, engineering, credit, and market analysis. In FY 2020, LPO will stop originating loans for the ATVM Loan Program but will continue to monitor the existing portfolio.

Program Highlights

The FY 2020 Budget eliminates the ATVM Loan Program

- The direct loan authority provided under section 129 of the Consolidated Security, Disaster Assistance, and Continuing Appropriations Act, 2009 is permanently cancelled.
- LPO will continue to manage its existing asset portfolios.
- The FY 2020 Budget proposes to use up to $5 million in unobligated balances carried forward from prior-year appropriations for loan-portfolio monitoring and related administrative expenses.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request[1]	FY 2020 Request vs FY 2019 Enacted	
				$	%
Tribal Energy Loan Guarantee Program					
Administrative Operations	1,000	1,000	0	-1,000	-100.0%
Loan Subsidy Cancellation	0	0	-8,500	-8,500	N/A
Total, Tribal Energy Loan Guarantee Program	**1,000**	**1,000**	**-8,500**	**-9,500**	**-950.0%**

[1]The FY 2020 Budget Request proposes to cancel $8.5 million in unobligated credit subsidy balances appropriated by the Consolidated Appropriations Act of 2017 (P.L. 115-31).

Appropriation Overview

Tribal Energy Loan Guarantee Program (TELGP) Section 2602 of the Energy Policy Act of 1992, as amended by the Energy Policy Act of 2005, authorized a loan guarantee program at the Department of Energy to support energy development by Indian tribes.

The FY 2020 Budget Request eliminates TELGP and proposes to cancel the $8,500,000 appropriated for credit subsidy. Loan Programs Office (LPO) will utilize up to $1 million in unobligated balances carried forward from prior-year appropriations to cover administrative expenses necessary to implement program termination. In FY 2020, the Loan Programs Office will stop originating loans for TELGP, but will continue to monitor any loans that may close prior to October 1, 2019.

Program Highlights

The FY 2020 Budget eliminates TELGP.

- The FY 2020 Budget proposes to cancel $8.5 million in unobligated credit subsidy balances appropriated by the Consolidated Appropriations Act of 2017 (P.L. 115-31).
- In FY 2020, LPO will discontinue loans origination activities for TELGP.
- The FY 2020 Budget proposes to use up to $1 million in unobligated balances carried forward from prior year appropriations for related administrative expenses.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Energy Information Administration					
National Energy Information System	125,000	125,000	118,000	-7,000	-5.6%
Total, Energy Information Administration	**125,000**	**125,000**	**118,000**	**-7,000**	**-5.6%**

Appropriation Overview

The **U.S. Energy Information Administration (EIA)** is the statistical and analytical agency within the U.S. Department of Energy (DOE). EIA collects, analyzes, and disseminates independent and impartial energy information to promote sound policymaking, efficient markets, and public understanding of energy and its interaction with the economy and the environment. EIA is the nation's premier source of energy information and, by law, its data, analyses, and forecasts are independent of approval by any other officer or employee of the U.S. government.

EIA conducts a wide range of data collection, analysis, forecasting, and dissemination activities to ensure that its customers, including Congress, federal and state governments, the private sector, the public, and the media, have ready access to timely, reliable, and relevant energy information. EIA's data and analysis inform important energy-related decisions, such as the availability of energy sources; government, business, and personal investment decisions; and policy development.

Program Highlights

EIA has evolved its program in recent years to provide an expanding customer base with coverage of increasingly complex and interrelated energy markets. The agency's ability to adapt to a changing industry landscape has been essential to the nation's ongoing dialogue on important energy issues.

The FY 2020 Budget Request will enable EIA to continue core statistical and analysis activities that produce reports critical to the nation, including:

- *Weekly Natural Gas Storage Report* (WNGSR), which is designated as one of the nation's Principal Federal Economic Indicators
- *Weekly Petroleum Status Report* (WPSR), which provides statistics on oil and petroleum product stocks, imports, and production
- *Short-Term Energy Outlook* (STEO), which provides monthly forecasts of U.S. and global supply, consumption, trade, stocks, and prices projected out 12 to 24 months
- *Annual Energy Outlook* (AEO), which projects U.S. energy supply, consumption, and trade over the next 25- to 30-year period

The FY 2020 Budget Request will also enable EIA to continue planned cybersecurity initiatives to bolster information security.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Science					
Advanced Scientific Computing Research	810,000	935,500	920,888	-14,612	-1.6%
Basic Energy Sciences	2,090,000	2,166,000	1,858,285	-307,715	-14.2%
Biological and Environmental Research	673,000	705,000	494,434	-210,566	-29.9%
Fusion Energy Sciences Program	532,111	564,000	402,750	-161,250	-28.6%
High Energy Physics	908,000	980,000	768,038	-211,962	-21.6%
Nuclear Physics	684,000	690,000	624,854	-65,146	-9.4%
Workforce Development for Teachers and Scientists	19,500	22,500	19,500	-3,000	-13.3%
Science Laboratories Infrastructure	257,292	232,890	163,600	-69,290	-29.8%
Safeguards and Security	103,000	106,110	110,623	+4,513	+4.3%
Program Direction	183,000	183,000	183,000	0	N/A
Total, Science	**6,259,903**	**6,585,000**	**5,545,972**	**-1,039,028**	**-15.8%**

Appropriation Overview

The **Office of Science (SC)** is the nation's largest Federal supporter of basic research in the physical sciences and funds programs in physics, chemistry, materials science, biology, environmental science, applied mathematics, and computer and computational science. The SC portfolio has two principal thrusts: direct support of scientific research, and direct support of the design, development, construction, and operation of unique, open-access scientific user facilities. The SC basic research portfolio includes extramural grants and contracts supporting over 22,000 researchers located at over 300 institutions and the 17 DOE national laboratories, spanning all fifty states and the District of Columbia. The portfolio of 27 scientific user facilities serves nearly 32,000 users per year. SC programs invest in foundational science, including basic research for the advancement of clean energy, to transform our understanding of nature and strengthen the connection between advances in fundamental science and technology innovation.

Program Highlights

- **Advanced Scientific Computing Research**
  Advanced Scientific Computing Research (ASCR) supports advanced computational research, applied mathematics, and computer science, as well as development and operation of multiple, large high performance and leadership computing user facilities and high performance networking. ASCR decreases by $14.6 million, or 1.6 percent, below the FY 2019 Enacted level. The Request provides investments to accelerate the development of exascale-capable computing systems, applications and software infrastructure in order to deploy the first exascale system in calendar year 2021 to provide next-generation tools for scientific discovery and meet national security needs. The Request funds:
  - Research, development, and design to ultimately achieve exascale-capable systems with a fifty fold improvement in true application performance over the current systems at the Leadership Computing Facilities at Argonne National Laboratory (ANL) and Oak Ridge National Laboratory (ORNL).
  - Foundational research to improve the robustness, reliability, and transparency of Big Data and Artificial Intelligence (AI) technologies, uncertainty quantification, and development of software tools.
  - Support of core research in applied mathematics, computer science, Scientific Discovery through Advanced Computing (SciDAC) program, and new strategic partnerships aimed at understanding the challenges that quantum information and neuromorphic technologies pose to DOE mission applications.
  - In partnership with the Basic Energy Sciences and High Energy Physics programs, establish at least one multi-disciplinary Quantum Information Sciences (QIS) center to promote basic research early stage development to accelerate the advancement of QIS through vertical integration between systems and theory and hardware and software in partnership with the BES and HEP programs.
  - Operations and preparation for upgrades at ASCR's four scientific user facilities, including site preparations and non-recurring engineering efforts at the Leadership Computing Facilities.

- **Basic Energy Sciences**
  Basic Energy Sciences (BES) supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. BES decreases by $307.7 million or 14.2 percent, below the FY 2019 Enacted level. The Request funds:
  - Core research activities to support Administrative Priorities that will empahsize QIS, next-generation microelectronics, data analytics and machine learning for data-driven science, ultrafast science, catalysis science, synthesis, instrumentation science, and materials and chemical research related to future nuclear energy systems, next-generation electrical energy storage, interdependent energy-water issues, and fundamental research to enable advancement of clean energy technologies.
  - Support for the Energy Frontier Research Centers (EFRCs) to expand the EFRC portfolio in topical areas of the highest priority to the Department, including QIS, microelectronics, and other program priorities.
  - Countinuing support for the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hubs.
  - Continuing support for computational materials and chemical sciences to deliver shared software infrastructure to the research communities as part of the Exascale Computing Initiative.
  - In partnership with other SC programs, establish at least one multi-disciplinary QIS center to promote basic research early stage development to accelerate the advancement of QIS through vertical integration between systems and theory and hardware and software.
  - Continuing operation of BES user facilities below optimal levels: five x-ray light sources, two neutron scattering sources, and five research centers for nanoscale science, as well as QIS research and related tools development.
  - Support for the Advanced Photon Source Upgrade project, the Advanced Light Source Upgrade (ALS-U) project, the Linac Coherent Light Source-II High Energy (LCLS-II-HE) project, the Proton Power Upgrade (PPU) project at the SNS, and the Second Target Station (STS) at SNS.
  - Initial funding for two new Major Item of Equipment projects: the NSLS-II Experimental Tools-II (NEXT-II) project to continue the phased build-out of beamlines at NSLS-II, and the Nanoscale Science Research Centers Recapitalization project.

- **Biological and Environmental Research**
  Biological and Environmental Research (BER) supports fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental and ecological processes at the scale of the planet Earth. BER decreases by $210.6 million, or 29.9 percent, below the FY 2019 Enacted level. The Request funds:
  - Core research in biological systems science including the DOE Bioenergy Research Centers, using approaches such as genome sequencing, secure biodesign, proteomics, metabolomics, structural biology, high-resolution imaging and characterization, and integration of information into computational models that can be iteratively tested and validated to advance a predictive understanding of biological systems for use in security and clean, affordable, and realiable energy for adaptation to industry, as well as contributing to QIS.
  - Core research in earth and environmental systems science, with activities focused on scientific analysis and modeling of the sensitivity and uncertainty of Earth system predictions to atmospheric, cryospheric, oceanic, and biogeochemical processes, with continued support of the Energy Exascale Earth System Model.
  - Continuing operation of the three BER scientific user facilities: the Joint Genome Institute, the Atmospheric Radiation Measurement Research Facility, and the Environmental Molecular Sciences Laboratory.

- **Fusion Energy Sciences**
  Fusion Energy Sciences (FES) supports research to understand matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. FES decreases by $161.3 million, or 28.6 percent, below the FY 2019 Enacted level. The Request funds:
  - The DIII-D program research and facility operations supports the study of high priority topics identified by community research needs workshops.
  - The National Spherical Torus Experiment Upgrade (NSTX-U) to implement repairs and corrective actions required to obtain robust, reliable research operations, and enhanced collaborative research at other facilities to support NSTX-U research program priorities.
  - Research opportunities for U.S. scientists on overseas superconducting tokamaks and stellerators and other international facilities with unique capabilities, enabled by U.S. hardware and intellectual contributions.

- Support for research in high-energy-density laboratory plasma science, discovery plasma science, and SciDAC in partnership with ASCR.
- The U.S. Contribution to the ITER project focusing on the highest-priority First Plasma hardware components, including the continued fabrication of the central solenoid superconducting magnet modules.
- The Matter in Extreme Conditions Petawatt upgrade project will provide initial design funding for an experimental research end-station that utilizes the Linac Coherent Light Source User Facility.
- The Materials-Plasma Exposure eXperiment project, which will be a world-leading facility for dedicated studies of reactor-relevant heat and particle loads on fusion materials.

- **High Energy Physics**

  High Energy Physics (HEP) supports research to understand how the universe works at its most fundamental level by discovering the most elementary constituents of matter and energy, probing the interactions among them, and exploring the basic nature of space and time. HEP decreases by $212.0 million, or 21.6 percent, below the FY 2019 Enacted level. The Request funds:
  - Research in QIS, which opens prospects for new capabilities in sensing, simulation, and computing. HEP activities will be a part of a larger national effort involving interagency coordination of programs.
  - Research in AI for machine learning and deep learning to address cross cut challenges across the HEP program in coordination with DOE investments in exascale computing and associated AI efforts.
  - Core research activities, with priority in the physics of the Higgs boson, neutrinos, dark matter, dark energy, and exploring the unknown, and world-leading R&D that requires long-term investments, including General Accelerator R&D, Detector R&D, Accelerator Stewardship, and Computational Physics.
  - Facility Operations, Fermilab Accelerator Complex, Accelerator Test Facility, start of the Facility for Advanced Accelerator Experimental Test II, and support to Sanford Underground Research Facility to meet DOE expectations of reliable, efficient, and safe operations during the construction of Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNE/DUNE).
  - The highest priority activities and projects identified by the high energy physics community to include strong support for the LBNF/DUNE and the Proton Improvement Plan-II project that will provide the world's highest proton beam intensity of greater than 1.2 megawatts for LBNF/DUNE, which are hosted at the Fermi National Accelerator Laboratory; and the High-Luminosity Large Hadron Collider Accelerator (LHC) and Compact Muon Solenoid and A Toroidal LHC Apparatus Detector Upgrade projects with international partners.

- **Nuclear Physics**

  Nuclear Physics (NP) supports research to discover, explore, and understand all forms of nuclear matter. NP decreases by $65.1 million or 9.4 percent, below the FY 2019 Enacted level. The Request funds:
  - High priority world-class nuclear physics research in Quantum Chromodynamics, Nuclei and Nuclear Astrophysics, and Fundamental Symmetries at universities and laboratories and preserves critical core competencies. Support for QIS efforts to enable precision NP measurements, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms.
  - Support for the DOE Isotope Program as it continues to introduce new medical isotopes for clinical trials and cancer therapy.
  - Operations of the Relativistic Heavy Ion Collider to study matter created moments after the "Big-Bang"; the Continuous Electron Beam Accelerator Facility to continue the scientific program with the recently upgraded 12 GeV machine to pursue opportunities for new discoveries and an improved understanding of quark confinement; operations of the Argonne Tandem Linac Acceleratory System for compelling research in nuclear structure and astrophysics; and operations for the Facility for Rare Isotope Beams(FRIB) to partially support the operational optimization of accelerator components as they complete fabrication and commissioning on the project, and the transition of some associated operational staff to the facility operations budget.
  - Continues construction of FRIB at Michigan State University consistent with the performance baseline profile; FRIB will provide world-leading capabilities for nuclear structure and nuclear astrophysics.
  - Initiation of engineering design of the United States Stable Isotope Production and Research Center at ORNL to increase the domestic production capabilities of stable isotopes for scientific, industrial, national security, and medical uses.
  - Initial funding for the U.S. Based Electron Ion Collider to address high priority, critically needed accelerator R&D to retire high risk technical challenges.

- Support for the following ongoing major investments in new scientific equipment: the Gamma-Ray Energy Tracking Array MIE, which will enable provision of advanced, high resolution gamma ray detection capabilities for FRIB; the Stable Isotope Production Facility MIE, which will provide increased domestic capability for production of critically needed enriched stable isotopes, and reduce the nation's dependency on foreign supply; the sPHENIX MIE, which will have enhanced capabilities that will further RHIC's scientific mission by studying high rate jet production.
- Initial funding for three new MIEs: the Isotope Harvesting accelerator improvement project at FRIB, which will add harvesting capabilities at FRIB; the Ton-scale Neutrinoless Double Beta Decay experiment to determine whether the neutrino is its own antiparticle; and the Measurement of a Lepton-Lepton Electroweak Reaction (MOLLER), which will measure the parity-violating asymmetry in electron-electron scattering with the 12 GeV CEBAF machine.

- **Workforce Development for Teachers and Scientists**
  Workforce Development for Teachers and Scientists (WDTS) ensures that DOE has the sustained pipeline of science, technology, engineering, and mathematics workers to meet national goals and objectives, now and in the future. WDTS funding decreases by $3.0 million or 13.3 percent, below the FY 2019 Enacted level.

- **Science Laboratories Infrastructure**
  Science Laboratories Infrastructure (SLI) sustains mission-ready infrastructure and safe and environmentally responsible operations by providing the infrastructure necessary to support leading edge research by the SC national laboratories. SLI decreases by $69.3 million or 29.8 percent, below the FY 2019 Enacted level. The Request funds:
  - Five new construction projects: the Critical Utilities Rehabilitation Project at BNL; the Seismic and Safety Modernization at Lawrence Berkeley National Laboratory (LBNL); the CEBAF Renovation and Expansion at Thomas Jefferson National Accelerator Facility; the Craft Resouces Support Facility at ORNL; and the Large Scale Collaboration Center at SLAC.
  - The continuation of six ongoing construction projects: the Science User Support Center at BNL; the Electrical Capacity and Distribution Capability project at ANL; the Translational Research Capability at ORNL; the Biological and Environmental Program Integration Center (BioEPIC) at LBNL; the Energy Sciences Capability at Pacific Northwest National Laboratory (PNNL); and the Integrated Engineering Research Center at Fermilab.
  - General purpose infrastructure projects that will address inadequate core infrastructure and utility needs; continued effort to de-inventory, remove, and transfer nuclear material at Building 350, formerly the site of the New Brunswick Laboratory on the ANL campus; the acquisition of previously leased real property on the PNNL campus; and support for Payment in Lieu of Taxes, nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation.

- **Safeguards and Security**
  Safeguards and Security (S&S) program ensures appropriate security measures are in place to support the SC mission requirement of open scientific research and to protect critical assets within SC national laboratories. S&S increases by $4.5 million or 4.3 percent, above the FY 2019 Enacted level. The Request funds:
  - Support for the initial stages of implementation of the Design Basis Threat mandated physical security modifications at SC laboratories, starting with highest priorities including the protection of personnel.

- **Science Program Direction**
  Program Direction (PD) supports the skilled and motivated Federal workforce that plans, develops, and oversees SC investments in world-leading basic research and scientific user facilities, and provides critical oversight to ten of DOE's national laboratories. The FY 2020 Request remains the same as the FY 2019 Enacted level and funds Salaries and Benefits, Travel, Support Services, Other Related Expenses, and Working Capital Fund requirements.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Environmental Management by Site					
Brookhaven National Laboratory	2,000	20,456	0	-20,456	-100.0%
Carlsbad/Waste Isolation Pilot Plant (WIPP)	383,041	403,487	398,334	-5,153	-1.3%
Idaho National Laboratory	446,043	443,200	347,654	-95,546	-21.6%
Oak Ridge	639,771	646,281	428,875	-217,406	-33.6%
Paducah	273,156	274,024	276,648	+2,624	+1.0%
Portsmouth	448,284	475,806	425,987	-49,819	-10.5%
Richland	947,422	954,097	718,098	-235,999	-24.7%
River Protection	1,560,000	1,573,000	1,392,460	-180,540	-11.5%
Savannah River	1,471,438	1,551,014	1,642,509	+91,495	+5.9%
Lawrence Berkeley National Laboratory	41,000	35,000	0	-35,000	-100.0%
Lawrence Livermore National Laboratory	101,175	26,704	129,727	+103,023	+385.8%
Los Alamos National Laboratory	220,000	220,000	195,462	-24,538	-11.2%
Nevada	60,136	60,136	60,737	+601	+1.0%
Sandia National Laboratories	2,600	2,600	2,652	+52	+2.0%
Separation Process Research Unit (SPRU)	4,800	15,000	15,300	+300	+2.0%
West Valley Demonstration Project	78,098	78,133	78,411	+278	+0.4%
Energy Technology Engineering Center	9,000	11,000	18,199	+7,199	+65.4%
Moab	37,884	45,000	35,693	-9,307	-20.7%
Other Sites	14,889	4,889	4,987	+98	+2.0%
Headquarters Operations	14,979	12,979	12,979	0	N/A
Technology Development	35,000	25,000	0	-25,000	-100.0%
Uranium/Thorium Reimbursement Program	35,732	11,000	21,035	+10,035	+91.2%
Program Direction	300,000	298,500	278,908	-19,592	-6.6%
Subtotal, Environmental Management by Site	**7,126,448**	**7,187,306**	**6,484,655**	**-702,651**	**-9.8%**
Adjustments					
Use of Prior Year Balances	0	-7,577	0	+7,577	+100.0%
Rescission of Prior Year Balances	0	-4,600	-15,562	-10,962	-238.3%
Total, Environmental Management by Site	**7,126,448**	**7,175,129**	**6,469,093**	**-706,036**	**-9.8%**

Appropriation Overview

The **Office of Environmental Management (EM)** supports the Department of Energy (DOE) to meet the challenges of the nation's Manhattan Project and Cold War legacy responsibilities. EM was established in 1989 and is responsible for the cleanup of millions of gallons of liquid radioactive waste, thousands of tons of spent (used) nuclear fuel and nuclear materials, 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. It involves some of the most dangerous materials known to mankind. To date, EM has completed cleanup activities at 91 sites in 30 states and in the Commonwealth of Puerto Rico. EM is currently responsible for cleaning up the remaining 16 sites in 11 states.

Program Highlights

- **Savannah River**

  In FY 2020, much progress will be made on the treatment of high-level radioactive waste in tanks across the complex---one of EM's largest environmental challenges. At the Savannah River Site, the FY 2020 request supports general ramp up of the Liquid Waste program in preparation for the initiation of radioactive operations of the Salt Waste Processing Facility in FY 2020. Operation of this facility will significantly increase salt treatment capacity thus enabling increased risk reduction by removing and treating the liquid waste currently in underground storage tanks. To this effect, the

Savannah River Site will work on a dozen tanks to prepare required feed, implement 24/7 operation in the Saltstone Facility, and complete final tie-ins. The Defense Waste Processing Facility will produce approximately 80-100 canisters of vitrified waste processed from tank waste and much work will be executed in support of regulatory commitments with the State of South Carolina. The FY 2020 request also supports continuing Saltstone Disposal Unit #7 cell construction; completing design and initiating construction of Saltstone Disposal Units #8 and #9; and initiating design of Saltstone Disposal Units #10, #11, and #12. The FY 2020 request also supports the design and construction of the Advanced Manufacturing Collaborative project, a modern research and development facility accessible by commercial industry and academia.

The increase over the FY 2019 Enacted level is attributed to initiation of the Advanced Manufacturing Collaborative Line Item Project, preparation work of older-style tanks for bulk waste removal efforts to make progress towards operational closure and in support of feed preparation for Salt Waste Processing Facility and Defense Waste Processing Facility, and increased support for Waste Acceptance Criteria assessments needed to enable shipments to Waste Isolation Pilot Plant and Performance Assessment update of E Area.

- **Office of River Protection**
  The Department is working aggressively to complete and operate the treatment facilities to safely immobilize and dispose of tank waste at Hanford. This budget supports continued safe operations of the tank farms, and continued construction, startup and commissioning of the Waste Treatment and Immobilization Plant's Low-Activity Waste Facility, Balance of Facilities, Effluent Management Facility and Analytical Laboratory. These facilities are integral to the Department's plan to begin treating Hanford low-activity tank waste by December 31, 2023, as required by the consent decree.

  The decrease from the FY 2019 Enacted level is consistent with the Department's focus on accomplishing a Direct Feed Low Activity Waste capability. In addition, the Department is now pursuing a two-phased approach to the Low-Activity Waste Pretreatment System project involving an initial pretreatment strategy using a tank-side cesium removal system to provide initial feed to support hot startup of the Low-Activity Waste Facility. The ongoing tank-side cesium removal activities including a portion of the tank farms upgrades for direct-feed low-activity waste in FY 2020 will be performed utilizing FY 2018 carry over funds.

- **Richland**
  The Richland Operations Office manages all cleanup activities at Hanford not managed by the Office of River Protection, while also providing site-wide services shared by the two offices. Cleanup activities include soil and groundwater remediation, facility decontamination and decommissioning, stabilization and disposition of nuclear materials and spent nuclear fuel, and disposition of waste other than the tank waste managed by the Office of River Protection. Richland's FY 2020 Request represents continued achievement of important cleanup progress required by the Tri-Party Agreement. It will maintain Richland safe operations; provide Hanford site-wide services; continue groundwater remediation; operate waste management facilities; support the construction project for dry storage of the cesium and strontium capsules, and continue remediation of the highly contaminated 300-296 waste site under the 324 Building.

  The decrease from the FY 2019 Enacted level reflects completion of the decommissioning and demolition activities of the Plutonium Finishing Plant facilities to slab-on-grade, completion of PUREX Tunnel #2, and, and completion of transfer of sludge off the Columbia River to T Plant in the Central Plateau. The decrease also reflects a shift in priorities within the Environmental Management Program to focus on near term completions and higher risk scope at other sites as well as the anticipated availability of prior year funds.

- **Oak Ridge**
  At Oak Ridge the FY 2020 budget request supports the ongoing cleanup effort at the East Tennessee Technology Park, investment in mercury characterization and remediation technologies, and continued preparations for Critical Decision-2/3 approval and continued planning for construction of the Outfall 200 Mercury Treatment Facility at the Y-12 National Security Complex.

The decrease from the FY 2019 Enacted level is attributed to funding received in FY 2019 to address critical deferred maintenance at ORNL and to address excess facilities in the Central Campus area, ramp up Outfall 200 Mercury Treatment Facility construction activities and to accelerate preliminary design activities of the On Site Waste Disposal Facility, and completion of major nuclear facility cleanup activities at the East Tennessee Technology Park.

- **Idaho**
  At the Idaho Site, the FY 2020 funding completes buried waste retrieval activities under the Accelerated Retrieval Project, and initiates accelerated decontamination and decommissioning of the Accelerated Retrieval Project structures facilitating the capping of the Subsurface Disposal Area. The request also supports initiation of Resource Conservation and Recovery Act closure of the Advance Mixed Waste Treatment Project allowing for decontamination, decommissioning and demolition of the treatment facility. FY 2020 funding continues certification and shipping of contact-handled transuranic waste to the Waste Isolation Pilot Plant, and continues transfers of spent nuclear fuel elements from wet to dry storage to meet the 2023 milestone. The funding request supports operation of the Integrated Waste Treatment Unit to process sodium bearing waste.

  The decrease from the FY 2019 Enacted level is attributed to completion of Outage J at Integrated Waste Treatment Unit and completion of treatment and characterization of all Contact-Handled Transuranic Non-Sludge waste at Advanced Mixed Waste Treatment Plant in FY 2019.

- **Carlsbad**
  The Carlsbad Field Office is responsible for managing the National Transuranic Waste Program and the Waste Isolation Pilot Plant (WIPP), the Nation's only mined geologic repository for the permanent disposal of defense-generated transuranic waste. The Waste Isolation Pilot Plant FY 2020 request supports disposal facility operations, regulatory and environmental compliance actions, continued progress on the line-item capital asset projects and significant investments in infrastructure that will focus on repairing and replacing the Waste Isolation Pilot Plant's degraded facility structures.

- **Paducah**
  The Paducah site is responsible for a multifaceted portfolio of processing and cleanup activities. The site operates one of two depleted uranium hexafluoride (DUF6) conversion facilities in the EM portfolio, with the Paducah facility expected to continue operations for approximately thirty years. Additionally, Paducah manages high-priority groundwater remediation; deactivation and decommissioning of excess facilities; and disposition of mixed and low-level waste. This FY 2020 Budget Request supports activities to continue environmental remediation and to further stabilize the gaseous diffusion plant. The stabilization activities include non-destructive assay characterization, activities to remove hazardous

  The increase from the FY 2019 Enacted level supports safety-related plant modifications needed for continued operations of four lines at the Depleted Uranium Hexafluoride Conversion Facility and the radiological characterization and deposit removal in C-331 and C-333 Process Buildings.

- **Portsmouth**
  The FY 2020 budget supports the continued decontamination and decommissioning of the Portsmouth Gaseous Diffusion Plant, including the design and construction of an on-site waste disposal facility for disposition of waste from the future demolition of the Portsmouth Gaseous Diffusion Plant facilities. The FY 2020 budget also supports further stabilization of the Paducah Gaseous Diffusion Plant facilities; as well as continued operations of the Depleted Uranium Hexafluoride Conversion facilities at Portsmouth and Paducah.

  The decrease from the FY 2019 Enacted level reflects an offset by the resumption of uranium transfers (barter) needed to continue deactivation of the second Process building (X-333).

- **Los Alamos National Laboratory**
  FY 2020 activities will continue to focus on surface and groundwater management at the Los Alamos National Laboratory. The Chromium Plume Control Interim Measure to control migration of a hexavalent chromium plume

beneath Mortandad and Sandia Canyons will continue. Additionally Plume-Center Characterization activities will continue to investigate and develop corrective measures for remediation of the hexavalent chromium plume, and initiating design of the proposed remedies. Activities also include planning and execution for removal of Los Alamos National Laboratory transuranic waste stored at the Waste Control Specialists facility.

The decrease from the FY 2019 Enacted level reflects operational capabilities at the WIPP and aboveground inventory restrictions.

- **Lawrence Livermore National Laboratory**
  The FY 2020 budget request supports the completion of decommissioning and demolition activities of the B280 Pool Type Reactor and commencement of decommissioning and demolition activities of subsequent High Risk excess facilities.

  The increase from the FY 2019 enacted level reflects funding needed to complete the decontamination and decommissioning of the B280 Pool Type Reactor and commence decontamination and decommissioning activities on additional identified High Risk excess facilities.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Legacy Management					
Legacy Management	137,674	140,575	283,767	+143,192	+101.9%
Program Direction	16,932	18,302	19,262	+960	+5.2%
Total, Legacy Management	**154,606**	**158,877**	**303,029**	**+144,152**	**+90.7%**

Appropriation Overview

Legacy Management (LM) ensures the long-term protection of human health and the environment after site cleanup is completed. LM's responsibilities include DOE Environmental Management closure sites, former uranium mills, sites remediated as part of the Formerly Utilized Sites Remedial Action Program (FUSRAP), and selected sites conveyed to DOE under other authorities. LM also funds the pensions and post-retirement benefits for former contractor personnel after site closure.

LM provides funding for Long-Term Surveillance and Maintenance (LTS&M), Archives and Information Management (AIM), Pensions and Benefits Continuity, Asset Management, Environmental Justice (EJ), Communication, Education, and Outreach (CEO), and Program Direction.

Program Highlights

The majority of LM's activities are long term and focus on maintaining the Department's legal, regulatory, community, and contractual commitments. Management of closure site activities by LM enables other DOE programs to focus on risk reduction and site closure. By the end of FY 2020, LM expects to have responsibility for long-term management of 103 sites. LM's functions span both physical and human resources. In the physical environment, LM conducts long-term surveillance and maintenance of environmental remedies (e.g., groundwater monitoring and disposal cell maintenance) to protect human health and the environment. For each site, LM maintains both the physical and electronic records and responds to over 1,800 requests for information each year. LM is responsible for the pension plan contributions and post-retirement benefits (e.g., medical and life insurance) for former contractor workers from seven sites. In addition, LM manages the sites' natural resources, promotes reuse, including transfer of sites to external parties; engages the public and performs outreach; supports an interagency agreement to address abandoned uranium mines; is responsible for the Department's Uranium Leasing Program. The Budget Request includes $141,000,000 to support the reform proposal to consolidate funding for Formerly Utilized Sites Remedial Action Program (FUSRAP) in LM with the U.S. Army Corps of Engineers (USACE) continuing to conduct the work. Program management of FUSRAP will return to DOE. USACE will continue to conduct cleanup of FUSRAP sites on a reimbursable basis. Consolidating cleanup programs under a single agency will allow the U.S. Department of Energy to consider the full range of cleanup responsibilities in prioritizing work each fiscal year.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
National Nuclear Security Administration					
Federal Salaries and Expenses	407,595	410,000	434,699	+24,699	+6.0%
Weapons Activities	10,642,138	11,100,000	12,408,603	+1,308,603	+11.8%
Defense Nuclear Nonproliferation	1,999,219	1,930,000	1,993,302	+63,302	+3.3%
Naval Reactors[1]	1,620,000	1,788,618	1,648,396	-140,222	-7.8%
Total, National Nuclear Security Administration	**14,668,952**	**15,228,618**	**16,485,000**	**+1,256,382**	**+8.3%**

[1]Amounts do not reflect the transfer of funding to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor in FY 2018 and FY 2019.

Appropriation Overview

The **National Nuclear Security Administration (NNSA)** FY 2020 Budget Request is $16,485,000,000, an increase of $1,256,382,000 (8 percent) above the FY 2019 Enacted level to fund NNSA's mission to support the security and safety of our nation. NNSA's FY 2020 Budget Request pursues five major national security endeavors: (1) maintain a safe, secure, and effective nuclear weapons stockpile; (2) reduce global nuclear threats; (3) strengthen key science, technology and engineering capabilities; (4) design and maintain safe and effective nuclear propulsion for the U.S. Navy; and (5) modernize the Nuclear Security infrastructure. The Request also supports efforts in the Administration's Government Reform Plan to create a lean, accountable, more efficient government; effectively and efficiently deliver NNSA programs; and align the NNSA Federal workforce to meet the needs of today and the future.

Program Highlights

The **NNSA Federal Salaries and Expenses (FSE)** FY 2020 Budget Request is $434,699,000, a $24,699,000 (6 percent) increase above FY 2019 Enacted.

The **Weapons Activities (WA)** FY 2020 Budget Request is $12,408,603,000, a $1,308,603,000 (12 percent) increase above FY 2019 Enacted.

The **Defense Nuclear Nonproliferation (DNN)** FY 2020 Budget Request is $1,993,302,000, a $63,302,000 (3 percent) increase above FY 2019 Enacted.

The **Naval Reactors (NR)** FY 2020 Budget Request is $1,648,396,000, a $140,222,000 (8 percent) decrease from FY 2019 Enacted.

Major Outyear Priorities and Assumptions

NNSA's FYNSP topline for FY 2021 – FY 2024 is $69.3 billion, maintaining stable and consistent funding that is key to the current and future nuclear strategy and enterprise. This Request supports the modernization efforts and the scientific tools necessary to execute the *2018 Nuclear Posture Review*. The Request continues to modernize America's nuclear stockpile and infrastructure, and the underlying science that supports strategic decisions and certification of the stockpile, as detailed in the annual *Stockpile Stewardship and Management Plan (SSMP)*. The Request supports the U.S Navy's nuclear fleet through safe and effective integrated nuclear propulsion systems. The Request also supports the nonproliferation goals outlined in NNSA's *Prevent, Counter, and Respond—A Strategic Plan to Reduce Global Nuclear Threats (NPCR)*.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
National Nuclear Security Administration					
NNSA Federal Salaries and Expenses					
Federal Salaries and Expenses	407,595	410,000	434,699	+24,699	+6.0%
Total, NNSA Federal Salaries and Expenses	**407,595**	**410,000**	**434,699**	**+24,699**	**+6.0%**

Appropriation Overview

NNSA Federal Salaries and Expense (FSE) funds recruiting, training, and retention of Federal staff to perform program and project management and oversight of approximately $14.4 billion in Weapons Activities and Defense Nuclear Nonproliferation funding across the nuclear security enterprise. The FY 2020 Budget Request for FSE provides for the salaries and benefits of 1,753 Federal Full-time Equivalents (FTEs), space and occupancy needs, travel costs, support service contractors, training, and other related expenses. Seventy-five percent of FSE funds are for Federal salaries and benefits.

The NNSA workforce consists of a diverse cadre of engineers, project managers, scientists, foreign affairs specialists, and highly technical support staff that perform program and project management and appropriate oversight of the national security missions related to the safety, security, and effectiveness of the nuclear weapons stockpile; supporting the nuclear modernization program; nuclear nonproliferation efforts; emergency response; safeguards and security oversight; strategic coordination of counterterrorism and counter-proliferation initiatives; and safe, secure, and compliant facilities and infrastructure. The workforce is also composed of mission support staff in information technology and cybersecurity, technical program management, corporate project management, procurement and contract management, safety and health, cost estimating and program evaluation, financial management, human capital management, and legal services.

FSE funds Federal staff geographically located in Washington, DC; Germantown, Maryland; Albuquerque, New Mexico; and at seven Federal field offices: Kansas City Field Office (Missouri); Lawrence Livermore Field Office (California); Los Alamos Field Office (New Mexico); Nevada Field Office (Nevada); NNSA Production Office (Texas and Tennessee); Sandia Field Office (New Mexico); and Savannah River Field Office (South Carolina).

NNSA's FSE also funds 15 employees in foreign countries through the Department's Working Capital Fund overseas presence business line. NNSA supervises both Federal employees and locally employed staff, and reimburses the Department of State for International Cooperative Administrative Support Services and Capital Security Cost Sharing charges.

Program Highlights

The $434,699,000 request reflects a $24,699,000 (6 percent) increase above the FY 2019 Enacted level. The increase supports 63 additional FTEs and additional funding for the Department's Working Capital Fund in the Building Occupancy business line.

The NNSA workforce is critical to the success of the Nation's nuclear security enterprise. NNSA must have sufficient people, with the right capabilities, to ensure NNSA can modernize the nuclear deterrent, recapitalize an aging infrastructure, and continue to meet the requirements of nonproliferation and counterterrorism programs. Meeting NNSA's growing mission requirements, as described in the *2018 Nuclear Posture Review*, requires an aggressive hiring strategy for the next several years. In FY 2020, NNSA will implement a hiring plan based upon two staffing studies, independently conducted and reported in FY 2018 by the Office of Personnel Management and the NNSA Office of Cost Estimating and Program Evaluation. These studies identified the need to significantly increase NNSA Federal staffing above the 1,690 FTE ceiling required in the *National Defense Authorization Act for Fiscal Year 2013*, as amended.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
National Nuclear Security Administration					
Weapons Activities					
Directed Stockpile Work	4,009,447	4,658,266	5,426,357	+768,091	+16.5%
Science	474,524	480,484	586,561	+106,077	+22.1%
Engineering	183,123	190,123	233,954	+43,831	+23.1%
Inertial Confinement Fusion Ignition and High Yield	544,934	544,934	480,595	-64,339	-11.8%
Advanced Simulation and Computing	746,244	717,119	839,849	+122,730	+17.1%
Advanced Manufacturing Development	85,540	81,558	136,908	+55,350	+67.9%
Infrastructure and Operations	3,117,803	3,087,852	3,208,442	+120,590	+3.9%
Secure Transportation Asset	291,168	278,639	317,162	+38,523	+13.8%
Defense Nuclear Security	770,577	690,638	778,213	+87,575	+12.7%
Information Technology and Cybersecurity	186,728	221,175	309,362	+88,187	+39.9%
Legacy Contractor Pensions	232,050	162,292	91,200	-71,092	-43.8%
Subtotal, Weapons Activities	**10,642,138**	**11,113,080**	**12,408,603**	**+1,295,523**	**+11.7%**
Use of Prior Year Balances	0	-13,080	0	+13,080	+100.0%
Total, Weapons Activities	**10,642,138**	**11,100,000**	**12,408,603**	**+1,308,603**	**+11.8%**

Appropriation Overview

Programs funded in the **Weapons Activities (WA)** appropriation support the Nation's safe, secure, and effective nuclear deterrent including the supporting infrastructure of science, technology, and engineering capabilities. Weapons Activities provides for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and performance; investment in scientific, engineering, and manufacturing capabilities for certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for maintenance and investment in the NNSA nuclear complex to be more responsive and cost effective. This work is done in partnership with the Department of Defense (DoD).

NNSA's laboratories, plants, and sites employ approximately 39,000 people, primarily at eight geographical sites, to execute these programs managed by a Federal workforce composed of civilian and military staff. Additional details about these programs will be included in the FY 2020 SSMP.

The FY 2020 request reflects an 11.8% increase above the FY 2019 Enacted level, and supports the current stockpile, life extension programs (LEP), modernization efforts, and the scientific tools necessary for these efforts. This scope is consistent with the *2018 Nuclear Posture Review*. FY 2020 funding increases are requested in a number of areas.

Program Highlights

- **Directed Stockpile Work (DSW)**
  DSW encompasses activities that support the nuclear weapons stockpile. These activities include maintenance and surveillance; planned refurbishment; reliability assessment; weapon dismantlement and disposition; and research, development, and certification of technology efforts to meet stockpile requirements and strategic materials. Requested increases in LEPs and major alterations (Alt) support continued execution of development engineering for the W80-4 LEP at a funding level consistent with Weapon Design and Cost Report, and the Feasibility Study & Design Options for the W87-1 Modification (formerly IW-1) to remain aligned with DoD. The Request also includes increases in Stockpile Systems and Services to ensure these activities remain aligned to DoD modernization plans, to meet the *2018 Nuclear Posture Review* requirements for sustaining the B83, conducting a Sea-Launched Cruise Missile (SLCM) study, continuing technology developments for future weapon systems, and to maintain and modernize the base capabilities for hydrodynamic and subcritical experiments. The Request includes increases for Strategic Materials to meet future pit production requirements, support uranium down-blending activities, and reduce operational risk of material storage.

- **Research, Development, Test and Evaluation (RDT&E)**
  RDT&E develops and maintains critical capabilities, tools, and processes needed to support science-based stockpile stewardship, refurbishment, and continued certification of the stockpile without the use of underground nuclear explosive testing. The FY 2020 Request supports the recapitalization of NNSA's plutonium experimental capabilities via the Enhanced Capabilities for Subcritical Experiments program. The Advanced Simulation and Computing funding supports exascale projects and accommodates the infrastructure demands of these next-generation computing platforms. Exascale projects improve NNSA weapons design, stockpile stewardship and certification capabilities, and ensure the United States maintains leadership in high-performance simulations capabilities. The increase in Science supports additional confirmatory and subcritical experiments for stockpile stewardship. The increase in Engineering supports weapon-aging assessments, experimental test facilities for future delivery systems and environments, enhanced threat survivability, critical surety technologies, and stockpile responsiveness. The increase in Advanced Manufacturing Development supports NNSA's ability to modernize obsolete materials or processes and increase production capacity and efficiencies across the enterprise.

- **Infrastructure and Operations (I&O)**
  I&O maintains, operates, and modernizes the NNSA infrastructure in a safe, secure, and cost-effective manner to support program results while maximizing return on investment and reducing enterprise risk. The program also plans, prioritizes, and constructs state-of-the-art facilities, infrastructure, and scientific tools. For FY 2020, funding will continue the stabilization of deferred maintenance, execute Recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems to meet program demands; decrease overall operating costs; and reduce safety, security, environmental, and program risk. The Request reflects an increase to continue the long-term effort to modernize NNSA infrastructure, improve working conditions of NNSA's aging facilities and equipment, and address safety and programmatic risks. The Request includes increases for Operations of Facilities to support programmatic schedules and Capability Based Investments to develop three new programmatic construction projects, continue the conceptual design for the Material Staging Facility, and to provide program specific equipment recapitalization supporting LEPs. These increases are largely offset by a decrease to Maintenance and Repair of Facilities for maintenance to catch up to significant increases in appropriated funding. The program will continue to address stabilization of deferred maintenance and improve the condition of NNSA infrastructure.

  The request for Construction includes increased funding for the Uranium Processing Facility per the project execution plan and efforts to phase out mission dependency on the existing aged facility. Increased Construction funding will also allow the High Explosive Science & Engineering Facility to complete design and fund the construction phase of the project that will update the current 60 year old facilities at Pantex to meet current codes and standards and program needs. Funding is also included for the Radiological Laboratory, Utility and Office Building (RLUOB) Equipment Installation Phase 2 (REI2) and PF-4 Equipment Installation, Phase 1 (PEI1) subprojects of the Chemistry and Metallurgy Research Replacement (CMRR) project, the U1a Complex Enhancements Project, the Lithium Processing Facility, the Tritium Finishing Facility, the 138kV Power Transmission System Replacement project, and Emergency Operations Centers at Sandia National Laboratories and Lawrence Livermore National Laboratory .

  The *National Defense Authorization Act for Fiscal Year 2018* directed the creation of the Infrastructure Modernization Initiative (IMI) program, which NNSA initiated in December 2017. The IMI will use the current budget structure with emphasis on the Recapitalization: Infrastructure & Safety and Maintenance and Repair of Facilities programs. The initial plan was transmitted to Congress in September 2018.

- **Secure Transportation Asset (STA)**
  STA supports the safe, secure movement of nuclear weapons, special nuclear material, and weapon components. The Program Direction in this account provides for the secure transportation workforce, including Federal agents. The pillars of the STA security concept are specialized vehicles to include highly secure trailers, well trained agents, and robust communication systems. In FY 2020, funding increase supports development of the Mobile Guardian Transport Test Article 1 head-on impact crash test, Test Article 2 assembly (for future side impact crash test), and the Pre-Production Unit Rolling Chassis Manufacturing Readiness Review. In addition, the FY 2020 funding supports efforts to restore Federal Agent strength levels required to meet the STA mission capacity and deferred maintenance and minor construction projects of existing facilities at STA's training facility in Ft. Smith, Arkansas. Projects planned include a drive track/skid pad, extension of a multi-use range, expansion of the Physical Training/Intermediate Use of Force building, and construction of a range classroom.

- **Defense Nuclear Security (DNS)**
  DNS provides protection for NNSA personnel, facilities, nuclear weapons, and materials from a full spectrum of threats, ranging from minor security incidents to acts of terrorism. In addition, DNS provides nuclear security expertise for a broad set of 21st century national security needs, such as those in defense nuclear nonproliferation, homeland security, and intelligence. Employing more than 1,500 protective force officers, DNS secures more than 4,400 buildings and protects more than 57,000 personnel. The FY 2020 Request includes funding to fill positions in key security program areas at the sites, including protective forces, physical security systems, information security, technical security, personnel security, nuclear material control and accountability, and security program operations and planning; supports sustaining implementation and operation of counter unmanned aircraft systems at sites possessing Category I special nuclear material; and supports efforts to begin implementation of the Design Basis Threat policy. It also includes funding for critical Security Infrastructure Revitalization Program projects, which address high-priority security systems and related security infrastructure and equipment refresh needs.

- **Information Technology (IT) and Cybersecurity**
  NNSA's Office for Information Management provides a range of IT and Cybersecurity support functions, and activities and manages cybersecurity operations and program areas within NNSA's laboratories, plants, and sites. The program executes and coordinates Public Key Infrastructure and other Committee on National Security Systems requirements, and leverages IT Modernization efforts across the NNSA nuclear security enterprise to increase the efficiency and cost-effectiveness of NNSA IT services consistent with the DOE Strategies. The FY 2020 request enables the continuation of integration and coordination of cybersecurity and IT support activities and functions throughout the nuclear security enterprise and provides continuity of operations for NNSA's critical information technology assets. Increased funding is requested for the continued recapitalization of the Enterprise Secure Network, modernization of the Federal and site Cybersecurity infrastructure, and the continuation of modernization efforts for classified and unclassified IT environments.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
National Nuclear Security Administration					
Defense Nuclear Nonproliferation					
Defense Nuclear Nonproliferation Programs					
Material Management and Minimization	308,594	293,794	333,533	+39,739	+13.5%
Global Material Security	390,108	407,108	342,350	-64,758	-15.9%
Nonproliferation and Arms Control	134,703	129,703	137,267	+7,564	+5.8%
Defense Nuclear Nonproliferation R&D	556,504	575,570	495,357	-80,213	-13.9%
Nonproliferation Construction	335,000	220,000	299,000	+79,000	+35.9%
Subtotal, Defense Nuclear Nonproliferation Programs	**1,724,909**	**1,626,175**	**1,607,507**	**-18,668**	**-1.1%**
Nuclear Counterterrorism and Incident Response Program	282,360	319,185	372,095	+52,910	+16.6%
Legacy Contractor Pensions	40,950	28,640	13,700	-14,940	-52.2%
Subtotal, Defense Nuclear Nonproliferation	**2,048,219**	**1,974,000**	**1,993,302**	**+19,302**	**+1.0%**
Use of Prior Year Balances	0	-25,000	0	+25,000	+100.0%
Rescission of Prior Year Balances	-49,000	-19,000	0	+19,000	+100.0%
Total, Defense Nuclear Nonproliferation	**1,999,219**	**1,930,000**	**1,993,302**	**+63,302**	**+3.3%**

Appropriation Overview

NNSA helps keep America safe by: preventing adversaries from acquiring nuclear weapons or weapons-usable materials, technology, and expertise; countering efforts to acquire such weapons or materials; and responding to nuclear or radiological accidents and incidents domestically and abroad. NNSA's programs share the United States' experience in managing special nuclear materials with partners around the world to achieve international nonproliferation and counterterrorism goals. NNSA uses the knowledge and infrastructure that underpins the stockpile stewardship program for a range of nonproliferation missions, from assessing foreign weapons programs and potential terrorist devices to managing the proliferation risks posed by civil nuclear applications. By limiting the number of nuclear-capable states and preventing terrorist access to materials and technology that can threaten the United States and its allies, NNSA plays an important role in enhancing global stability and constrains the range of potential threats facing the nation, our allies and partners.

This appropriation funds the core **Defense Nuclear Nonproliferation (DNN)** program and the Nuclear Counterterrorism and Incident Response (NCTIR) program. DNN and NCTIR have a primary role in the United States' approach for reducing nuclear security risks. These two programs, as part of a whole-of-government approach, provide policy and technical leadership to prevent or limit the spread of materials, technology, and expertise related to weapons of mass destruction (WMD); develop technologies to detect nuclear proliferation; secure or eliminate inventories of nuclear weapons-related materials and infrastructure; and ensure technically trained teams and state-of-the-art equipment are prepared to respond to any nuclear or radiological emergency domestically or abroad. DNN's efforts reduce the danger that hostile nations or terrorist groups may acquire nuclear devices, radiological dispersal devices, weapons-usable material, nuclear and dual-use commodities and technology, or nuclear-related expertise. DNN's missions are interconnected with NNSA's Weapons Activities and Naval Nuclear Propulsion efforts to meet the priorities outlined in the *2018 Nuclear Posture Review*. The President's *2017 National Security Strategy*, the *2018 Nuclear Posture Review*, and the *National Strategy for Countering WMD Terrorism* reinforce the important work of NNSA's nonproliferation programs, including committing to "augment measures to secure, eliminate, and prevent the spread of WMD and related materials."

These activities are carried out within a dynamic global security environment, as described in NNSA's annual NPCR.

This environment is characterized by the persistent threat of state and non-state actors seeking to obtain nuclear and radiological materials; state actors potentially undermining arms control agreements and nonproliferation regimes; increased risk of the availability of nuclear and radiological materials as a result of the global expansion of nuclear power and possible spread of fuel cycle technology; increased opportunities for illicit nuclear material trafficking and sophisticated procurement networks; and technology advances that may shorten nuclear weapon development timelines and complicate nuclear safeguards and security missions.

Program Highlights

- **Material Management and Minimization (M^3)**
  M^3 programs minimize and, when possible, eliminate weapons-usable nuclear material around the world to achieve permanent threat reduction. The FY 2020 Budget Request funds the conversion or shut-down of research reactors and isotope production facilities that use high enriched uranium (HEU), support of non-HEU-based Molybdenum-99 (Mo-99) production facilities in the United States, removal and disposal of weapons-usable nuclear material, continuation of activities to implement the dilute and dispose strategy for plutonium disposition, and downblending of HEU.

- **Global Material Security (GMS)**
  Global Material Security (GMS) directly contributes to national security efforts to reduce global nuclear security threats. The FY 2020 Budget Request focuses on preventing terrorists and other actors from obtaining nuclear and radioactive material to use in an improvised nuclear device or a radiological dispersal device; work with partner countries to improve the security of vulnerable materials and facilities; and efforts to improve partners' capacity to detect, disrupt, and investigate illicit trafficking of nuclear and radioactive materials.

- **Nonproliferation and Arms Control (NPAC)**
  NPAC works to prevent the proliferation of WMD by state and non-state actors. The FY 2020 Budget Request funds efforts to develop and implement programs and strategies to strengthen international nuclear safeguards; control the spread of dual-use WMD material, equipment, technology, and expertise; verify nuclear reductions and compliance with nonproliferation and arms control treaties and agreements; and address enduring and emerging nonproliferation and arms control challenges and opportunities.

- **Defense Nuclear Nonproliferation Research and Development (DNN R&D)**
  DNN R&D drives the innovation of U.S. technical capabilities to detect nuclear detonations; foreign nuclear weapons programs' activities; and the presence, movement, or diversion of special nuclear materials. To meet national and departmental nuclear security requirements, DNN R&D leverages the unique facilities and scientific skills of DOE/NNSA, academia, and industry to perform research, conduct technology demonstrations, develop prototypes, and produce and deliver sensors for integration into operational systems. The FY 2020 Budget Request includes planned activities for early detection of proliferation-related R&D and continued production of nuclear detonation detection satellite payloads. The Request also supports efforts toward establishing a nonproliferation stewardship initiative to build and sustain requisite technical competencies, based on enabling infrastructure, science and technology, and workforce expertise, that are needed to support policymakers and future nonproliferation missions.

- **Nonproliferation Construction**
  Nonproliferation Construction consolidates construction costs for DNN projects. The FY 2020 Budget Request supports the continuation of termination activities for the Mixed-Oxide Fuel Fabrication Facility project and continues to pursue the dilute and dispose strategy. The request will support the continuation of preliminary design for the Surplus Plutonium Disposition (SPD) project, as well as long lead procurements. The SPD project will add additional glovebox capacity at the Savannah River Site in South Carolina to accelerate plutonium dilution and aid in the removal of plutonium from the State of South Carolina.

- **Nuclear Counterterrorism and Incident Response (NCTIR)**
  NCTIR includes the Counterterrorism and Counterproliferation (CTCP) subprogram, which applies the unique technical expertise from the NNSA's nuclear security enterprise to prepare for, prevent, mitigate, and respond to a nuclear or radiological incident domestically or abroad, providing technical advice to DoD; the Federal Bureau of Investigation; other interagency and international partners; and state and local organizations in support of nuclear counterproliferation, nuclear counterterrorism, nuclear incident response, and nuclear forensics. NCTIR also includes the Emergency Operations subprogram, which is responsible for administering and directing the implementation and integration of emergency management programs across the Department. The Emergency Operations subprogram further ensures a comprehensive and integrated approach to emergency management, including planning, mitigation, preparedness, response, and recovery. Together these programs ensure that DOE/NNSA will be ready to respond promptly, efficiently, and effectively to any emergency involving or affecting National equities worldwide by applying the necessary resources to mitigate impacts, respond to consequences, and protect workers, the public, the environment, and national security.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
National Nuclear Security Administration					
Naval Reactors					
Naval Reactors Operations and Infrastructure	466,884	525,764	553,591	+27,827	+5.3%
Naval Reactors Development	473,065	514,951	531,205	+16,254	+3.2%
S8G Prototype Refueling	250,000	250,000	155,000	-95,000	-38.0%
Columbia -Class Reactor Systems Development	156,700	138,000	75,500	-62,500	-45.3%
Program Direction	47,651	48,709	50,500	+1,791	+3.7%
Construction	225,700	311,194	282,600	-28,594	-9.2%
Total, Naval Reactors[1]	**1,620,000**	**1,788,618**	**1,648,396**	**-140,222**	**-7.8%**

[1]Amounts do not reflect the transfer of funds to the Office of Nuclear Energy for maintenance and operation of the Advanced Test Reactor in FY 2018 and FY 2019.

Appropriation Overview

Naval Reactors' (NR) activities play a critical leadership role in meeting the goal to design and maintain safe and effective integrated nuclear propulsion systems for the U.S. Navy. The Naval Reactors program has responsibility for all naval nuclear propulsion work, from reactor plant technology development and design, continuing through reactor plant operation and maintenance, and ending with reactor plant disposal.

Program Highlights

Funding for the program supports continued safe and reliable operation of the Navy's nuclear-powered fleet (68 submarines, 11 aircraft carriers, and 4 research, development, and training platforms), constituting approximately 45 percent of the Navy's major vessels. The Program's development work consists of refining and improving existing technology to ensure that the U.S. Navy's nuclear propulsion plants are increasingly efficient and effective and will be capable of meeting future threats to national security.

In addition to supporting the existing nuclear fleet, Naval Reactors has three major DOE initiatives: the *Columbia*-Class Reactor Systems Development, the Land-based S8G Prototype Refueling Overhaul, and the Spent Fuel Handling Recapitalization Project.

Naval Reactors supports the President's *2017 National Security Strategy* with the continued development of the reactor plant system for the *Columbia*-Class submarine and stewardship of naval nuclear infrastructure. Ensuring the continuity of a sea-based strategic deterrent, the FY 2020 Budget Request provides for the research, design, and development of the reactor plant system for the *Columbia*-Class submarine, to include the development of a life-of-ship reactor core. The FY 2020 Request further provides funding for the refueling and overhaul of the Land-based S8G Prototype reactor, a critical research and development asset for the long-term. Lastly, the Spent Fuel Handling Recapitalization Project will ensure the continued capability to refuel and defuel aircraft carriers and submarines, which is critical to maintaining the nuclear fleet's operational availability for national security missions.

- **Naval Reactors Operations and Infrastructure**
  The FY 2020 Request will support facility and systems maintenance and regulatory requirements across the Program's four DOE sites, environmental remediation, and necessary general plant projects and capital equipment to recapitalize aging infrastructure and equipment.

- **Naval Reactors Development**
  The FY 2020 Request will support the Advanced Test Reactor at the Idaho National Laboratory in Idaho Falls, Idaho, reactor core material development, radioactive test and evaluation efforts, and reactor core examinations.

- **S8G Prototype Refueling**
  The decrease from FY 2019 Enacted levels is consistent with the planned project profile and supports refueling overhaul execution.

- ***Columbia*-Class Reactor Systems Development**
  The decrease from FY 2019 Enacted levels is consistent with the planned project profile and supports FY 2020 production, analysis, and testing execution.

- **Construction**
  The decrease from FY 2019 Enacted levels is in accordance with NR's program of record, as detailed in the Ten-Year Facilities Plan and supports construction ramp-up for the Spent Fuel Handling Recapitalization Project.

- **Program Direction**
  The FY 2020 Request places Naval Reactors in a position to execute its mission and provide Federal oversight of the program's DOE laboratories.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Departmental Administration					
Office of the Secretary	5,300	5,395	5,119	-276	-5.1%
Congressional and Intergovernmental Affairs	6,200	6,200	5,895	-305	-4.9%
Chief Financial Officer	48,484	48,912	52,000	+3,088	+6.3%
Economic Impact and Diversity	10,169	10,169	9,494	-675	-6.6%
Office of Indian Energy Policy and Programs[1]	18,000	0	0	0	N/A
Chief Information Officer	126,274	131,624	124,554	-7,070	-5.4%
Other Departmental Administration					
Management	54,745	55,385	54,358	-1,027	-1.9%
Project Management Oversight and Assessments	15,192	15,005	14,255	-750	-5.0%
Chief Human Capital Officer	25,513	26,125	24,316	-1,809	-6.9%
Office of Small and Disadvantaged Business Utilization	3,000	3,170	3,609	+439	+13.8%
General Counsel	33,000	33,075	33,075	0	N/A
Energy Policy and Systems Analysis[2]	10,432	0	0	0	N/A
Office of Policy	0	10,010	8,000	-2,010	-20.1%
International Affairs[3]	18,878	22,878	0	-22,878	-100.0%
Public Affairs	6,589	6,594	6,260	-334	-5.1%
Office of Technology Transitions	6,876	8,505	9,080	+575	+6.8%
Subtotal, Other Departmental Administration	**174,225**	**180,747**	**152,953**	**-27,794**	**-15.4%**
Strategic Partnership Projects (SPP)	40,000	40,000	40,000	0	N/A
Subtotal, Departmental Administration (Gross)	**428,652**	**423,047**	**390,015**	**-33,032**	**-7.8%**
Adjustments					
Use of Prior Year Balances	0	-9,500	0	+9,500	+100.0%
Defense-Related Administrative Support	-143,000	-151,689	-179,092	-27,403	-18.1%
Subtotal, Departmental Administration	**285,652**	**261,858**	**210,923**	**-50,935**	**-19.5%**
Miscellaneous Revenues					
Revenues Associated with SPP	-40,000	-40,000	-40,000	0	N/A
Other Revenues	-56,000	-56,000	-53,378	+2,622	+4.7%
Subtotal, Miscellaneous Revenues	**-96,000**	**-96,000**	**-93,378**	**+2,622**	**+2.7%**
Total, Departmental Administration (Net)	**189,652**	**165,858**	**117,545**	**-48,313**	**-29.1%**

[1] The Office of Indian Energy Policy and Programs is no longer funded in DA after FY 2019. Funding is requested in FY 2020 under a separate appropriation.

[2] Energy Policy Systems and Analysis is no longer funded in DA after FY 2019.

[3] The Office of International Affairs is requesting $36.1 million in funds under a separate appropriation in FY 2020, due to consolidations and multi-year funding requirements.

Appropriation Overview

The **Departmental Administration (DA)** appropriation proposes to fund 13 management and mission support programs that have enterprise-wide responsibility for administration, accounting, budgeting, contract and project management, congressional and intergovernmental liaison, information management & cybersecurity, life-cycle asset management, legal services, workforce diversity and equal employment opportunity, ombudsman services, small business advocacy, sustainability, technology transition activities and public affairs.

DA appropriation supports Strategic Partnership Projects that are reimbursed by customers of the DOE laboratories; and receives Miscellaneous Revenues from other sources that can be used to offset costs notwithstanding the Miscellaneous Receipts Act. Additionally, DA is partially funded through Defense-Related Administrative Support (DRAS), Other Defense Activities, recognizing that DA supports administrative activities that benefit defense-related programs.

Program Highlights

In FY 2020, the Office of Indian Energy Policy & Programs and EPSA are no longer funded in DA. The Budget also requests that the Office of International Affairs be funded in a separate appropriation due to its consolidations, activities, and multiple year funding requirements. The FY 2020 DA Budget reflects a dedication to strengthen enterprise-wide management and mission support functions, including the activities outlined below:

- **Chief Financial Officer (CFO):** In FY 2020, CFO is requesting additional funds for corporate business systems to ensure compliance with new cyber security requirements and initiatives to enhance systems for streamlining business processes.

- **Office of Technology Transitions (OTT)**: Funding will support OTT's operational requirements to support the Technology-to-Market functions transferred and centralized from other offices. The FY 2020 Request will maintain adequate staffing to fulfill Congressional and Administration direction to increase Departmental engagement for the transition of new and evolving energy technology to the U.S. markets.

- **Chief Information Officer (CIO)**: CIO will continue to work on network modernization initiatives, which will include improving cybersecurity, scaling capacity commensurate with demand, and continuing to establish the foundation for future IT enterprise capabilities. In FY 2020, CIO is requesting additional staff to support critical functions and strategic priorities of the Department.

- **Office for Human Capital (HC):** HC will maintain its operational capacity to carry out personnel actions and conduct strategic workforce planning related to proposed Departmental programmatic changes. As the FY 2020 Budget anticipates significant changes to several DOE programs and the composition of their federal staff, HC is strategically positioned to provide oversight of human capital matters, especially those that specifically impact changes to skill requirements of existing personnel and fluctuating staffing levels. This includes an emphasis on workforce planning and development of effective talent management strategies to ensure DOE can successfully perform its mission.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Independent Enterprise Assessments					
Independent Enterprise Assessments	24,068	24,068	24,068	0	N/A
Program Direction	50,863	52,702	57,211	+4,509	+8.6%
Total, Independent Enterprise Assessments	**74,931**	**76,770**	**81,279**	**+4,509**	**+5.9%**

Appropriation Overview

The **Office of Enterprise Assessments (EA)** supports the Department's mission priorities and strategic plan for the secure, safe, and efficient operation of the nuclear weapons complex, science and energy research, and environmental cleanup activities by conducting independent assessments of security and safety performance throughout the Department, holding contractors accountable for violations of security and safety regulations, providing training programs that institutionalize enterprise security and safety lessons learned, and coordinating program management improvement initiatives. EA activities complement, but do not replace the responsibility of DOE line management to ensure compliance with security and safety requirements or effective management of the Department's programs. EA is organizationally independent of the DOE entities that develop and implement security and safety policy and programs and therefore can objectively provide timely information to DOE senior leadership, contractor organizations, and other stakeholders on whether national security material and information assets are appropriately protected; and whether Departmental operations provide for the safety of its employees and the public. EA activities evaluate whether the Department is effective in promoting protection strategies and informed risk management decisions. EA is designated to implement congressionally authorized contractor enforcement programs pertaining to classified information security, nuclear safety, and worker safety and health. EA also operates the DOE National Training Center (NTC) in Albuquerque, New Mexico, maintains collaborative relationships with security and safety related organizations within and outside the Department, and coordinates the implementation of program improvement initiatives throughout the Department.

Program Highlights

EA's key activities in FY 2020 are:

Strengthening the Department's posture and ability to protect national security assets (special nuclear material [SNM], controlled unclassified information, and classified matter), its employees and the public by:

- Conducting comprehensive independent security performance assessments and follow-up assessments at DOE National Security / Category I SNM sites (those with high value assets), utilizing "limited notice" safeguards and security performance tests to provide accurate, up-to-date assessments of DOE site security response capabilities, and focusing on insider threats from employees who may seek to compromise National security and/or the ability of the Department to meet its mission;
- Enhancing the methods and tools used to conduct comprehensive independent cybersecurity assessments, including unannounced "red team" performance testing, to identify vulnerabilities in the Department's National Security, Intelligence, scientific, and other information systems against external and internal attacks;
- Conducting nuclear safety, worker safety and health, and emergency management independent performance assessments of the Department's operations including high hazard nuclear construction projects and operations such as those at the Los Alamos National Laboratory, Y-12 National Security Complex, Savannah River Site, Hanford Site, and Idaho National Laboratory;
- Implementing the DOE enforcement function that holds contractor organizations accountable for noncompliance with worker safety and health, nuclear safety, and classified information security regulations; and
- Providing training programs and other related functions via the DOE National Training Center in Albuquerque, NM, that institutionalize security and safety lessons learned.

Supporting the development and implementation of program management improvement policies and strategies to promote improvements in program management and more efficiently advance and deliver DOE, including the National Nuclear Security Administration, products and services to the American public.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Office of Hearings and Appeals					
Office of Hearings and Appeals	5,605	5,739	4,852	-887	-15.5%
Subtotal, Office of Hearings and Appeals	**5,605**	**5,739**	**4,852**	**-887**	**-15.5%**
Use of Prior Year Balances	0	-2000	0	+2,000	+100.0%
Total, Office of Hearings and Appeals	**5,605**	**3,739**	**4,852**	**+1,113**	**+29.8%**

Appropriation Overview

The **Office of Hearings and Appeals (OHA)** is the central administrative adjudicatory body for the Department of Energy. OHA's jurisdiction includes conducting evidentiary hearings to determine an employee's eligibility for a security clearance, Freedom of Information Act and Privacy Act appeals, and requests for exception relief from DOE regulations and orders, such as regulatory relief from the appliance energy efficiency standards. OHA also offers alternative dispute resolution (ADR) services such as mediation for a variety of matters. OHA utilizes video teleconferencing to conduct hearings at DOE field sites in order to reduce travel and other costs.

Program Highlights

Over the last nine years, OHA has reduced its case-processing time in all areas of its jurisdiction without compromising the high quality of its decisions. The Request supports salaries and benefits for 22 FTEs operating in OHA's Personnel Security and Appeals Division, Employee Protection and Exceptions Division, and the Alternative Dispute Resolution Office.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Office of the Inspector General					
Office of the Inspector General	49,000	51,330	54,215	+2,885	+5.6%
Total, Office of the Inspector General	**49,000**	**51,330**	**54,215**	**+2,885**	**+5.6%**

Appropriation Overview

The **Office of the Inspector General (OIG)** reviews the integrity, economy, and efficiency of DOE programs and operations, including the National Nuclear Security Administration and the Federal Energy Regulatory Commission. The OIG has the authority to inquire into all DOE programs and activities as well as related activities. Audits, inspections, investigations, and other reviews are used to detect and prevent fraud, waste, abuse, and violations of law.

The Federal Information Security Modernization Act of 2014 directs the OIG to conduct an annual evaluation of DOE's information security systems. The OIG is also charged with reviewing the Department's efforts to eliminate improper payments, in conformance with the Improper Payments Elimination and Recovery Act of 2010. The OIG routinely conducts reviews of the most significant management challenges facing the Department, to include its Environmental Management programs. In addition, the OIG addresses alleged violations of law that impact Department programs, operations, facilities, and personnel.

Program Highlights

The OIG focuses its efforts to enhance the efficiency and effectiveness of Department's programs and operations in the following key areas:

- **Hotline Allegations.** The OIG uses hotline allegations to identify potential areas of fraud, waste, and abuse.
- **Contractor Whistleblower Retaliation.** OIG conducts reviews of alleged contractor whistleblower retaliation that serve to inform health and safety issues throughout the Department.
- **Contract Review.** OIG assesses the Department's award and administration of approximately $25 billion in contracts. Recent OIG work has resulted in sizeable settlements of approximately $121 million by subcontractors in FY 2018.
- **Cybersecurity Oversight Efforts.** The OIG frequently partners with other agencies to address attacks impacting the Department.
- **NNSA Modernization Efforts.** NNSA is undertaking a massive modernization effort that involves major projects (e.g., weapons complex transformation) that could benefit from OIG reviews that proactively seek to identify opportunities to improve the efficiency and effectiveness of such operations.
- **Environmental Management.** The Department's environmental liability of $494 billion was added to the Government Accountability Office's Biennial High Risk List in 2017. The OIG routinely reviews the efficacy of the Department's environmental programs, which annually expend approximately $6.5 million.
- **Loan Guarantee Programs.** The potential elimination of the Title 17 Innovative Technology Loan Guarantee program will require the OIG to utilize experts to assist with reviews to confirm compliance with loan terms and conditions and program termination requirements.
- **Mission Support Costs.** OIG assists in identifying potential costs savings in areas such as the estimated $5.9 billion spent each year on National Laboratory support costs.
- **Cost Accounting Standards (CAS).** OIG provides reviews of Department contractors' incurred costs and compliance with Cost Accounting Standards.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
International Affairs					
Departmental Administration					
Other Departmental Administration					
International Affairs	18,878	22,878	0	-22,878	-100.0%
International Affairs					
International Affairs	0	0	36,100	+36,100	N/A
Total, International Affairs	**18,878**	**22,878**	**36,100**	**+13,222**	**+57.8%**

Appropriation Overview

The **Office of the International Affairs (IA)** advises Departmental leadership on strategic implementation of U.S. international energy policy, in line with energy security and market objectives. IA develops and leads the Department's bilateral and multilateral R&D cooperation, including investment and trade activities with other nations and international agencies, and represents the Department and the United States Government in interagency processes, intergovernmental forums, and bilateral and multilateral proceedings that address energy policies, strategies and objectives. IA leads Department efforts to fulfill requirements of the Committee of Foreign Investment in the U.S. (CFIUS), including the expanded responsibilities and authorities authorized under the Foreign Investment Risk Review Modernization Act (FIRRMA) of 2018.

Program Highlights

In FY 2020, IA is funded under a new, separate appropriation to increase transparency and reflect the multi-year nature of program requirements. In alignment with Administration reforms and previous transfer of EERE international staff, this request also consolidates DOE international staffing and programs currently within the Office of Fossil Energy and the Office of Nuclear Energy into the new Office of International Affairs.

IA's key initiatives in FY 2020 include:

- Consolidating and coordinating DOE international activities in alignment with Administration reforms, to include NE and FE activities. Specifically, the International Nuclear Energy Cooperation (INEC) mission will be consolidated into IA. INEC has provided the Department the ability to meet demands for engagement with international partners on civil nuclear policy, research, development and demonstration (RD&D) and related activities.
- FE activities consolidated into IA will include coordinating international activities in the clean coal and carbon management arena.
- Expanding support to CFIUS, including additional staff. CFIUS helps with determining potential national security risks arising from foreign acquisition of a U.S. business. To address growing national security concerns over foreign exploitation of certain investment structures, additional funding will ensure that DOE has the resources needed to meet current and evolving challenges and to effectively implement FIRRMA. Caseloads are expected to increase fourfold—from 250 in FY 2019 to over 1000 anticipated by FY 2020.
- Increasing support for the U.S.- Israel Energy Center of Excellence. IA will engage with DOE program offices and identify experts to work with Israelis to: negotiate the detailed R&D priorities section and the selection criteria for a Funding Opportunity Announcement (FOA); participate in the technical merit review of FOA applicants; and stay engaged in periodic technical oversight of research progress.
- Supporting Israel-US Binational Industrial Research and Development (BIRD). BIRD was established by the U.S. and Israel governments in 1977 to generate mutually beneficial cooperation between U. S. and Israeli companies. BIRD's scope extends to agriculture, communications, construction technologies, electronics, electro-optics, life sciences, software, homeland security, renewable and alternative energy and other technology sectors. BIRD supports approximately 20 projects annually.

($K)

	FY 2018 Enacted	FY 2019 Enacted	FY 2020 Request	FY 2020 Request vs FY 2019 Enacted	
				$	%
Federal Energy Regulatory Commission (FERC)					
Just and Reasonable Rates, Terms and Conditions	168,111	369,900	382,000	+12,100	+3.3%
Safe, Reliable, Secure, and Efficient Infrastructure	131,836	0	0	0	N/A
Mission Support through Organizational Excellence	67,653	0	0	0	N/A
FERC Revenues	-367,600	-369,900	-382,000	-12,100	-3.3%
Subtotal, Federal Energy Regulatory Commission	**0**	**0**	**0**	**0**	**N/A**
Fees and Recoveries in Excess of Annual Appropriations	-9,000	-16,000	-16,000	0	N/A
Total, Federal Energy Regulatory Commission	**-9,000**	**-16,000**	**-16,000**	**0**	**N/A**

Appropriation Overview

The **Federal Energy Regulatory Commission (FERC or the Commission)** is an independent agency within the Department of Energy (DOE) that regulates the transmission and wholesale sale of electricity and gas in interstate commerce, and regulates the transportation of oil by pipelines in interstate commerce. FERC also reviews proposals to build interstate natural gas pipelines, natural gas storage projects, and liquefied natural gas (LNG) terminals, and licenses and inspects non-Federal hydropower projects. The Commission protects the reliability and cybersecurity of the Nation's bulk-power system through the establishment and enforcement of mandatory reliability standards and oversees environmental matters related to natural gas pipeline and non-Federal hydro projects. The Commission enforces its regulatory requirements through the imposition of civil penalties and other means.

FERC's mission is to assist consumers in obtaining economically efficient, safe, reliable, and secure energy services at a reasonable cost through appropriate regulatory and market means, and collaborative efforts. FERC seeks to ensure that rates, terms, and conditions of jurisdictional service are just, reasonable, and not unduly discriminatory or preferential, relying on competitive markets where appropriate. Through its oversight and enforcement authorities, FERC seeks to increase compliance with its rules and regulations and detect and deter market manipulation. FERC's responsibilities also include promoting the development of safe, reliable, and secure energy infrastructure that serves the public interest.

Program Highlights

- **Ensure Just and Reasonable Rates, Terms, and Conditions**

  One of the Commission's fundamental statutory responsibilities is to ensure that rates, terms and conditions for wholesale sales and transmission of electric energy and natural gas in interstate commerce, as well as for transportation of oil by pipeline in interstate commerce, are just and reasonable and not unduly discriminatory or preferential. To fulfill this responsibility, the Commission uses a combination of market and regulatory means, complemented by oversight and enforcement measures. The Commission carries out this responsibility by issuing orders and establishing rules and policies that continually balance two important interests: protecting energy consumers against excessive rates, and providing an opportunity for regulated entities to recover their costs and earn a reasonable return on their investments. For example, the Commission seeks to improve the competitiveness of organized wholesale electric markets, which in turn encourages entry of new resources, spurs innovation and deployment of new technologies, improves operating performance, and exerts downward pressure on costs. Another example of the Commission's use of market and regulatory means in support of this goal is found in the Commission's requirements for public utility transmission providers to participate in an open and transparent regional transmission planning process. In addition, the Commission approves cost-based, and where appropriate, market-based rates for the interstate transportation of natural gas and oil on jurisdictional pipelines, and for the interstate transmission, and wholesale sales of electric energy. The Commission also reviews proposed mergers and other transactions in the electric industry to ensure that these proposals will not harm the public interest.

  Oversight, surveillance and enforcement are essential complements to the Commission's approach to ensure that rates, terms, and conditions of service are just and reasonable and not unduly discriminatory or preferential. The Commission conducts compliance audits, issues publicly available audit reports, and engages in formal and informal

outreach efforts to promote effective compliance programs. Audits are planned and prioritized using a risk-based approach in order to maximize the impact of the Commission's resources. The Commission also conducts public and non-public investigations of possible violations of the statutes, regulations, rules, orders, and tariffs administered by the Commission. These investigations often rely upon oversight and surveillance that employ sophisticated technology to monitor market behavior. When violations of sufficient seriousness are discovered, the Commission attempts to resolve the resulting investigation through settlement with appropriate sanctions and future compliance improvements before initiating further enforcement proceedings.

- **Promote Safe, Reliable, and Secure Infrastructure**
  The Commission plays an important role in the development of energy infrastructure that operates safely and reliably. One aspect of the Commission's role in energy infrastructure development stems from siting authority that includes licensing non-federal hydropower projects, certificating interstate natural gas pipelines and storage projects, authorizing liquefied natural gas (LNG) facilities, and, in certain circumstances, permitting electric transmission lines. With the rising demand for natural gas and hydropower comes increased infrastructure construction, making it all the more important that FERC oversee the private sector development of safe, reliable, and secure infrastructure in a way that fosters economic and environmental benefits for the nation. The Commission reviews applications to construct, operate, or modify natural gas and hydropower infrastructure by ensuring that facilities are constructed and operated in compliance with the conditions of FERC orders. The Commission must respond to energy infrastructure applications with timely and well-reasoned decisions that balance a range of factors such as competing interests, legal requirements, and environmental impacts. The Commission encourages, and sometimes requires, project proponents to engage in early involvement with state and federal agencies, Indian tribes, affected landowners and the public.

  The Commission also has an important role in ensuring that energy infrastructure, once authorized, continues to operate safely and reliably. FERC conducts timely safety reviews and inspections with rigorous requirements, thereby advancing the safety of non-federal hydropower projects and LNG facilities throughout their entire life cycle. The Commission relies on physical inspections for detecting and preventing potential catastrophic structural failures. In regards to jurisdictional LNG facilities, the Commission conducts construction and operational inspections to ensure that the facilities are constructed and operated in accordance with the conditions of Commission Orders, including safety measures and plans. Inspections at both types of facilities protect the public against the risks associated with incidents at the facilities.

  The Commission also oversees the development and review of mandatory reliability and security standards for the bulk-power system, as well as compliance with these standards. A Commission-certified Electric Reliability Organization (ERO) develops and enforces mandatory Reliability Standards, subject to the Commission's oversight and approval. The Reliability Standards address the planning and operation, as well as the cyber security and physical protection of the Nation’s electric transmission grid. The Commission may also, upon its own motion or upon complaint, order the ERO to submit a proposed reliability standard or a modification of an existing reliability standard that addresses a specific reliability matter. To that end, the Commission incorporates performance data-driven, risk-informed decision making into its reliability oversight. In addition, FERC provides leadership, expertise, and assistance in identifying, communicating and developing comprehensive solutions to cyber and physical security risks to energy infrastructure. This is achieved through collaboration with private sector energy industry entities and in coordination with government agencies to research, identify, and share information on threats and vulnerabilities, and to promote voluntary best practices that exceed but are complementary to mandatory regulations thereby improving resilience. The Commission engages with the owners and operators of key critical infrastructure facilities to identify and share threat information, analyze system vulnerabilities, and assist with effective mitigation.

- **Mission Support Through Organizational Excellence**
  The public interest is best served when the Commission operates in an efficient, responsive and transparent manner. The Commission pursues this goal by maintaining processes and providing services in accordance with governing statutes, authoritative guidance, and prevailing best practices. These processes and services help prioritize resource allocations, make prudent investments that yield returns that directly benefit the agency’s mission and use Commission resources in an efficient manner. The Commission also provides services, tools, and resources to equip employees to drive success and accomplish the agency’s mission. The Commission thus makes continued investments in its human capital, information technology (IT) resources, and physical infrastructure. The Commission allocates over two-thirds of its budget to directly cover the

compensation costs of its employees on an annual basis. The Commission continues to focus its human capital efforts on the competencies and positions most affected by the potential loss of its staff to retirement. The Commission also will maintain disciplined information technology planning and governance and pursue a number of projects that will advance priority IT initiatives. These projects will modernize core mission and support systems, expand existing data analytics and visualization capabilities, and improve the agency's cyber security posture. Through the successful execution of these projects, the Commission expects to maintain a cost-effective suite of IT products and services that will meet its near-term mission needs and provide a scalable platform to support future needs beyond 2020, while meeting applicable security mandates. The Commission is also undergoing a multi-year renovation effort within its headquarters building which commenced in FY 2018 and will conclude in FY 2021. The renovation project will enable the agency to realize significant space savings. The FY 2020 request includes approximately $22.9 million to continue the modernization effort.

Facilitating understanding of how the Commission carries out its responsibilities and maintaining public trust in the Commission are important components of the Commission's commitment to organizational excellence. Trust and understanding increase acceptance of Commission decisions. Through the use of the Commission's eLibrary and eSubscriptions web pages, the public can obtain extensive information concerning documents both submitted to and issued by the Commission. The Commission also manages several social media sites to promote transparency and open communication.