DOE/CF-0167

Department of Energy

FY 2021 Congressional Budget Request

Budget in Brief

February 2020

Office of Chief Financial Officer

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PROMOTING ENERGY INDEPENDENCE, PROGRESSING SCIENTIFIC RESEARCH, AND PROTECTING THE NATION

The mission of the Department of Energy (DOE) is to advance U.S. national security and economic growth through transformative science and technology innovation that promotes affordable and reliable energy through market solutions, and meets nuclear security and environmental cleanup challenges. DOE's Fiscal Year (FY) 2021 Budget Request provides for research, emerging energy technologies, and nuclear capabilities to support DOE's mission, activities, and policies.

America's central position in the global energy system is as a leading producer, consumer, and innovator. Access to domestic sources of clean, affordable, and reliable energy will underpin a prosperous, secure, and powerful America for decades to come. Affordable energy is central to modern life. The Nation must take advantage of abundant domestic resources and energy efficiency to promote competitiveness across industries. Utilizing the Nation's energy resources of coal, natural gas, petroleum, renewables, and nuclear, stimulates the economy and builds a foundation for future growth.

The United States must lead in research, technology, and invention to maintain competitive advantage. As other countries continue to advance, the U.S. must advance as well. DOE prioritizes emerging technologies critical to economic growth and security, such as advanced computing technologies and artificial intelligence (AI). The U.S. must plan for the future by supporting research and development (R&D), including at the National Laboratories. The National Laboratories have served as leading institutions for scientific innovation in the U.S. for more than 75 years. American ingenuity, combined with free-market capitalism, can drive tremendous technological breakthroughs leading to improvements in America's economy and environment.

The U.S. needs to continuously address threats to national security. Given the geopolitical environment, the U.S. must have capabilities to address these challenges. The return to great power competition coupled with an unprecedented range and mix of threats requires the U.S. to maintain a diverse set of nuclear capabilities that can provide flexible and tailored options to enhance deterrence and to achieve objectives should deterrence fail. The Department must sustain U.S. nuclear weapons, modernize nuclear forces and infrastructure, and maintain deterrence in light of increasingly capable opponents. National Security also depends on a resilient electric grid and successfully countering evolving and increasing cyber-attacks on networks, data, facilities, and infrastructure.

OVERVIEW

The President's Budget for FY 2021 requests $35.4B for the Department of Energy to meet today and tomorrow's challenges by promoting energy independence, progressing scientific research, and protecting the Nation. The Budget highlights crosscutting, early-stage applied research in energy storage, grid integration, critical minerals, and harsh environment materials for a secure, resilient, affordable, and integrated energy system. The Budget maintains global leadership in scientific and technological innovation in part through 17 National Laboratories, including basic research to support Industries of the Future. DOE remains committed to managing and cleaning up nuclear waste. The Budget also supports aggressively modernizing the nuclear security enterprise for the safety and security of America.

The FY 2021 Budget Request provides:

- $3.6B for technologies that will make the Nation's energy supply more affordable, reliable, and efficient promoting energy independence and dominance.
- $5.9B to progress cutting-edge scientific R&D, including support for Industries of the Future, such as quantum information science (QIS) and AI. The Budget also funds key technologies such as microelectronics, advanced manufacturing, biotechnology, and technology transfer. The Budget also supports state-of-the art scientific tools and facilities keeping U.S. researchers at the forefront of scientific innovation.

DEPARTMENT OF ENERGY
FY 2021

DOE	**$M**
• Energy	3,603
• Science	5,856
• National Security	26,891
• Administration and Oversight	215
• Savings and Receipts	*-722*
• Reduction for Loan Programs and ARPA-E	*-480*
DOE Total	**35.363***

- $26.9B to support national security, and includes:
    - $6.1B to continue cleanup of sites resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research.
    - $19.8B to sustain and modernize the U.S. nuclear stockpile and aging infrastructure, reduce global nuclear threats, and propel the nuclear Navy.

The Budget also emphasizes coordinated crosscutting research of technologies for energy storage, critical minerals, harsh environment materials, grid integration, advanced manufacturing, exascale computing, and microelectronics.

The Budget seeks innovations and includes $190M for Advanced Energy Storage Initiative (AESI) to support the Energy Storage Grand Challenge (ESGC), a holistic approach to accelerate the development, commercialization, and utilization of next-generation energy storage technologies. The Department integrated the existing dispersed storage efforts from the Office of Science (SC), Grid Modernization Initiative, AESI, Beyond Batteries, and others into ESGC, an integrated, comprehensive DOE-wide strategy. The vision for the ESGC is to create and sustain global leadership in energy storage utilization and exports, with a secure domestic manufacturing supply chain that is independent of foreign sources of critical materials, by 2030.

To promote efficiency and maximize impact, the Budget maintains momentum on the Harsh Environment Materials Initiative (HEMI) launched in FY 2020. The Budget provides approximately $58.5M for HEMI, including $6.5M from the Office of Energy Efficiency and Renewable Energy (EERE), up to $22M from the Office of Fossil Energy (FE), and $30M from the Office of Nuclear Energy (NE). The initiative exploits synergies in materials and component manufacturing process research for advanced thermoelectric power plants. Building on current applied energy programs, this initiative leverages activities related to advanced reactor technologies and high efficiency low emission modular coal plants to align R&D of novel materials, integrated sensors, and manufacturing processes.

The Budget also establishes a $131M Critical Minerals Initiative (CMI) to coordinate research across the Department. Funds will come from program offices including, EERE with $53M, FE with $32M, NE with $1M, and SC with $45M, to initiate a National Laboratory-led team approach modeled after the Grid Modernization Laboratory Consortium to elevate and coordinate research activities.

To maintain U.S. leadership in supercomputing, the Budget provides almost $710M from SC ($475M) and the National Nuclear Security Administration (NNSA) ($235M). In FY 2021, funding will support continued development of two SC-supported exascale systems. The first of these two exascale systems will be deployed calendar year 2021 at Argonne National Laboratory, with the second coming on line in the 2021 – 2022 timeline at Oak Ridge National Laboratory. In addition, the FY 2021 Request will provide support for the procurement of and site preparation for a third exascale system delivered to NNSA at Lawrence Livermore National Laboratory in FY 2023. The SC and NNSA partnership will bolster America's national security by strengthening the nuclear stockpile and next generation of science breakthroughs not possible with today's fastest computing systems.

In FY 2021, the Budget provides $249M from SC ($237M) and NNSA ($12M) in support of QIS research. Supporting the National Quantum Initiative and the Administration's Industries of the Future initiative, the Budget provides funding for research activities including strategic partnerships in quantum computing and data intensive applications, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms, and early stage research associated with the initial steps to establish a dedicated Quantum Network.

To support fiscal responsibility and streamline DOE activities, the Budget eliminates the Advanced Research Projects Agency—Energy (ARPA-E) program, the Title XVII Innovative Technology Loan Guarantee Program, the Advanced Technology Vehicle Manufacturing Loan Program, and the Tribal Energy Loan Guarantee Program. ARPA-E elimination facilitates opportunities to integrate the positive aspects of ARPA-E into DOE's applied energy research programs including through changes to the implementation of the Small Business Innovation Research and Small Business Technology Transfer (SBIR/STTR) program. Loan programs are eliminated because the private sector is better positioned to finance deployment of commercially viable projects. To further achieve fiscal discipline and reduce taxpayer risk the request proposes to repeal the Western Area Power Administration's (WAPA) borrowing authority that finances the construction of electricity

transmission projects. Investments in transmission assets are best carried out by the private sector with appropriate market and regulatory incentives.

PROMOTING ENERGY INDEPENDENCE

Recognizing that the U.S. has among the most abundant and diverse energy resources in the world, including oil, gas, coal, nuclear, and renewables, the FY 2021 Budget Request supports a variety of efforts that emphasize and strengthen that unique advantage, including establishing a uranium reserve, to promote energy independence. The Budget provides $3.6B for energy and related programs and funds basic research while continuing the Administration's support of early-stage applied R&D, and targeted later-stage R&D to address unique challenges. DOE is committed to supporting energy initiatives that will attract investments, safeguard the environment, and strengthen energy security.

Highlights include:

ENERGY
FY 2021

Energy Programs	$M
• Energy Efficiency and Renewable Energy	720
• Cyber Security, Energy Security, & Emergency Response	185
• Electricity	195
• Nuclear Energy	1,180
• Interim Storage and Nuclear Waste Fund Oversight	28
• Uranium Reserve	150
• Fossil Energy Research and Development	731
• Petroleum Reserves	200
• Energy Information Administration	129
• Indian Energy	8
• Power Marketing Administrations	79
Energy Total	**3,603**

- $719.6M for EERE prioritizing core lab activities, particularly in renewables and energy efficiency. The Budget also maintains funding at the National Renewable Energy Laboratory. EERE invests in early-stage research to spur private-sector research, development, and commercialization of critical energy technologies such as: sustainable transportation technologies to increase fuel diversity and improve efficiency across the transportation sector ($161M); renewable power generation technologies to compete with other electricity sources without subsidies ($160M); and energy efficiency to improve affordability, energy productivity, and resiliency of homes, buildings, and manufacturing sectors ($164M). The Budget invests in the Plastics Innovation Challenge and continues to support AESI in support of ESGC, HEMI, CMI, and other cross-cutting activities. The Budget divests from Weatherization and State Energy subprograms which are more appropriately funded at the state level.

- $184.6M for Cybersecurity, Energy Security, and Emergency Response to invest in an all hazards approach to energy-sector cybersecurity. The Budget supports development of capabilities to identify, prevent, protect against, mitigate, and respond to cybersecurity threats during an emergency event that pose risk to energy delivery operations. The Budget funds R&D, public and private-sector partnerships, and emergency preparedness and response.

- $195M for the Office of Electricity to support the mission of secure and resilient sources of electricity. The investment addresses the challenges of increased threats to energy infrastructure, increased demand, changes in supply mix and location of the Nation's generation portfolio, and increased variability and uncertainty of supply and demand. The Budget will support four priorities: develop and implement an integrated North American Energy Resiliency Model; pursue a megawatt-scale storage; revolutionize sensing technology; and pursue transmission permitting and technical assistance.

- $1.2B for Office of Nuclear Energy to fund a diverse set of programs to advance nuclear energy technologies that are critical to the Nation's energy mix. The Budget supports early-stage R&D and targeted later-stage R&D to address unique challenges. The Budget provides for the Reactor Concepts R&D, Fuel Cycle R&D, and Nuclear Energy Enabling Technologies as critical laboratory infrastructure and safeguards needed to support nuclear energy R&D. Of the $1.2B, $295M is for the Versatile Test Reactor (VTR) project, one of the Department's highest priorities. The VTR is a first-of-a-kind fast reactor that would assist the private sector to develop and demonstrate new energy technologies. The Budget request reinforces the Administration's commitment to re-energize the U.S. nuclear sector with funds to support design and construction of the VTR.

- $27.5M for the Interim Storage and Nuclear Waste Fund Oversight program to fund the development and implementation of a robust interim storage program, DOE's fiduciary responsibility for Yucca Mountain, and oversight of the Nuclear Waste Fund. Coupled with DOE's funding for storage, transportation, and disposal R&D, the Budget supports the development of a durable, predictable yet flexible plan that addresses more efficiently storing waste temporarily in the near term, followed by permanent disposal, and the Administration will establish an interagency working group to develop this plan in consultation with States.

- $150M to establish a Uranium Reserve that provides assurance of availability of uranium in the event of a market disruption and supports strategic U.S. fuel cycle capabilities. This action addresses the immediate challenge to the production of domestic uranium and reflects the Administration's Nuclear Fuel Working Group priorities.

- $730.6M for Fossil Energy R&D to conduct 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.

- $200M net amount for the Office of Petroleum Reserves, with $187M for the Strategic Petroleum Reserve (SPR). The SPR provides strategic and economic security against potential interruptions in U.S. petroleum supplies. The Budget supports the programs operational readiness and drawdown capabilities. Consistent with prior budget requests, the Administration is re-proposing the sale and closure of the Northeast Gasoline Supply Reserve (NGSR), which has not been used since its establishment. Proceeds from the sale from the NGSR will be contributed to deficit reduction. Additionally, the Department is proposing to close the Northeast Home Heating Oil Reserve which has also never been used for its intended purposed and is not a good use of taxpayer funds. The Budget further proposes a sale of 15 million barrels of SPR crude oil to raise funds for other Departmental priorities, including $242M needed to fund the completion of remediation work at the NPR-1 site. The Naval Petroleum and Oil Shale Reserves will be funded at $13M.

- $128.7M for the Energy Information Administration (EIA) 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. EIA will also begin a multi-year effort to modernize its energy modeling capabilities. Expected benefits include greater agility in EIA's modeling system to address key current and emerging trends. The Budget will also enable EIA to continue planned cybersecurity initiatives to bolster information security.

- $8M for the Office of Indian Energy Policy and Programs for energy development and deployment on Indian lands, reduction of energy costs, assistance in economic development, and electrification in tribal communities where unemployment and poverty rates far exceed national averages.

- $78.6M for the four Power Marketing Administrations (PMA) to sell electricity primarily generated by federally owned hydropower projects to public entities and electric cooperatives. The Budget again proposes to repeal WAPA's borrowing authority that finances the construction of electricity transmission projects. Investments in transmission assets are best carried out by the private sector with appropriate market and regulatory incentives that support resiliency and reliability. The Request again proposes to sell the transmission assets owned and operated by the PMAs, and authorize the PMAs to charge rates comparable to those charged by for-profit investor owned utilities. Reducing the government's role in electricity transmission infrastructure ownership, and introducing market-based incentives for power sales from Federal dams would encourage an efficient allocation of economic resources and mitigate risk to taxpayers.

PROGRESSING SCIENTIFIC RESEARCH

The FY 2021 Budget Request includes $5.9B to progress scientific research continuing U.S. dominance in research and science. The Budget funds the science mission by focusing on early-stage research, operating the national laboratories, and continuing high priority construction projects. The Budget includes ongoing investments for exascale and QIS for creating new ways of processing and analyzing information.

The Budget funds the Office of Science at $5.8B providing $475M for Exascale computing to help secure a global leadership role in exascale, $237M for QIS, $125M for AI and machine learning, and $45M to enhance materials and chemistry foundational research to support U.S.-based leadership in microelectronics. SC's work, particularly in the areas of QIS and AI, will support the Industries of the Future Initiative. SC efforts in QIS includes development of quantum computing and quantum sensor technology. QIS will benefit national security, economic competitiveness, and secure America's continued leadership in science.

Highlights include:

- $988M for Advanced Scientific Computing Research (ASCR) to strengthen U.S. leadership in strategic computing, the foundations of AI and QIS, and the infrastructure that enables data-driven science. To meet SC's high performance computing mission for the exascale project, the Budget prioritizes basic research in Applied Mathematics and Computer Science with emphasis on the challenges of data intensive science, including AI and machine learning, and computing technologies. The Budget increases support for ASCR's Computational Partnerships focusing on developing partnerships in quantum computing and data intensive applications, and new partnerships in exascale and data infrastructure. The Budget also provides support for ASCR user facilities operations to ensure the availability of high performance computing, data, and networking to the scientific community.

SCIENCE
FY 2021

Science	**$M**
Office of Science Programs	
• Advanced Scientific Computing Research	988
• Basic Energy Sciences	1,936
• Biological and Environmental Research	517
• Fusion Energy Sciences	425
• High Energy Physics	818
• Nuclear Physics	653
• Workforce Development for Teachers and Scientists	21
• Science Laboratory Infrastructure	174
• Safeguards and Security	116
• Program Direction	190
Office of Science Programs Total	**5,838**
Artificial Intelligence and Technology Office	**5**
Office of Technology Transitions	**13**
Science Total	**5,856**

- $1.9B for Basic Energy Sciences (BES) to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels providing foundations for new energy technologies, to mitigate the environmental impact of energy use. BES supports DOE missions in energy, environment, and national security. DOE aims to better understand the physical world and harness nature to benefit people and society. Specifically, funds provide for exascale computing, QIS, and operation of user facilities. The Budget will continue ongoing construction projects and fund a new construction project, the Cryomodule Repair and Maintenance Facility.

- $516.9M for Biological and Environmental Research (BER) to support 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 Budget supports research in biological systems science, earth and environmental systems science, and new efforts in translating biodesign rules to functional properties of novel biological polymers. The Budget 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.

- $425.1M for the Office of Fusion Energy Sciences (FES) for research to develop a fusion energy source and to understand matter at very high temperatures and densities. Fusion energy is a carbon-free energy source with enormous potential, such as combatting climate change, serving as a vast energy source, providing economic benefits, and promoting national security. The Budget continues to support research and facility operations, including research at international facilities with unique capabilities, research in QIS, and research in high-density laboratory plasma science. Funding for

facilities operations includes DIII-D for magnetic fusion, the National Spherical Torus Experiment Upgrade facility repairs, and upgrades at the Matter in Extreme Conditions Petawatt facility project. The Budget also funds the U.S. in-kind hardware contribution for the ITER international research project.

- $818.1M for High Energy Physics (HEP) for 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 underpins and advances DOE mission and objectives through this research. The Budget funds core research activities including QIS, AI, exascale computing, and next-generation microelectronics. The Budget further funds the Accelerator Traineeship Program to expand workforce development in advanced technology and HEP facilities.

- $653.2M for Nuclear Physics to support research to discover, explore, and understand all forms of nuclear matter. The Budget funds world class nuclear physics, QIS, the DOE Isotope program. The Budget also supports new initiatives in AI and Strategic Accelerator R&D as they relate to nuclear physics.

- $20.5M for Workforce Development for Teachers and Scientists to provide for a sustained pipeline of science, technology, engineering, and mathematics (STEM) professionals to meet current and future national goals and objectives. Maintaining U.S. leadership requires specialized computer scientists and applied mathematicians to develop supercomputing methods to solve real world problems today and develop technology of the future. The Budget 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.

- $174.1M for Science Laboratories Infrastructure to sustain mission-ready infrastructure and safe and environmentally responsible operations by providing the infrastructure necessary to support leading edge research at ten national science laboratories. The Budget funds the new and ongoing construction projects that will address inadequate core infrastructure and utility needs.

The Budget funds $5M for operations of the Artificial Intelligence and Technology Office (AITO). AI is a foundational technology that is disruptive and will drive decades of innovation. AITO leads Department-wide efforts to evaluate the scope and effectiveness of DOE's AI programs and identify gaps not addressed by programs, functional offices, sites, or associated National Laboratories. AITO is uniquely situated to develop and lead collaborative solutions across the Department that are consistent with the Secretary's priorities and objectives. The office will also be instrumental in supporting the Administration's Industries of the Future Initiative.

The Budget funds $12.6M for the Office of Technology Transitions to support ongoing activities, including the Technology Commercialization Fund, Lab Partnering Service, Energy I-Corps, and Innovation XLab summits. The Budget will fully implement the Empowering Novel American Businesses with Laboratory Embedding competition.

PROTECTING THE NATION

Environmental Management

The Department must continue to manage nuclear waste in all forms including some of the most dangerous materials known. The FY 2021 Budget Request includes $6.1B for environmental management to continue cleanup resulting from six decades of nuclear weapons development and production and Government-sponsored nuclear energy research. Funds will support cleanup of millions of gallons of liquid radioactive waste and thousands of tons of spent nuclear fuel and nuclear materials. DOE will dispose of large volumes of transuranic and mixed/low-level waste, and huge quantities of contaminated soil and water. To date, the Office of Environmental Management (EM) has completed cleanup activities at 91 sites in 30 states and in the Commonwealth of Puerto Rico. EM is responsible for cleanup at 16 remaining sites in 11 states.

Highlights include:

- $1.7B to support the Liquid Waste Program at Savannah River Site (SRS) to achieve additional risk reduction by stabilization and immobilization of high activity radionuclides through vitrification into canisters at the Defense Waste Processing Facility and disposition of decontaminated salt waste in Saltstone Disposal Units. The Request supports continuing construction of saltstone disposal units. The Salt Waste Processing Facility is poised to start in FY 2020 and in

FY 2021 will begin 24-7 operations. The Budget also includes $25M for the design and construction of the Advanced Manufacturing Collaborative Facility.

- $1.3B 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. The Budget supports construction, start up, and commissioning of facilities that are integral to begin treating Hanford low-activity tank waste by December 2023 as required by the 2016 Amended Consent Decree.

- $655M for the Richland site to support 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 Budget will maintain safe operations, provide Hanford site-wide services, and conduct critical site infrastructure projects, as well as startup preparation activities for the Integrated Disposal Facility to support Direct Feed Low Activity Waste commissioning and startup.

- $491M for the decontamination and decommissioning of the Portsmouth Gaseous Diffusion Plant facilities, including construction and design of on-site waste disposal facilities.

- $432M for cleanup activities at the Oak Ridge site, including continued slab and soil remediation at the East Tennessee Technology Park, mercury characterization and remediation technologies, planning for construction of the mercury treatment facility at the Y-12 National Security Complex, as well as continued design for the On-Site Disposal Facility to support Y-12 National Security Complex and Oak Ridge National Laboratory.

ENVIRONMENTAL MANAGEMENT
FY 2021

Environmental Management	**$M**
• Savannah River	1,703
• River Protection	1,258
• Richland/Hanford	655
• Portsmouth	491
• Oak Ridge	432
• Carlsbad/Waste Isolation Pilot Plant	390
• Idaho	271
• Program Direction	275
• Paducah	282
• Los Alamos	120
• West Valley Demonstration Project	92
• Lawrence Livermore National Laboratory	2
• Nevada	61
• Moab	48
• Technology Development	25
• Uranium Thorium Reimbursements	21
• Separation Process Research Unit (SPRU)	15
• Headquarters Operations	13
• Energy Technology Engineering Center	11
• Other Sites	5
• Sandia National Laboratory	5
• *Offset (Rescission of Prior Year Balances)*	*-109*
EM Total	**6,066**

- $390M to safely continue waste emplacement at the Waste Isolation Pilot Plant, the Nation's only mined geologic repository for permanent disposal of defense-generated transuranic waste, including $50M for continued progress on the utility shaft project to increase underground airflow for simultaneous mining and waste emplacement operations, as well as $10M to begin the Hoisting Capability Project.

- $271M to continue cleanup at the Idaho site. The Budget supports Integrated Waste Treatment operations and additional treated sodium bearing waste storage capacity, supports completing buried waste exhumation activities, and continued progress in characterizing, packing, and shipping stored contact-handled and remote handled transuranic waste, as well as spent nuclear fuel activities in order to meet the Idaho Settlement Agreement milestone for 2023.

- $282M for the Paducah site to continue environmental remediation and further stabilize the gaseous diffusion plant.

- $120M to continue focus on surface and groundwater management at Los Alamos National Lab (LANL). The Budget also continues activities to control migration of a hexavalent chromium plume beneath Montana and Sandia Canyons. DOE will plan and execute retrieval and repackaging of the below-grade transuranic waste.

Legacy Management

The Budget provides $317M for Legacy Management (LM) to support long-term activities, administer an interagency agreement addressing abandoned defense related uranium mines, execute the Department's Uranium Leasing Program, develop applied studies and technology to reduce scope and costs, and close the Grand Junction, Colorado Disposal Site.

The Budget also includes $150M to support and expand the Reform Proposal to consolidate funding for the administration for Formerly Utilized Sites Remedial Action Program under LM.

National Nuclear Security Administration

NNSA is responsible for maintaining a safe, secure, and effective nuclear weapons stockpile that preserves a credible nuclear deterrent in the return of great power competition, for preventing, countering, and responding to evolving and emerging nuclear proliferation and terrorism threats. NNSA also provides safe, reliable, and long-term nuclear propulsion to the Nation's Navy as it protects American and allied interests around the world.

To support these activities the Budget proposes $19.8B for NNSA. Consistent with the nation's nuclear deterrence mission and the policy set forth in the 2018 Nuclear Posture Review (NPR), the Budget invests in the security and safety of the Nation by maintaining a safe, secure, and effective nuclear weapons stockpile; reducing global nuclear threats and keeping material out of the hands of terrorists; strengthening key science, technology, and engineering capabilities; providing safe and effective integrated nuclear propulsion systems for the U.S. Navy; and modernizing the national security infrastructure as well as funding for staff critical to carry out the NNSA mission.

Highlights include:

NATIONAL SECURITY
FY 2021

National Security Programs	**$M**
NNSA Programs	
• Weapons Activities	15,602
• Defense Nuclear Nonproliferation	2,031
• Naval Reactors	1,684
• Federal Salaries and Expenses	454
NNSA Total	**19,771**
Environmental Management	**6,066**
Other Defense Activities	**1,054**
• Legacy Management	317
National Security Total	**26,891**

- $15.6B for Weapons Activities to maintain the safety, security, and effectiveness of the nuclear stockpile, continue the nuclear modernization program, and modernize and recapitalize NNSA's nuclear security infrastructure portfolio in alignment with the NPR.
    - $4.3B for Stockpile Management to support stockpile sustainment, dismantlement, and modernization of the nuclear weapons program. The Budget funds sustainment of the current stockpile, major warhead modernization efforts, safe and secure dismantlement of weapons, and production operations.
    - $2.5B for Production Modernization to support strategic materials production capabilities for nuclear weapons, including primaries, canned subassemblies, radiation cases and non-nuclear components needed to sustain the nuclear stockpile near- to long-term. The Budget funds equipment, facilities, and personnel required to reestablish the Nation's ability to produce pits with the goal of producing 80 pits per year by 2030 at LANL and SRS.
    - $2.8B for Stockpile Research, Technology, and Engineering to provide the scientific foundation for science-based stockpile decisions and actions, including the capabilities, tools, and components enabling assessment of the active stockpile and certification of warhead modernization programs. The Budget for FY 2021 supports the continued implementation of the Enhanced Capabilities for Subcritical Experiments (ECSE). Funding includes $235M for activities and research leading to deployment of exascale capability for national security applications. This includes $85.5M for a multi-year non-recurring engineering collaboration focusing on advanced system engineering efforts and software technologies to make the 2023 exascale system a capable and productive computing resource for the Stockpile Stewardship Program.
    - $4.4B for Infrastructure and Operations 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 project and design of the Lithium Processing Facility at Y-12 and the Tritium Finishing Facility at SRS. The Budget also continues construction of the Chemistry and Metallurgical Research Replacement project to sustain plutonium science activities.
- $2B for Defense Nuclear Nonproliferation to address nuclear threats by preventing the unwanted 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 supports design, long lead procurements, and site preparation for the Surplus Plutonium Disposition project, increases funding for nuclear forensics, and continues support of non-Highly Enriched Uranium-based Molybdenum-99 production facilities in the U.S.

- $1.7B for Naval Reactors to continue funding for delivery of the reactor core for the Columbia-class submarine and refueling of the S8G prototype reactor. The Request also supports 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.

Cybersecurity

Cyberattacks pose an increasing threat to the Nation's energy infrastructure. Recognizing the seriousness of the threat against critical infrastructure, the Budget supports increased funding for cyber and energy security initiatives. DOE will improve energy infrastructure security by addressing the emerging threats of tomorrow while protecting the reliable flow of energy to Americans today. The Budget includes $158.8M in program office budgets to support improved energy-sector cybersecurity, in addition to $375M for the information technology and cybersecurity of NNSA.

Other Defense Activities

The FY 2021 Budget Request provides $1.1B to support defense activities conducted by the Department including $317M for LM. These include Environment, Health, Safety and Security, Enterprise Assessments, Specialized Security Activities, Hearings and Appeals, and Defense Related Administrative Support (DRAS). Funding from DRAS is used to offset administrative expenses for work supporting defense-oriented activities.

ADMINISTRATION AND OVERSIGHT

The FY 2021 Budget Request includes $215M for Administration and Oversight activities, including Departmental Administration (DA), International Affairs, the Office of the Inspector General, and offsets.

Highlights include:

ADMINISTRATION AND OVERSIGHT
FY 2021

	$K
Administration and Oversight	**215**
Savings and Receipts	***-722***

- $123.5M for DA to fund management and mission support organizations that have enterprise-wide responsibility for administration, accounting, budgeting, contract and project management, human resources, 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, and public affairs. In January 2020, the Secretary of Energy announced that the Office of Policy will be restructured to the Office of Strategic Planning and Policy (OSPP). OSPP will become a direct report to the Office of the Secretary for a more efficient and effective approach to the analysis, formulation, development, and advancement of all policy across the Department.
- $33M for International Affairs (IA) to coordinate the Department's international work and promote global market opportunities for U.S. energy companies and technology exports.
- $58M for Office of the Inspector General to review the integrity, economy, and efficiency of DOE programs and operations, including NNSA and the Federal Energy Regulatory Commission.
- -$722M in savings and receipts including from the sale of the NEHHOR (-$75M), sale of oil from SPR and gasoline from the NGSR (-$589M), and savings from the Federal Energy Regulatory Commission fees and recoveries in excess of annual appropriations (-$9).

CONCLUSION

The Department of Energy FY 2021 President's Budget Request provides for America's future by promoting energy independence, progressing scientific research, and protecting the Nation. The Budget demonstrates fiscal discipline and commitment to an efficient and effective Federal government. To that end, DOE will focus spending in areas with the highest return on investment of

tax payer dollars. Achieving goals established in the Request requires an exceptional workforce. The Department will invest in the workforce by attracting, training, and retaining the Nation's best talent. The President's Budget supports the critical role the Department of Energy has in energy independence and dominance, economic growth, and the safety and security of the Nation. The Department appreciates the support of Congress and looks forward to continuing to work together.

DEPARTMENT OF ENERGY
Appropriation Summary
FY 2021
(Dollars in Thousands)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs. FY 2020 Enacted	
				$	%
Department of Energy Budget by Appropriation					
Energy Efficiency and Renewable Energy	2,379,000	2,777,277	719,563	-2,057,714	-74.09%
Electricity	156,000	190,000	195,045	5,045	2.66%
Cybersecurity, Energy Security and Emergency Response	120,000	156,000	184,621	28,621	18.35%
Nuclear Energy*	1,180,000	1,340,000	1,042,131	-297,869	-22.23%
Uranium Reserve	0	0	150,000	150,000	0.00%
Interim Storage and Nuclear Waste Fund Oversight	0	0	27,500	27,500	0.00%
Fossil Energy Research and Development	740,000	750,000	730,601	-19,399	-2.59%
Strategic Petroleum Reserve	235,000	195,000	187,081	-7,919	-4.06%
Naval Petroleum and Oil Shale Reserve	10,000	14,000	13,006	-994	-7.10%
Strategic Petroleum Reserve Petroleum Account	10,000	10,000	0	-10,000	-100.00%
Northeast Home Heating Oil Reserve	10,000	10,000	0	-10,000	-100.00%
Total, Fossil Energy Petroleum Reserve Accounts	**265,000**	**229,000**	**200,087**	**-28,913**	**-12.63%**
Total, Fossil Energy Programs	**1,005,000**	**979,000**	**930,688**	**-48,312**	**-4.93%**
Uranium Enrichment Decontamination and Decommissioning (D&D) Fund	841,129	881,000	806,244	-74,756	-8.49%
Energy Information Administration	125,000	126,800	128,710	1,910	1.51%
Non-Defense Environmental Cleanup	310,000	319,200	275,820	-43,380	-13.59%
Science	6,585,000	7,000,000	5,837,806	-1,162,194	-16.60%
Artificial Intelligence Technology Office	0	0	4,912	4,912	0.00%
Advanced Research Projects Agency - Energy	366,000	425,000	-310,744	-735,744	-173.12%
Departmental Administration	165,858	161,000	136,094	-24,906	-15.47%
Indian Energy Policy and Programs	18,000	22,000	8,005	-13,995	-63.61%
Inspector General	51,330	54,215	57,739	3,524	6.50%
International Affairs	0	0	32,959	32,959	0.00%
Title 17 Innovative Technology Loan Guarantee Program	12,311	29,000	-160,659	-189,659	-654.00%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	5,000	0	-5,000	-100.00%
Tribal Energy Loan Guarantee Program	1,000	2,000	-8,500	-10,500	-525.00%
Total, Credit Programs	**18,311**	**36,000**	**-169,159**	**-205,159**	**-569.89%**
Total, Energy Programs	**13,320,628**	**14,467,492**	**10,057,934**	**-4,409,558**	**-30.48%**
Federal Salaries and Expenses	410,000	434,699	454,000	19,301	4.44%
Weapons Activities	11,100,000	12,457,097	15,602,000	3,144,903	25.25%
Defense Nuclear Nonproliferation	1,930,000	2,164,400	2,031,000	-133,400	-6.16%
Naval Reactors*	1,788,618	1,648,396	1,684,000	35,604	2.16%
Total, National Nuclear Security Administration	**15,228,618**	**16,704,592**	**19,771,000**	**3,066,408**	**18.36%**
Defense Environmental Cleanup	6,024,000	6,255,000	4,983,608	-1,271,392	-20.33%
Nuclear Energy	146,090	153,408	137,800	-15,608	-10.17%
Other Defense Programs	860,292	906,000	1,054,727	148,727	16.42%
Total, Environmental and Other Defense Activities	**7,030,382**	**7,314,408**	**6,176,135**	**-1,138,273**	**-15.56%**
Total, Atomic Energy Defense Activities	**22,259,000**	**24,019,000**	**25,947,135**	**1,928,135**	**8.03%**
Southwestern Power Administration	10,400	10,400	10,400	0	0.00%
Western Area Power Administration	89,372	89,196	89,372	176	0.20%
Falcon and Amistad Operating and Maintenance Fund	228	228	228	0	0.00%
Colorado River Basins Power Marketing Fund	0	-42,800	-21,400	21,400	**-50.00%**
Total, Power Marketing Administrations	**100,000**	**57,024**	**78,600**	**21,576**	**37.84%**
Total, Energy and Water Development and Related Agencies	**35,656,628**	**38,527,516**	**36,083,669**	**-2,443,847**	**-6.34%**
Excess Fees and Recoveries, FERC	-16,000	-16,000	-9,000	7,000	-43.78%
Title XVII Loan Guarantee Program Section 1703 Negative Credit Subsidy Receipt	-107,000	-15,000	-49,000	-34,000	226.67%
Sale of Northeast Home Heating Oil Reserve	0	0	-75,000	-75,000	0.00%
Sale of Oil from Strategic Petroleum Reserve**	0	0	-589,000	-589,000	0.00%
Total, Funding by Appropriation	**35,533,628**	**38,512,516**	**35,361,669**	**-3,150,847**	**-8.18%**
DOE Budget Function	**35,533,628**	**38,512,516**	**35,361,669**	**-3,150,847**	**-8.18%**
NNSA Defense (050) Total	15,228,618	16,704,592	19,771,000	3,066,408	18.36%
Non-NNSA Defense (050) Total	7,030,382	7,314,408	6,176,135	-1,138,273	-15.56%
Defense (050)	*22,259,000*	*24,019,000*	*25,947,135*	*1,928,135*	*8.03%*
Science (250)	6,585,000	7,000,000	5,837,806	-1,162,194	-16.60%
Energy (270)	6,689,628	7,493,516	3,576,728	-3,916,788	-52.27%
Non-Defense (Non-050)	*13,274,628*	*14,493,516*	*9,414,534*	*-5,078,982*	*-35.04%*

* Funding does not reflect statutory transfer of funds from Naval Reactors to Nuclear Energy for maintenance and operation of the Advanced Test Reactor ($85.5M in FY19; $88.5M in FY20).

**Includes a $50M sale from the Northeast Gasoline Supply Reserve.

DEPARTMENT OF ENERGY
Funding by Organization
FY 2021
(Dollars in Thousands)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs. FY 2020 Enacted $	FY 2021 Request vs. FY 2020 Enacted %
Department of Energy Budget by Organization					
Under Secretary for Nuclear Security and National Nuclear Security Administration					
National Nuclear Security Administration					
Weapons Activities	11,100,000	12,457,097	15,602,000	3,144,903	25.25%
Defense Nuclear Nonproliferation	1,930,000	2,164,400	2,031,000	-133,400	-6.16%
Naval Reactors*	1,788,618	1,648,396	1,684,000	35,604	2.16%
Federal Salaries and Expenses	410,000	434,699	454,000	19,301	4.44%
Total, Under Secretary for Nuclear Security and National Nuclear Security	**15,228,618**	**16,704,592**	**19,771,000**	**3,066,408**	**18.36%**
Under Secretary of Energy					
Energy Programs					
Energy Efficiency and Renewable Energy	2,379,000	2,777,277	719,563	-2,057,714	-74.09%
Office of Electricity	156,000	190,000	195,045	5,045	2.66%
Power Marketing Administrations	100,000	57,024	78,600	21,576	37.84%
Cybersecurity, Energy Security, and Emergency Response	120,000	156,000	184,621	28,621	18.35%
Petroleum Reserves	265,000	229,000	200,087	-28,913	-12.63%
Fossil Energy Research and Development	740,000	750,000	730,601	-19,399	-2.59%
Nuclear Energy*	1,326,090	1,493,408	1,357,431	-135,977	-9.10%
Office of Indian Energy Policy and Programs	18,000	22,000	8,005	-13,995	-63.61%
Office of Policy	2,510	7,000	7,631	631	9.01%
Project Management Oversight and Assessment	15,005	12,596	15,577	2,981	23.67%
Environment, Health, Safety, and Security	202,839	207,839	209,688	1,849	0.89%
Credit Programs					
Title 17 Innovative Technology Loan Guarantee Program	12,311	29,000	-160,659	-189,659	-654.00%
Tribal Energy Loan Guarantee Program	1,000	2,000	-8,500	-10,500	-525.00%
Advanced Technology Vehicles Manufacturing Loan Program	5,000	5,000	0	-5,000	-100.00%
Other Energy Programs					
Advanced Research Projects Agency - Energy	366,000	425,000	-310,744	-735,744	-173.12%
Energy Information Administration	125,000	126,800	128,710	1,910	1.51%
Under Secretary for Science					
Science	6,585,000	7,000,000	5,837,806	-1,162,194	-16.60%
Environmental Management	7,175,129	7,455,200	6,065,672	-1,389,528	
Legacy Management Programs	158,877	162,029	316,993	154,964	95.64%
Office of Technology Transitions	8,505	14,080	12,639	-1,441	-10.23%
Departmental Administration (Direct Reports)					
Chief Information Officer	131,624	140,200	134,778	-5,422	-3.87%
Management	55,385	54,358	57,258	2,900	5.34%
Chief Human Capital Officer	26,125	24,316	26,191	1,875	7.71%
Economic Impact and Diversity	10,169	10,169	9,931	-263	-2.34%
Office Of The Secretary	5,395	5,119	5,582	463	9.04%
Chief Financial Officer	48,912	52,000	53,591	1,591	3.06%
Congressional and Intergovernmental Affairs	4,200	4,395	5,616	1,221	27.78%
Public Affairs	6,594	4,000	5,954	1,954	48.85%
General Counsel	33,075	32,575	35,111	2,536	7.79%
International Affairs	22,878	26,825	0	-26,825	-100.00%
Artificial Intelligence Technology Office	0	2,500	0	-2,500	-100.00%
Office of Small & Disadvantaged Business Utilization	3,170	3,337	3,402	65	1.95%
Strategic Partnership Projects and Revenues	-56,000	-53,378	-53,378	0	0.00%
Other Defense Activities (Direct Reports)					
Office of Enterprise Assessments	76,770	78,779	81,584	2,805	3.56%
Specialized Security Activities	266,378	273,409	258,411	-14,998	-5.49%
Hearings and Appeals	3,739	4,852	4,262	-590	-12.16%
Other Departmental Offices					
Artificial Intelligence Technology Office	0	0	4,912	4,912	0.00%
International Affairs	0	0	32,959	32,959	0.00%
Inspector General	51,330	54,215	57,739	3,524	6.50%
Federal Energy Regulatory Commission	-16,000	-16,000	-9,000	7,000	43.80%
Sale of Northeast Gas Reserves	0	0	-75,000	-75,000	0.00%
Sale of Oil from Strategic Petroleum Reserve	0	0	-589,000	-589,000	0.00%
Title XVII Loan Guar. Prog Section 1703 Negative Credit Subsidy Receipt	-107,000	-15,000	-49,000	-34,000	226.67%
Total, Funding by Organization	**35,533,628**	**38,512,516**	**35,361,669**	**-3,150,847**	**-8.18%**

* Funding does not reflect statutory transfer of funds from Naval Reactors to Nuclear Energy for maintenance and operation of the Advanced Test Reactor ($85.5M in FY19; $88.5M in FY20).

Program and Functional Office Details

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Sustainable Transportation					
Vehicle Technologies	344,000	396,000	74,400	-321,600	-81.2%
Bioenergy Technologies	226,000	259,500	44,500	-215,000	-82.9%
Hydrogen and Fuel Cell Technologies	120,000	150,000	42,000	-108,000	-72.0%
Renewable Power					
Solar Energy Technologies	246,500	280,000	67,000	-213,000	-76.1%
Wind Energy Technologies	92,000	104,000	22,100	-81,900	-78.8%
Water Power Technologies	105,000	148,000	45,000	-103,000	-69.6%
Geothermal Technologies	84,000	110,000	26,000	-84,000	-76.4%
Energy Efficiency					
Advanced Manufacturing	320,000	395,000	94,600	-300,400	-76.1%
Federal Energy Management Program	30,000	40,000	8,400	-31,600	-79.0%
Building Technologies	226,000	285,000	61,000	-224,000	-78.6%
Weatherization and Intergovernmental Programs					
Weatherization Assistance Program	254,000	305,000	0	-305,000	-100.0%
Training and Technical Assistance	3,000	3,500	0	-3,500	-100.0%
State Energy Program	55,000	62,500	0	-62,500	-100.0%
Total, Weatherization and Intergovernmental Programs	312,000	371,000	0	-371,000	-100.0%
Corporate Support Programs					
Facilities and Infrastructure (NREL)	97,000	130,000	107,000	-23,000	-17.7%
Program Direction	162,500	165,000	122,563	-42,437	-25.7%
Strategic Programs	14,000	14,500	5,000	-9,500	-65.5%
Subtotal, EERE	**2,379,000**	**2,848,000**	**719,563**	**2,128,437**	**-74.7%**
P.L. 116-94: Unobligated Balance Rescission	0	-58,000	0	58,000	+100.0%
P.L. 116-94 Section 308: Energy Program Rescission	0	-12,723	0	12,723	+100.0%
Total, EERE	**2,379,000**	**2,777,277**	**719,563**	**2,057,714**	**-74.1%**

Appropriation Overview

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 in addressing the 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, commercialization, and deployment of energy technologies. The Request 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 provides $720 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 that industry does not have the technical bandwidth to undertake or are too far from market realization to merit sufficient industry focus and critical investments. 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 provides opportunities to make progress with a more efficient organizational structure.

The Budget for EERE includes funding for crosscut areas:

- Grid Modernization Initiative ($114,500,000) — Develops new architectural concepts, tools, and technologies that will better measure, analyze, predict, protect, and control the grid of the future. Areas include beyond LCOE (Levelized Cost of Energy), electricity affordability, generation and hybrid systems, resilience modeling, cyber-physical security, advanced sensing, energy storage and system flexibility.
- Energy Storage Grand Challenge (ESGC) ($97,000,000) — DOE is taking a holistic approach to accelerate the development, commercialization, and utilization of next-generation energy storage technologies. The Department integrated the existing disparate storage efforts from the Office of Science, Grid Modernization Initiative (GMI), Advanced Energy Storage Initiative (AESI) and others into the Energy Storage Grand Challenge (ESGC), an integrated, comprehensive DOE-wide strategy. The ESGC will deploy the Department's extensive resources and expertise to address technology development, commercialization, manufacturing, valuation, and workforce challenges. The vision for the ESGC is to create and sustain global leadership in energy storage utilization and exports, with a secure domestic manufacturing supply chain that is independent of foreign sources of critical materials, by 2030.
- Critical Minerals Initiative ($52,600,000) — In support of Executive Order (EO) 13817, the Request elevates the existing critical minerals activities across DOE to an intradepartmental initiative. Specifically, the Request transitions the current Critical Materials Institute to a broader National Laboratory-led consortium modeled after the Grid Modernization Laboratory Consortium. This new consortium is tasked with developing and implementing a multi-year program plan, including aggressive, yet achievable goals, encompassing all efforts across the Applied Energy Offices and the Office of Science to diversify supply of, develop substitutes for, and drive recycling, reuse, and more efficient use of critical minerals. Specifically, EERE will increase activity at all levels of the supply chain, including exploration, mining, concentration, separation, alloying, recycling, and reprocessing critical minerals called for in EO 13817.
- Plastics Innovation Challenge ($20,500,000) — Plastics are used in thousands of products essential to modern life, and plastic waste is also a growing global challenge. Last year, DOE announced a comprehensive program to accelerate innovations in energy-efficient plastics recycling technologies. EERE will explore novel technologies and approaches to economically deconstruct existing plastics, increase opportunities for upcycling, and develop infinitely recyclable polymers. The purpose of the Plastics Innovation Challenge is to reduce the energy costs associated with the current lifecycle of plastics; develop new polymers that are recyclable-by-design; and develop biological and chemical methods to deconstruct plastic waste, including from rivers and oceans, into useful chemical feedstock streams. This includes emphasis on designing and manufacturing new technologies for both recyclability and reliability across our technologies entering the marketplace.
- Water Security Grand Challenge ($20,000,000) — a White House-initiated, DOE-led challenge to advance transformational technology and innovation to meet the global need for safe, secure, and affordable water. EERE will focus on desalination technologies, resource recovery from municipal wastewater, and small modular energy-water systems (in coordination with DOE's Offices of Fossil Energy and Nuclear Energy).
- Energy Sector Cybersecurity ($13,600,000) — EERE supports early stage R&D, provides technical assistance, and develops best practices to identify and mitigate cyber risks to energy systems. Work supported by EERE complements the DOE Multiyear Plan for Energy Sector Cybersecurity.
- Harsh Environment Materials Initiative ($6,500,000): A coordinated effort to exploit synergies in materials and component manufacturing R&D for advanced thermoelectric power plants.

Program Highlights

Sustainable Transportation

Vehicle Technologies — FY 2021 funding supports early-stage research to generate knowledge upon which industry can develop and deploy a broad range of affordable, efficient, and clean transportation choices to move people and goods across America. The Battery and Electrification Technologies subprogram will explore new battery materials; improve high-power, fast-charging methods; develop innovative chemistries beyond lithium ion technology; and advanced cell technologies, with a focus on reducing or eliminating the need for critical materials such as cobalt. The Energy Efficient Mobility Systems (EEMS) subprogram will create breakthrough modeling and simulations to understand how new mobility technologies can improve mobility energy productivity, and apply new artificial intelligence capabilities developed by the National Laboratories to increase transportation system efficiency for passengers and freight. In Advanced Engine and Fuel Technologies, research will advance and improve our understanding and ability to increase combustion efficiency by 30 to 35 percent by 2030. Materials Technology research will focus on novel approaches to building lightweight, multi-material structures and creating new materials that can withstand extreme temperatures and pressures. The Technology Integration subprogram will continue support for statutory requirements related to public information about alternative fuels and vehicle fuel economy. The program's analysis effort will use advanced vehicle and transportation data to conduct techno-economic and interdisciplinary analyses critical to informing program targets and research planning.

Bioenergy Technologies — FY 2021 funding supports R&D of transformative, sustainable, bioenergy technologies that can support a growing bioeconomy. The program's early-stage R&D emphasizes advanced technologies to produce renewable-gasoline, -diesel, -jet, and -marine fuels, as well as, co-produced bioproducts from biomass and waste streams in order to provide affordable, domestically sourced and produced fuels across the full range of transportation modes. The Request prioritizes consortium-based research that brings together unique capabilities from across the DOE National Laboratories and focuses on key challenges and opportunities for bioenergy technologies. Funding will support joint research with the Advanced Manufacturing Office under the Plastics Innovation Challenge to develop new plastic recycling technologies and bio-derived plastics that are recyclable by design in order to decrease the energy intensity and reduce environmental costs associated with the current lifecycle of plastics. In collaboration with the Vehicles Technologies Office, Bioenergy will explore the co-optimization of fuels and engines to evaluate the most promising biofuel candidates to enable fuel economy, emissions reduction, and efficiency targets for advanced compression ignition engines.

Hydrogen and Fuel Cell Technologies — FY 2021 funding will continue to focus on the H2@Scale concept which will enable affordable and reliable hydrogen generation, transport, storage, and utilization across sectors and expand fuel cell applications beyond light duty vehicles. Investments in hydrogen fuel R&D technologies will help avoid curtailing variable renewables like solar and wind; optimize baseload operation of nuclear, coal, and natural gas plants; and will support innovations in the industrial sector like steel manufacturing, manufacturing for low cost hydrogen production, and the development of carriers for economical storage and transport of hydrogen, including export potential. Investments in fuel cell technologies will increase the emphasis on heavy-duty vehicles and new applications (e.g. trucks, marine, rail, aviation, data centers). In addition, the Budget funds materials and component R&D for affordable hydrogen infrastructure, electrolyzer R&D, and carbon fiber R&D. FY 2021 funding will focus on reducing the cost and improving the performance and durability of fuel cells, as well as developing affordable and efficient technologies supporting hydrogen production, delivery, and storage for new uses.

Renewable Power

Solar Energy — FY 2021 funding supports the DOE in improving the affordability, reliability, and performance of solar technologies on the grid. Reflecting the recent and projected future growth in Photo Voltaic deployment, the program is placing a continued emphasis on addressing the challenges and opportunities related to integrating high penetrations of solar onto the electric grid, including the integration of solar energy with energy storage and other technologies for solar energy to be available on demand. The program will also continue its efforts to build the knowledge base upon which industry can achieve further reductions in the cost of solar electricity, promoting greater energy affordability. Taken together, these objectives will invigorate American technological leadership in solar energy, diversify the Nation's electricity supply, enhance grid resilience and reliability, and catalyze domestic economic growth including job creation.

Wind Energy — FY 2021 funding supports fundamental, early-stage R&D to improve 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 cost and risks, technology to reduce on-site operations and maintenance (O&M) costs, 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 Levelized Cost of Energy and maximize the value and resiliency of microgrids using wind energy. Funding will address wind and radar challenges, develop technical solutions to reduce environmental compliance costs, and support development of a robust domestic wind energy workforce.

Water Power — FY 2021 funding supports R&D and strengthen the body of scientific and engineering knowledge that enables industry to develop new technologies that increase U.S. hydropower and marine and hydrokinetic energy generation. The program supports the Energy Storage Grand Challenge and continues its focus on hydropower and Pumped-Storage Hydropower's (PSH) roles in grid reliability and resiliency. The program continues National Laboratory and industry R&D efforts to develop standard, modular, hydropower components, and site designs for new opportunities at existing non-powered dams. The program also supports an ongoing effort in hydropower plant upgrades and modernization to help provide the tools, technology, and analysis necessary to maintain and enhance the existing hydropower fleet. It also continues its work to develop turbine design and evaluation tools that improve fish passage and turbine efficiency in order

to reduce the time, cost, and uncertainty in hydropower licensing. In marine and hydrokinetics (MHK), the program will competitively select industry-led projects to test and validate performance of at least one wave device at PacWave, the Nation's first accredited grid-connected MHK test facility in a high-energy site. The program continues assistance to private industry to test early stage subscale marine energy systems, in collaboration with U.S. universities and the National Laboratories and through its partnerships with the Navy.

Geothermal Technologies — FY 2021 funding supports early-stage R&D of Geothermal Technologies. Within Enhanced Geothermal Systems (EGS), the program will continue implementation of the Frontier Observatory for Research in Geothermal Energy (FORGE) in Milford, Utah in FY 2021 with prior year funds. Requested funding will support two new subsurface enhancement and sustainability efforts. The first will target advanced completions and wellbore engineering to facilitate successful isolation of targeted zones for stimulation, and the other will focus on methods or tools for assessing and tracking fundamental hydraulic properties of EGS reservoirs, including the amount of time it takes fluid to pass through a reservoir. The Hydrothermal subprogram will focus on drilling technologies; building on the work awarded under the 2018 EDGE Funding Opportunity. The request also provides funding to validate technologies developed under the Energy Storage Grand Challenge. Following on prior year work, the program will initiate an effort to attract innovative technologies that can effectively separate critical materials from geothermal brines**.**

Energy Efficiency

Advanced Manufacturing — FY 2021 funding supports early-stage 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 to develop technologies to enable domestic supply of critical materials related to energy applications, substitutes for critical materials and technologies for reuse and recycling of critical materials. Funding is also requested for the Energy Storage Grand Challenge to develop innovative manufacturing processes for energy storage systems; the Harsh Environment Materials Initiative, a 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; and joint research with the Bioenergy Technologies Office under the Plastics Innovation Challenge to develop new plastic recycling technologies and the next generation of bio-derived polymers that are recyclable by design.

Federal Energy Management Program (FEMP) — FY 2021 funding will strengthen agencies' ability and agility to manage their critical missions and to provide strategic energy management assistance for agencies to become resilient, efficient and secure in support of Administration priorities for American energy dominance. FEMP will strive to increase government accountability and development of a future-focused workforce. FEMP supplies agencies with the information, tools, and technical assistance needed to meet and track energy-related requirements and goals through strategic programming and integration planning, facility and fleet optimization, energy and water resilience and security, energy and project procurement development services, and federal leadership.

Building Technologies — FY 2021 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, affordable, and secure building systems. In support of the Energy Storage Grand Challenge, particular focus will be placed on building system interaction with the grid in terms of controllable loads and thermal energy storage technologies. A key goal of the Buildings program is to overcome the high degree of fragmentation across the heterogeneous buildings industry, spanning construction to appliance and equipment manufacturing, to enhance energy efficiency. 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 cyber-secure advanced sensors and controls will help strengthen the body of knowledge to enable industry 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, resilience, and energy affordability. Through the Better Buildings Initiative, the Building program will foster the accelerated adoption of energy efficient technologies and practices by attracting and establishing close, trusted relationships with key market leaders and encourage private sector investment into energy efficient technologies.

Weatherization and Intergovernmental Programs — The Budget provides no funding in FY 2021 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 2021 will encompass 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.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Electricity					
Transmission Reliability and Resilience	39,000	57,000	55,950	-1,050	-1.8%
Resilient Distribution Systems	40,000	45,000	18,300	-26,700	-59.3%
Energy Storage	46,000	56,000	83,500	+27,500	+49.1%
Transformer Resilience and Advanced Components	7,000	7,000	9,000	+2,000	+28.6%
DCEI Energy Mission Assurance	0	0	1,650	+1,650	N/A
Transmission Permitting and Technical Assistance	7,000	7,000	7,000	0	0.0%
Program Direction	17,000	18,000	19,645	+1,645	+9.1%
Total, Electricity	**156,000**	**190,000**	**195,045**	**+5,045**	**+2.7%**

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 electricity. 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 to secure the electrification for the Nation. The goal for the future grid is to deliver reliable, affordable, and resilient electricity.

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 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 for U.S. economic competitiveness and leadership.

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

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

- 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 Energy Storage Grand Challenge (ESGC) objectives and other OE R&D efforts are also complementary to ESGC 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.

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 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 Request supports assessment of cross-infrastructure interdependencies and contingencies in the North American energy system. 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.[a] A Sensors and Data Analytics activity is also continued 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 is primarily due to transitioning core capabilities of the DOE-developed Advanced Distribution Management System (ADMS) platform to industry for further development in response to industry needs and because the Coordinated Management of Microgrids and Networked Distributed Energy Resources (COMMANDER) National Testbed Laboratory was fully funded in FY 2020.

- **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. OE's Energy Storage program is part of the ESGC crosscut, and was also part of the Department's Advanced Energy Storage Initiative, which is included within the ESGC. The increase supports design and construction 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. The increase is offset by reductions for two Congressionally directed projects that were fully funded in FY 2020.

- **Transformer Resilience and Advanced Components** supports modernization, hardening, response, and restoration of electric infrastructure 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. TRAC will continue

[a] 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

to address critical research needs for solid-state power substations (SSPS) with an emphasis on advanced materials, embedded sensors, and capabilities to evaluate prototype converter building blocks.

- **Defense Critical Energy Infrastructure (DCEI) Energy Mission Assurance** will identify, evaluate, prioritize, and assist in developing executable strategies to strengthen the energy infrastructure systems that supply critical infrastructure needed for government continuity following severe natural and manmade disasters and events. This is a proposed new activity in FY 2021 and will be coordinated with owners and users of DCEI.

- **Transmission Permitting and Technical Assistance** promotes a resilient and reliable electricity system by addressing key institutional issues through a collaborative process with Federal, State, local, territorial, Tribal, regional, community, and industry decision makers. TPTA works with experts around the country to advance methods and approaches addressing emerging challenges including incorporating resilience into planning processes, developing effective grid modernization strategies, evaluating myriad resource options, improving the coordination of planning and operations across the bulk power and distribution systems, and applying regulatory and business models that provide the appropriate incentives for building a resilient and efficient energy system.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Power Marketing Administrations					
Southeastern Power Administration					
Southeastern Power Administration	75,324	77,301	96,647	+19,346	+25.0%
Less Alternative Financing/Offsetting Collections	-75,324	-77,301	-96,647	-19,346	-25.0%
Total, Southeastern Power Administration	**0**	**0**	**0**	**0**	**N/A**
Southwestern Power Administration					
Southwestern Power Administration	126,876	131,863	157,194	+25,331	+19.2%
Less Alternative Financing/Offsetting Collections	-116,476	-121,463	-146,794	-25,331	-20.9%
Total, Southwestern Power Administration	**10,400**	**10,400**	**10,400**	**0**	**N/A**
Western Area Power Administration					
Western Area Power Administration (CROM)					
Western Area Power Administration (CROM)	834,567	883,923	878,633	-5,290	-0.6%
Less Alternative Financing/Offsetting Collections (CROM)	-745,195	-789,551	-774,261	-15,290	-1.9%
Rescission of Prior Year Balances	0	-176	0	+176	+100.0%
Use of Prior Year Balances	0	-5,000	-15,000	-10,000	-200.0%
Total, Western Area Power Administration (CROM)	**89,372**	**89,196**	**89,372**	**+176**	**+0.2%**
Falcon and Amistad O&M Fund					
Operation and Maintenance	4,440	5,647	7,302	+1,655	+29.3%
Less Alternative Financing/Offsetting Collections	-1,712	-4,119	-7,074	-2,955	-71.7%
Use of Prior Year Balances	-2,500	-1,300	0	+1,300	+100.0%
Total, Falcon and Amistad O&M Fund	**228**	**228**	**228**	**0**	**0.0%**
Colorado River Basins Power Marketing Fund					
Spending Authority from Offsetting Collections	220,337	220,244	245,047	+24,803	+11.3%
Offsetting Collections	-220,337	-263,044	-266,447	-3,403	-1.3%
Total, Colorado River Basins Power Marketing Fund	**0**	**-42,800**	**-21,400**	**+21,400**	**+50.0%**
Total, Western Area Power Administration	**89,600**	**46,624**	**68,200**	**+21,576**	**+46.3%**
Total, Power Marketing Administrations	**100,000**	**57,024**	**78,600**	**+21,576**	**+37.8%**

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 facilitate faster recoupment of 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. The FY 2021 budget request also seeks authority for Southeastern to purchase or construct a new headquarters facility.

- **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 maintain the infrastructure and modernize systems to increase the reliability, efficiency, and use of Federal assets, Southwestern utilizes appropriations, Federal power receipts, and alternative financing. Of these, 93.0% is derived from use of receipts and alternative financing, resulting in a net appropriation of only 7.0%.

- **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. 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 increased 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 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 primarily 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 2021, estimated total requirements of all Bonneville programs of $4,246 million include estimated budget obligations of $3,844 and

estimated capital transfers of $402 million. Estimated obligations include operating expenses of $2,978 million, capital investments of $800 million, and $66 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.

The budget includes a re-proposal to authorize the Federal government to sell/divest the transmission assets of Bonneville Power Administration, which operates and maintains over 15,000 circuit-miles of high voltage transmission lines and 261 substations. The budget also includes a proposal to change the statutory requirement that the rates the PMAs charge be based on recovering costs to a rate structure that takes into consideration rates charged by comparable utilities and which could allow for faster recoupment of tax payer investment.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Cybersecurity, Energy Security, and Emergency Response					
Cybersecurity for Energy Delivery Systems	89,500	95,000	103,100	+8,100	+8.5%
Infrastructure Security and Energy Restoration	19,000	48,000	70,000	+22,000	+45.8%
Program Direction	11,500	13,000	11,521	-1,479	-11.4%
Total, Cybersecurity, Energy Security, and Emergency Response	**120,000**	**156,000**	**184,621**	**+28,621**	**+18.3%**

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 energy sector 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 and other federal agencies, 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 access and actions) of the U.S. energy infrastructure. Reliable, resilient, and secure 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 assist utilities secure and reduce risks to today's energy infrastructure from advanced cyber threats and design next-generation systems that are built from inception to automatically detect, reject, and withstand cyber incidents, regardless of the threat.
- Public and private-sector partnerships to strengthen the energy sector's cybersecurity posture, using 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 entities, for preparedness, resilience, and recovery of U.S. energy infrastructure from all threats and hazards.

Program Highlights

- **Cybersecurity for Energy Delivery Systems** (CEDS) 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 aims to 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 may support 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 Request supports the acceleration of research and development initiatives, in particular for the Cybersecurity for the Operational Technology Environment (CyOTE™) program, building upon the initial pilot activities to test and analyze the scalability of the technology and vendor neutral approach. This type of approach includes the secure cloud storage and access controls for DOE access control capabilities which are designed to limit access to data based on individual energy sector company's data-sharing. The

CEDS request includes support to the application of state-of-the-art capabilities including the continued development and operation of the Cyber Analytics Tools and Techniques 2.0 (CATT™2.0) 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. The capabilities will include the ability to pre-process data to filter redundant data, anonymize/de-anonymize, and tag data from different sources into a standardized format for CATT™ analytics. The request also supports the establishment of 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).

- **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.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Fossil Energy Petroleum Accounts					
Naval Petroleum and Oil Shale Reserves					
Production Operations	8,000	12,000	11,000	-1,000	-8.3%
Management	2,000	2,000	2,006	+6	0.3%
Total, Naval Petroleum and Oil Shale Reserves	**10,000**	**14,000**	**13,006**	**-994**	**-7.1%**
Strategic Petroleum Reserve					
Facilities Development and Operations	180,026	168,235	159,174	-9,061	-5.4%
Management for SPR Operations	25,974	26,765	27,907	+1,142	+4.3%
Northeast Gasoline Supply Reserve	29,000	0	0	0	0
Northeast Home Heating Oil Reserve[1]					
Northeast Home Heating Oil Reserve	10,000	10,000	0	-10,000	-100%
Total, Northeast Home Heating Oil Reserve	**10,000**	**10,000**	**0**	**-10,000**	**-100%**
SPR Petroleum Account[2]					
SPR Petroleum Account	10,000	10,000	0	0	0
Total, SPR Petroleum Account	**10,000**	**10,000**	**0**	**0**	**0**
Total, Fossil Energy Petroleum Accounts	**265,000**	**229,000**	**200,087**	**-28,913**	**-12.6%**
Energy Security & Infrastructure Modernization Fund	**300,000**	**150,000**	**0**	**-150,000**	**-100.0%**
Offsets					
Sale of Northeast Home Heating Oil Reserve	0	0	-94,000	-94,000	N/A
Use of Receipts for Northeast Home Heating Oil Reserve	0	0	19,000	19,000	N/A
Net Sale of Northeast Home Heating Oil Reserve	**0**	**0**	**-75,000**	**-75,000**	**N/A**
Sale of Oil from Strategic Petroleum Reserve[3]	0	0	-831,000	-831,000	N/A
Use of Receipts for Elk Hills Remediation	0	0	242,000	242,000	N/A
Net of Sale from SPR	**0**	**0**	**-589,000**	**-589,000**	**N/A**

Appropriation Overview

Fossil Energy Petroleum Accounts consist of three energy security programs, one SPR modernization program, and post-sale remediation activities at Naval Petroleum Reserves Nos. 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, all of which are re-proposed for sale and closure given the lack of use for mission-based purposes and represent a low value for taxpayers. Legacy environmental clean-up and 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). This proposal will allow us to complete activities in the mid-2020's.

[1] In FY 2021, The Department is requesting authority to disestablish the Northeast Home Heating Oil Reserve and sell the one-million barrels of government-owned ultra-low sulfur distillate.

[2] The FY 2020 Congressional Budget Justification did not include a request for direct appropriations; instead, the Department requested authorization to deposit up to $27 million in proceeds from the sale of the Northeast Gasoline Supply Reserve's (NGSR) one-million barrels of refined petroleum product (gasoline blendstock). Similarly, the FY 2021 budget request re-proposes selling the NGSR's entire product reserve and requests authorization to deposit into the SPR Petroleum Account up to $19 million in proceeds from the proposed sale.

[3] Total includes Northeast Gasoline Supply Reserve.

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. Program will perform cavern wellbore testing and remediation activities to ensure the availability of the SPR's crude oil inventory.

  - Northeast Gasoline Supply Reserve: The Budget re-preposes to disestablish the NGSR in this FY 2021 request. The NGSR has not been used since its establishment, and is not considered to be cost efficient or operationally effective. A portion of the proceeds from sale will finance logistical costs associated with current law SPR crude oil sales with the remainder dedicated to deficit reduction.

- **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 $19 million in proceeds from the proposed sale of one-million barrels of refined petroleum product (gasoline blendstock) from the 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 January 2020, 98 AOCs have received NFA certification from California's DTSC, and 4 AOCs are under DTSC review for NFA certification. The remaining 29 AOCs require remediation. This FY 2021 budget request includes funding that supports remediation of 3 sub-AOCs.

  In addition to the $13 million appropriation request, the Department is proposing a sale of 15 million barrels of SPR crude oil to raise funding for other Departmental priorities, including $242 million needed to fund the completion of comprehensive remediation work at the NPR-1 site.

- **Northeast Home Heating Oil Reserve**
  The Budget re-proposes to disestablish the Northeast Home Heating Oil Reserve (NEHHOR) in this FY 2021 request. The NEHHOR has never been used for its intended purpose to supplement heating oil supplies following a disruption since it was established, and the reserve is not a good use of taxpayer funds.

- **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 concluded the four-year (2017 - 2020) financing structure of multi-year crude oil sales that support an effective modernization program for the SPR. No budget request is made for FY 2021.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Fossil Energy Research and Development					
Advanced Coal Energy Systems and CCUS					
Advanced Energy Systems	157,683	150,000	321,900	+171,900	+114.6%
Cross-cutting Research	46,350	49,000	65,250	+16,250	+33.2%
Carbon Capture, Utilization and Storage	198,767	217,800	123,000	-94,800	-43.5%
Supercritical Transformational Electric Power (STEP)	22,430	16,000	0	-16,000	-100.0%
Transformational Coal Pilots	25,000	20,000	0	-20,000	-100.0%
NETL Coal Research and Development	36,000	38,000	36,000	-2,000	-5.3%
Subtotal, Advanced Coal Energy Systems and CCUS	**486,230**	**490,800**	**546,150**	**+55,350**	**+11.3%**
Natural Gas Technologies	51,000	51,000	15,000	-36,000	-70.6%
Unconventional Fossil Energy Technologies from	46,000	46,000	17,000	-29,000	-63.0%
Program Direction	61,070	61,500	62,451	+951	+1.5%
Special Recruitment Programs	700	700	900	+200	+28.6%
NETL Infrastructure	45,000	50,000	43,100	-6,900	-13.8%
NETL Research and Operations	50,000	50,000	46,000	-4,000	-8.0%
Total, Fossil Energy Research & Development	**740,000**	**750,000**	**730,601**	**-19,399**	**-2.6%**

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:

- Novel fossil-fueled power systems and components that improve the reliability and efficiency of new and existing units;
- Advanced materials and computational systems;
- Utilization of coal and CO_2 for the production of critical materials and products;
- Transformational CO_2 capture technologies applicable to both new and existing fossil-fueled facilities; and,
- 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 proposed restructure of the Advanced Energy Systems (AES) and Carbon, Capture, Utilization & Storage (CCUS) accounts within FER&D is designed to create better alignment between program budget structure and DOE-FE's programmatic and research priorities to efficiently support early-stage, transformational R&D that has the potential to modernize our fossil generation infrastructure, provide economic benefits to consumers, and provide resiliency to the grid. With better alignment, DOE is able to more effectively manage programs, projects, and day-to-day R&D activities, and clearly link the funding and related authorized work to measurable program outcomes. A funding crosswalk in the "Budget Structure Crosswalks" chapter of this narrative provides details of the proposed changes.

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 by:

- Advancing the Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) initiative: R&D on technologies for coal plants of the future that are highly efficient and flexible, with zero or 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.

The Office of Fossil Energy has launched an effort—the Coal FIRST (Flexible, Innovative, Resilient, Small, and Transformative) initiative—to support R&D insights and integrated designs of the coal plant of the future needed to provide secure, stable, and reliable power. The Coal FIRST initiative will make future coal-fired power plants more adaptive to the modern electrical grid and eliminate emissions. The initiative is focused on early stage R&D that benefits multiple technologies for use with different coal types and regions throughout the United States across a broader coal and power industry, including publically available reports on the results of the R&D. Through innovative technologies and advanced approaches to design and manufacturing, the initiative will look beyond today's utility-scale power plant concepts (e.g. base-load units) in ways that facilitate electrical grid integration both domestically and internationally. Modular Coal FIRST technologies could increase U.S. energy exports, create domestic jobs, and support our partners abroad—reducing energy poverty in African and Asian nations, while providing affordable electricity and opportunities for economic prosperity to people worldwide.

DOE envisions the future coal fleet may be based on electricity generating units possessing traits, such as:

- Zero or near-zero emissions including carbon dioxide or even negative emissions when combined with biomass co-firing;
- High overall plant efficiency (40%+ HHV or higher at full load, with minimal reductions in efficiency over the required generation range);
- Small, high-quality, low-cost units that minimize field construction time;
- Ramp rates and minimum loads compatible with 2050 estimates of renewable energy integration;
- Integration with thermal or other energy storage (e.g., chemical production) to mitigate inefficiencies and equipment damage;
- Minimized water consumption;
- Accelerated design, construction, and commissioning schedules;
- Enhanced maintenance features, including technology advances with monitoring and diagnostics to reduce downtime;
- Integration with coal upgrading, or other plant value streams (e.g., co-production); and,
- Capable of natural gas co-firing.

- **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 while maintaining environmental standards. Early-stage R&D will focus on developing and testing power plant components; novel combustion processes; advanced coal processing; and advanced materials for components, turbines, and fuel cells that will improve the competitiveness of new and existing coal-fired power plants. Development of advanced coal power plants of the future will restore U.S. technical leadership in this area while maintaining the required technical advancements to service the existing fleet for grid stability.

  Specific efforts will focus on seven R&D activities:
  - Advanced Combustion/Gasification Systems;
  - Advanced Turbine;
  - Solid Oxide Fuel Cells;
  - Advanced Sensors and Controls and Other Novel Concepts;
  - Advanced Coal Processing;
  - Advanced Energy Materials; and,
  - Power Generation Efficiency.

R&D advances in these areas will support performance improvements for the existing coal fleet, which in turn can also apply to the future fleet. Two key goals of the AES subprogram are to improve the average modeled efficiency (heat rate) of a typical plant in the existing fleet by 5% (i.e., to 32.5% from the 2017 baseline of 31%) by the end of FY 2022, and of an advanced or new coal plant by 5+% by the end of FY 2023 (i.e., to 40+% from the 2017 baseline of 38% of the most recently constructed plants). The primary focus on coal-based power systems, improvements to these technologies are also accretive to other fossil energy systems.

- **Crosscutting Research**
  The Crosscutting Research subprogram advances and accelerates promising fossil energy technology by supporting innovative early-stage R&D that improves the reliability, availability, efficiency, and environmental performance of advanced fossil-based power systems. The program also aims to obtain new knowledge regarding plant performance and operation that can be incorporated into a new generation of plant control technologies. Crosscutting Research is focused on six activities:
  - Critical Minerals (CM);
  - Water Management R&D;
  - Modeling, Simulation and Analysis;
  - Advanced Energy Storage Initiative (AESI);
  - University Training and Research (UTR), which comprises funding for University Coal Research (UCR), Historically Black Colleges and Universities (HBCU) and other Minority-Serving Institutions (MSI); and,
  - International Activities.

- **Carbon Capture, Utilization & Storage**
  The CCUS subprogram is focused on early-stage R&D that reduces the cost of capturing CO_2 from fossil, industrial sources, and from the atmosphere, systems that result in negative CO_2 emissions; advances approaches to safely and securely store CO_2 underground long-term; and advances novel approaches to using CO_2, such as developing useable products and fuels. Specifically, carbon capture R&D is focused on the development of transformational CO_2 separation technologies—membranes, sorbents, solvents, and cryogenic—for both pre- and post-combustion coal-fired power plants systems that will capture CO_2 at approximately $30 per ton. The program will also use its previous and existing CCUS R&D efforts for other applications such as natural gas power, industrial sources, and negative emissions technologies such as direct air capture. Many of the technologies developed for pre- and post-combustion carbon capture can be applied to these sectors. Carbon utilization R&D is focused on using captured CO_2 and/or carbon-containing substances, or directly using CO_2 from flue gas or other gas streams, and conversion into valuable products. Carbon storage R&D supports the development and testing of advanced sensing and data telemetry capabilities, fault/fracture network characterization, stress state, fluid/pressure migration, and wellbore integrity that advanced real-time, decision-making capabilities. A goal of the CCUS subprogram is to support a new coal-fired plant with CO_2 capture at a cost of electricity at least 30% lower than a supercritical pulverized coal (PC) with CO_2 capture, or approximately $30 per ton of CO_2 captured by 2030. For existing plant retrofits, the subprogram's goal is to reduce the cost of capture by 30% (actual cost of capture varies for each unit).

- **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 use funding to 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.

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 the Nation's energy independence through early-stage research and development that supports the prudent development, distribution, and storage of natural gas resources. The program is comprised of two subprograms: Natural Gas Infrastructure Research and Gas Hydrates. Given the importance of natural gas in the energy system, it is critical for 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 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:
  - High Performance Computer
  - Laboratory and Site-wide Facilities
  - Safeguards and Security; and,
  - 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.

- **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 2019 Enacted[1,2]	FY 2020 Enacted[1,3]	FY 2021 Request	FY 2021 Request vs FY 2020 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%
Reactor Concepts RD&D	323,500	267,000	111,500	-155,500	-58.2%
Fuel Cycle Research and Development	263,915	305,100	187,000	-118,100	-38.7%
Nuclear Energy Enabling Technologies	152,585	113,450	116,000	2,550	2.2%
Radiological Facilities Management	29,000	0	11,500	11,500	100.0%
Advanced Reactor Demonstration Program	0	230,000	20,000	-210,000	-91.3%
Versatile Test Reactor Project	0	0	295,000	295,000	100.0%
Infrastructure	0	334,450	0	-334,450	-100.0%
Idaho Facilities Management	318,000	0	226,000	226,000	100.0%
Idaho Sitewide Safeguards and Security	146,090	153,408	137,800	-15,608	-10.2%
International Nuclear Energy Cooperation	3,000	0	0	0	0.0%
Program Direction	80,000	80,000	75,131	-4,869	-6.1%
Total, Nuclear Energy	**1,326,090**	**1,493,408**	**1,179,931**	**-313,477**	**-21.0%**

Appropriation Overview

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

Program Highlights

- **Reactor Concepts Research, Development and Demonstration**
  Activities will include early-stage cost-shared research under Advanced Small Modular Reactor Research and Development (R&D); support Light Water Reactor Sustainability through early-stage cost-shared efforts to extend the life and improve the economic competitiveness of the existing commercial nuclear reactor fleet through research in the areas of materials aging and degradation, safety margin characterization, safety technologies, and instrumentation and controls; and early-stage research into other 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.

- **Fuel Cycle Research and Development**
  Request includes enhanced emphasis on Used Nuclear Fuel Disposition R&D to expand and accelerate research and development on storage, transportation, and disposal technologies. It also supports progress towards developing one or more light water reactor fuel concepts with significantly enhanced accident tolerance, the investigation of technologies for producing high assay low enriched uranium (HALEU), and R&D supporting mining and conversion capabilities in the U.S. including investigation of advanced uranium production water treatment technologies.

[1] Funding does not reflect the transfer of SBIR/STTR to the Office of Science.

[2] Funding does not reflect the mandatory transfer of $85.5M from Naval Reactors for operation of the Advanced Test Reactor.

[3] Funding does not reflect the mandatory transfer of $88.5M from Naval Reactors for operation of the Advanced Test Reactor.

- **Nuclear Energy Enabling Technologies**
  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. 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 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 Budget 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. Activities include procurement of Training, Research, Isotopes, General Atomics (TRIGA) fuel elements. This effort supports U.S. universities to have access to a life time supply of fuel for TRIGA research reactors.

- **Advanced Reactor Demonstration Program**
  The Budget provides funding for R&D in support of the newly-established Advanced Reactor Demonstration Program This funding will continue the R&D portions of the program. In FY 2021, the program supports execution of the FY 2020 demonstration awards.

- **Versatile Test Reactor Project**
  Formal establishment of the Versatile Test Reactor (VTR) Project as a line item construction project. This effort will provide the U.S. with a fast neutron testing capability to support the development of advanced nuclear reactor technologies. The VTR project will provide a leading-edge capability for accelerated testing of advanced nuclear fuels, materials, instrumentation, and sensors. Critical Decision (CD)-0, Approve Mission Need, for the Versatile Test Reactor (VTR) project was granted on February 22, 2019 and CD-1, Alternative Selection and Cost Range, is expected by the end of the third quarter of FY 2020 with completion of National Environmental Policy Act (NEPA) documents and initiation of long lead procurements in the fourth quarter of FY 2021.

- **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 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Uranium Reserve					
Uranium Acquisition and Storage	0	0	150,000	+150,000	N/A
Total, Uranium Reserve	**0**	**0**	**150,000**	**+150,000**	**N/A**

Overview

The Uranium Reserve (UR) program provides assurance of availability of uranium in the event of a market disruption and supports strategic U.S. fuel cycle capabilities. In addition, while no immediate national security need has been identified, the reserve may also provide a source of U.S.-origin uranium. Establishing a reserve is an urgent step needed in response to an overreliance on imported uranium product that has undermined U.S. energy security and impacted U.S. fuel supply capabilities. This action addresses near-term challenges to the production and conversion of domestic uranium, where the risks are most immediate, and is consistent with the priorities of the Administration's Nuclear Fuel Working Group (NFWG). U.S. energy and national security depends upon a viable U.S. nuclear fuel cycle.

On July 12, 2019, the President issued a Memorandum, which states that "the United States uranium industry faces significant challenges in producing uranium domestically and that this is an issue of national security." The NFWG was directed to "examine the current state of domestic nuclear fuel production to reinvigorate the entire nuclear fuel supply chain, consistent with United States national security and nonproliferation goals." The NFWG will continue to evaluate domestic uranium production issues and the challenges facing the front end of the fuel cycle and is preparing its findings and recommendations for presentation to the President.

Highlights of the FY 2021 Budget Request

The FY 2021 Budget Request of $150 million establishes the UR for the U.S. to support domestic uranium production and uranium conversion services, provides assurances of uranium availability in the event of a market disruption, and supports strategic U.S. fuel cycle capabilities.

In addition, the Office of Nuclear Energy will interact with policy entities, and collect information from industry to establish an acquisition approach, and begin procurement of U.S. uranium for the reserve and conversion services for uranium. It is expected that this effort will directly support the operation of at least two U.S. uranium mines and the reestablishment of active domestic conversion capabilities. The UR is not designed to replace or disrupt market mechanisms.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Interim Storage and Nuclear Waste Fund Oversight					
Interim Storage and Nuclear Waste Fund Oversight	0	0	27,500	+27,500	N/A
Total, Interim Storage and Nuclear Waste Fund Oversight	**0**	**0**	**27,500**	**+27,500**	**N/A**

Appropriation Overview

The mission of the **Interim Storage and Nuclear Waste Fund Oversight** program is to develop and implement a robust interim storage program, support the Department's fiduciary responsibilities for Yucca Mountain, and continue oversight of the Nuclear Waste Fund (NWF). The actions of this program contribute to the safe and secure management of spent nuclear fuel and high-level waste currently located at numerous sites across the United States and the Department remains committed to fulfilling the Federal Government's legal and moral obligations to properly manage and dispose of that material. The FY 2021 Budget Request proposes funding from the NWF in the amount of $27,500,000.

Program Highlights

The Interim Storage and Nuclear Waste Fund Oversight program's FY 2021 Budget Request prioritizes the development and implementation of an interim storage program for nuclear waste. Funding is primarily dedicated to performing activities that would lay the groundwork necessary to ensure near –term deployment of interim storage to ensure safe and effective consolidation and temporary storage of nuclear waste.

The Request also includes funding for continued oversight for the NWF fiduciary responsibilities for the Yucca Mountain site to include the security, maintenance, and environmental requirements.

These funds are inclusive of program direction activities necessary to carry out the mission.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 vs. FY 2020 $	FY 2021 vs. FY 2020 %
Indian Energy Policy and Programs					
Indian Energy Policy and Programs	13,200	17,000	4,479	-12,521	-73.6%
Program Direction	4,800	5,000	3,526	-1,474	-29.5%
Total	**18,000**	**22,000**	**8,005**	**-13,995**	**-63.6%**

Appropriation Overview

The Office of Indian Energy Policy and Program's (IE) financial and technical assistance are beneficial in 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

The Office of Indian Energy Policy and Program's financial and technical assistance are beneficial to promoting energy development, efficiency, and use, reducing or stabilize energy costs, strengthening energy and economic infrastructure, and bringing electrical power and service to Indian land and homes, with the ancillary benefit of providing employment on Tribal Lands. This assistance is intended to overcome barriers to energy development, increase energy reliability and resiliency, and electrify lands and homes.

Technical assistance facilitates expeditious obligation of funds towards Alaska and Arctic energy initiatives. In their unique role, our partners can rapidly deploy federal solutions in the State of Alaska. The technical assistance initiative ensures more appropriate and local support to energy technical assistance requests. Through local partner organizations Indian Energy can deliver Alaskan solutions with Alaskans very familiar with the nuances and challenges of the state. Previously, Indian Energy relied on the National Renewable Energy Laboratory to provide services in-state. For highly specialized needs, the lab will still be leveraged; all routine technical assistance will be delivered locally by experts who know Alaska best.

Alaska Native Energy STEM education targets K-12 students across the state of Alaska to introduce them to energy education and possible careers. The program is administered with the help of our federal partner through a local non-profit education organization that has existed for nearly fifty years. The initiative targets all of the state with a pilot community in each of twelve regions over the course of three semesters.

The Financial Assistance program will support funding opportunities toward energy infrastructure deployment in Indian Country in the form of competitive grant awards.

From 2010-2019, DOE's Office of Indian Energy has invested nearly $85 million in more than 180 tribal energy projects implemented across the contiguous 48 states and in Alaska. These projects, valued at over $180 million, are leveraged by $100 million in recipient cost share.

In FY 2019, the Office of Indian Energy awarded 13 grants for energy infrastructure, building on the 14 grants selected in FY 2018 and awarded in 2019. Combined these fuel and technology neutral energy projects valued at nearly $60 million, represent a DOE investment of nearly $22.5 million, resulting in tangible results. Specifically, these projects represent over 19 MW in new generation in Indian Country, savings of over $9 million annual for these communities and nearly $260 million over the life of the projects.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Environment, Health, Safety and Security Mission Support					
Environment, Health, Safety and Security Mission Support	133,839	136,839	134,320	-2,519	-1.8%
Program Direction	69,000	71,000	75,368	+4,368	+6.2%
Total, Environment, Health, Safety and Security Mission Support	**202,839**	**207,839**	**209,688**	**+1,849**	**+0.9%**

Appropriation Overview

Environment, Health, Safety and Security (EHSS) supports 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, 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.

In FY 2021, the Request proposes to:

- Keep DOE's EHSS policies 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 failing systems 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 and develop advanced computer tools to decrease the cost and increase the accuracy of derivative classifier work throughout the DOE/NNSA complex.
- Manage programs that support EHSS excellence and efficiency across the complex such as the Voluntary Protection Program.
- Manage programs that promote improvements in EHSS knowledge and capabilities such as the Nuclear Safety Research and Development Program and international health studies.

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**
  Provides 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 to 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**
  Provides Federal staffing, travel, support services and other resources required for execution of EHSS program activities and provides technical support for liaison activities with the Defense Nuclear Facilities Safety Board.

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Administrative Expenses	33,000	32,000	3,000	-29,000	-90.6%
Offsetting Collections[1]	-20,689	-3,000	-3,000	0	0
FY 2011 Loan Subsidy Cancellation[2]	0	0	-160,659	-160,659	N/A
Total	**12,311**	**29,000**	**-160,659**	**-189,659**	**-654.0%**
ARRA Loan Subsidy Cancellation[3]	0	0	-488,855	-488,855	N/A

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 2021 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 million in appropriation offset by $3 million in collections, the LPO will use approximately $26 million in unobligated balances carried forward from prior-year appropriations to cover loan portfolio monitoring and administrative expenses; salaries for full time employees as well as the cost of outside advisors for financial, legal, engineering, credit, and market analyses. In FY 2021, LPO will stop originating loans for the Title 17 Loan Guarantee Program, and will continue to monitor the existing portfolio. No projects are assumed to reach conditional commitment and no conditionally committed loans are expected to reach financial close prior to FY 2020.

Program Highlights

The FY 2021 Budget Request eliminates the Title 17 Loan Guarantee Program.

- The FY 2021 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, 2020.
- In addition to $3 million in appropriation offset by $3 million in collections, the Loan Programs Office (LPO) will use approximately $26 million in unobligated balances carried forward from prior-year appropriations to cover loan portfolio monitoring and administrative expenses.

[1] In FY 2019 $20,688,522.19 in fees were collected and credited as offsetting collections. Also, $2,108,157.89 in fees collected from prior years were made available. The Congressional estimate for fees to be received in FY 2019 was $15 million.

[2] The FY 2021 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 FY2021 Budget proposes to cancel $489 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.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Administrative Expenses	5,000	5,000	0	-5,000	-100%
Total	**5,000**	**5,000**	**0**	**-5,000**	**-100%**
Loan Subsidy Cancellation[a]	0	0	-4,333,500	- 4,333,500	N/A

[a] The FY 2021 Budget 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 cancellation.

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 2021 Budget eliminates the ATVM Loan Program and proposes to rescind $4.3 billion in remaining, emergency-designated, appropriated credit subsidy. The FY 2021 Budget proposes using 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 full-time employees as well as the cost of outside advisors for financial, legal, engineering, credit, and market analysis. In FY 2021, LPO will stop originating loans for the ATVM Loan Program, and will though continue to monitor the existing portfolio.

Program Highlights

The FY 2021 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 existing asset portfolios.
- The FY 2021 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 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Administrative Expenses	1,000	2,000	0	-2,000	-100.0%
Loan Subsidy Cancellation[1]	0	0	-8,500	-8,500	N/A
Total	1,000	2,000	-8,500	-10,500	-525.0%

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 2021 Budget Request eliminates TELGP and proposes to cancel the $8,500,000 appropriated for credit subsidy. Loan Programs Office (LPO) will use up to $2 million in unobligated balances carried forward from prior-year appropriations to cover administrative expenses necessary to implement program termination. In FY 2021, LPO will stop originating loans for TELGP, and will though continue to monitor any loans that may close prior to October 1, 2020.

Program Highlights

The FY 2021 Budget eliminates TELGP.

- The FY 2021 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 2021, LPO will discontinue loans origination activities for TELGP.
- The FY 2021 Budget proposes to use up to $2 million in unobligated balances carried forward from prior year appropriations for related administrative expenses.

[1] The FY 2021 Budget proposes to cancel $8.5 million in unobligated credit subsidy balances appropriated by the Consolidated Appropriations Act of 2017 (P.L. 115-31).

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Energy Information Administration					
National Energy Information System	125,000	126,800	128,710	1,910	1.5%
Total, Energy Information Administration	**125,000**	**126,800**	**128,710**	**1,910**	**1.5%**

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 support 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

The Request supports EIA's continued use of 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 energy 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.

EIA will also begin a multi-year effort to modernize its energy modeling capabilities. Expected benefits to EIA stakeholders include greater agility in EIA's modeling system to address key current and emerging trends, for example, the increased prominence of natural gas in the U.S. domestic energy profile, growing penetration of renewables, and more flexible options for modeling energy-related CO2 emissions.

The Request will also continue EIA's planned cybersecurity initiatives to bolster information security.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Office of Science					
Advanced Scientific Computing Research	935,500	980,000	988,051	+8,051	+0.8%
Basic Energy Sciences	2,166,000	2,213,000	1,935,673	-277,327	-12.5%
Biological and Environmental Research	705,000	750,000	516,934	-233,066	-31.1%
Fusion Energy Sciences	564,000	671,000	425,151	-245,849	-36.6%
High Energy Physics	980,000	1,045,000	818,131	-226,869	-21.7%
Nuclear Physics	690,000	713,000	653,327	-59,673	-8.4%
Workforce Development for Teachers and Scientists	22,500	28,000	20,500	-7,500	-26.8%
Science Laboratory Infrastructure	232,890	301,000	174,110	-126,890	-42.2%
Safeguards and Security	106,110	112,700	115,623	+2,923	+2.6%
Program Direction	183,000	186,300	190,306	+4,006	+2.2%
Total, Office of Science	**6,585,000**	**7,000,000**	**5,837,806**	**-1,162,194**	**-16.6%**

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 23,000 researchers located at over 300 institutions and the 17 DOE national laboratories, spanning all fifty states and the District of Columbia. The portfolio of 28 scientific user facilities serves over 33,000 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.

The SC Request includes ongoing investments to support the Administrations Industries of the Future (IOTF) initiative through research in quantum information sciences (QIS) and artificial intelligence (AI) and machine learning (ML). The Request also supports research efforts in next-generation microelectronics, genomic sciences to inform biosecurity research, and critical scientific infrastructure needs at DOE laboratories. The Request also initiates several new multidisciplinary research initiatives including: data and computational collaboration with NIH, integrated computational and data infrastructure for scientific discovery, next generation biology, rare earth and separation science, revolutionizing polymer upcycling, and strategic accelerator technology. These new initiatives position SC to meet new research demands in an enhanced collaborative effort.

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. The efforts prioritize basic research in applied mathematics and computer science with emphasis on the challenges of data intensive science, including AI and ML, and future computing technologies. The Request increases support for ASCR's Computational Partnerships with a focus on developing strategic partnerships in quantum computing and data

intensive applications, and new partnerships that broaden the impact of both exascale and data infrastructure investments in areas of strategic importance to DOE and SC. The Request funds:

- Research, development, and design activities to achieve exascale-capable systems with a five fold improvement in true application performance over the Summit system at the Oak Ridge Leadership Computing Facility.
- Foundational research to improve the robustness, reliability, and transparency of Big Data and AI technologies, uncertainty quantification, and development of software tools and initiation of an activity to deploy AI software and technologies to create an integrated computational and data infrastructure across the SC programs and laboratories.
- Support of core research in applied mathematics and computer science, the Scientific Discovery through Advanced Computing (SciDAC) program, and strategic partnerships aimed at understanding the challenges that quantum information and neuromorphic technologies pose to DOE mission applications.
- Support for partnerships with BES, HEP and FES in microelectronics and new data, and AI partnerships with NIH.
- In partnership with other SC programs, continuing support for QIS centers to promote basic research and early stage development to accelerate the advancement of QIS through vertical integration between systems and theory and hardware and software. In addition to the QIS centers, support for early stage research associated with the first steps to establish a dedicated Quantum Network.
- 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. The Request funds:

  - Core research activities to support Administration Priorities including QIS, next-generation microelectronics, data analytics and machine learning for data-driven science (AI/ML), exascale computing, next-generation biology, critical materials, polymer upcycling, and strategic accelerator technology.
  - Continuing support for the Energy Frontier Research Centers (EFRCs) as well as the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hubs.
  - 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, continuing support for QIS centers 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 near optimal levels: five x-ray light sources, two neutron scattering sources, and five research centers for nanoscale science that also supports QIS research and related tools development.
  - Five ongoing construction projects: the Advanced Photon Source Upgrade(APS-U), 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).
  - Continuing support for two 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.
  - A new construction project for a Cryomodule Repair and Maintenance Facility (CRMF).

- **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. The Request funds:

- Core research in biological systems science using approaches such as genome sequencing, secure biodesign, proteomics, metabolomics, structural biology, high-resolution imaging and characterization, including full support of the Bioenergy Research Centers. Integration of this experimental biological information into computational modelsfor iterative testing and validation to advance a predictive understanding of biological systems for use in secure, clean, affordable, and reliable energy for adaptation to industry, as well as contributing to QIS.
- New efforts in translating biodesign rules to functional properties of novel biological polymers.
- 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 The Request funds:
  - Research and facility operations at the DIII-D national fusion facility to support the study of high-priority topics identified by community research needs workshops.
  - The National Spherical Torus Experiment Upgrade (NSTX-U) recovery 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 at overseas superconducting tokamaks and stellerators and other international facilities with unique capabilities, enabled by U.S. hardware and intellectual contributions.
  - In partnership with other SC programs, continuing support for QIS centers to promote basic research early stage development to accelerate the advancement of QIS through vertical integration between systems and theory and hardware and software.
  - Support for SciDAC in partnership with ASCR, research in high-energy-density laboratory plasma science, and discovery plasma science.
  - 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.
  - Initial design funding for an experimental research end-station at the Linac Coherent Light Source User Facility for the Matter in Extreme Conditions Petawatt upgrade project.
  - 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, enabling the discovery of the most elementary constituents of matter and energy, the probing of the interactions among them, and the exploration of the basic nature of space and time. The Request funds:
  - Core research activities to support Administration Priorities: QIS, which opens prospects for new capabilities in sensing, simulation, and computing in support of the National Quantum Initiative; AI/ML, to address cross cutting challenges across the HEP program in coordination with DOE investments in exascale computing and associated AI efforts; next-generation microelectronics; and the Accelerator Traineeship Program for expanded workforce development in research areas of Advanced Technology R&D.

- Continuing support for QIS centers to promote basic research and early stage development necessary to accelerate the advancement of QIS through vertical integration between systems and theory and hardware and software.
- Core research activities, with emphasis on the physics of the Higgs boson, neutrinos, dark matter, and dark energy; exploring the unknown; and enabling early and visible scientific results from HEP project investments.
- R&D that requires long-term investments, including Advanced Technology R&D, Accelerator Stewardship, and cross-cutting efforts in QIS and AI/ML to accelerate discovery in particle physics.
- Continuing operation of HEP user facilities: Fermilab Accelerator Complex consists of four accelerators that work together to provide world-class particle beams for experiments at the Intensity Frontier; Brookhaven Accelerator Test Facility (ATF) provides high power lasers synchronized with high brightness electron beams, to explore the science of particle acceleration and radiation generation, and to develop new accelerator technologies; and SLAC Facility for Advanced Accelerator Experimental Tests (FACET) provides beam-driven plasma wakefield particle acceleration to carry out experiments.
- Continuing support to Sanford Underground Research Facility (SURF) to meet DOE expectations of reliable, efficient, and safe operations during the construction of Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNE/DUNE).
- Continuing support for the highest priority projects identified by the high energy physics community to include Fermilab-hosted LBNF/DUNE and Proton Improvement Plan-II (PIP-II), which will provide the world's highest proton beam intensity of greater than 1.2 megawatts, and the CERN-based, High-Luminosity Large Hadron Collider (HL-LHC) Accelerator, and A Toroidal LHC Apparatus (ATLAS) and Compact Muon Solenoid (CMS) Detector Upgrade Projects, supported in collaboration with international partners.
- Initial funding for the Cosmic Microwave Background-Stage 4 (CMB-S4) Major Item of Equipment. The sensitivity necessary to test the inflation model of cosmology requires designing the next generation CMB project. CMB-S4 will also provide information about dark energy and neutrino properties.
- Design studies support for a new Fermilab Accelerator Control System. Much of the Fermilab accelerator control system dates from the original 1970's construction. Upgrading the control system will allow the Fermilab Accelerator Complex to operate more precisely and efficiently, resulting in better performance and lower operating costs.

- **Nuclear Physics**
  Nuclear Physics (NP) supports research to discover, explore, and understand all forms of nuclear matter 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 preservation of 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, in support of the National Quantum Initiative.
  - Support for the DOE Isotope Program as it continues to introduce new medical isotopes for clinical trials and cancer therapy.
  - Operations of NP Facilities including: the Relativistic Heavy Ion Collider; the 12 GeV Continuous Electron Beam Accelerator Facility; the Argonne Tandem Linac Acceleratory System; and the Facility for Rare Isotope Beams (FRIB).
  - New initiatives in AI and Strategic Accelerator Research and Development to achieve groundbreaking advances in these fields related to Nuclear Physics.
  - Support for final efforts to complete the FRIB at Michigan State University consistent with the performance baseline profile. FRIB will provide world-leading capabilities for nuclear structure and nuclear astrophysics.
  - Continuation of engineering design of the U.S. Stable Isotope Production and Research Center (SIPRC) at ORNL to increase the domestic production capabilities of stable isotopes for scientific, industrial, national security, and medical uses.

- Continuing support for R&D and design activities for the Electron Ion Collider at BNL.
- Continuing design and long-lead activities for the SIPRC to mitigate U.S. dependence on foreign sources of enriched stable isotopes for research and applications.
- Support for fabrication of new NP scientific equipment: the Gamma-Ray Energy Tracking Array Major Item of Equipment (MIE), which will enable the provisioning of advanced, high resolution gamma ray detection capabilities for FRIB and the sPHENIX MIE, which will have enhanced capabilities that will further RHIC's scientific mission by studying high rate jet production; the High Resolution Spectrometer (HRS) to study fast neutron beams at FRIB, the Ton-scale Neutrinoless Double Beta Decay MIE 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 a sustained pipeline of science, technology, engineering, and mathematics workers to meet national goals and objectives, now and in the future.

- **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 at the ten SC DOE national laboratories. The Request funds:
  - Three new construction projects: Princeton Plasma Innovation Center and Critical Infrastructure Recovery & Renewal project at Princeton Plasma Physics Laboratory (PPPL), and the Infrastructure Modernization project at Ames.
  - Continuation of 15 ongoing construction projects: the Critical Utilities Rehabilitation project and the Science User Support Center at Brookhaven National Laboratory (BNL); the Seismic and Safety Modernization project, the Linear Assets Modernization project, and the Biological and Environmental Program Integration Center (BioEPIC) at Lawrence Berkeley National Laboratory (LBNL); the CEBAF Renovation and Expansion at Thomas Jefferson National Accelerator Facility (TJNAF); the Craft Resources Support Facility and the Translational Research Capability project at Oak Ridge National Laboratory (ORNL); the Critical Utilities Infrastructure Revitalization project and Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC); the Argonne Utilities Upgrade at Argonne National Laboratory (ANL); the Energy Sciences Capability project at Pacific Northwest National Laboratory (PNNL); the Utilities Infrastructure project and the Integrated Engineering Research Center at Fermi National Accelerator Laboratory (FNAL); and the Tritium System Demolition and Disposal project at PPPL.
  - General purpose infrastructure projects that will address inadequate core infrastructure and utility needs; 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 supports appropriate security measures are in place for the SC mission requirement of open scientific research and to protect critical assets within SC national laboratories. S&S increases by $2.9 million, or 2.6 percent, above the FY 2020 Enacted level. The Request funds:
  - Continued implementation of the Design Basis Threat and Science and Technology Policy 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 Request funds Salaries and Benefits, Travel, Support Services, Other Related Expenses, and Working Capital Fund requirements.

($K)

Environmental Management by Site	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs. FY 2020 Enacted	
				$	%
Brookhaven National Laboratory	20,456	0	0	0	0.0%
Carlsbad/Waste Isolation Pilot Plant (WIPP)	403,487	403,599	390,066	-13,533	-3.4%
Idaho National Laboratory	443,200	446,300	270,954	-175,346	-39.3%
Oak Ridge	646,281	682,348	431,848	-250,500	-36.7%
Paducah	274,024	314,339	282,403	-31,936	-10.2%
Portsmouth	475,806	493,427	491,306	-2,121	-0.4%
Richland	954,097	1,001,301	654,584	-346,717	-34.6%
River Protection	1,573,000	1,616,000	1,257,681	-358,319	-22.2%
Savannah River	1,551,014	1,629,924	1,702,870	72,946	4.5%
Lawrence Berkeley National Laboratory	35,000	31,000	0	-31,000	-100.0%
Lawrence Livermore National Laboratory	26,704	66,727	1,764	-64,963	-97.4%
Los Alamos National Laboratory	220,000	220,000	120,000	-100,000	-45.5%
Nevada	60,136	60,737	60,737	0	0.0%
Sandia National Laboratories	2,600	2,652	4,860	2,208	83.3%
Separation Process Research Unit (SPRU)	15,000	15,300	15,000	-300	-2.0%
West Valley Demonstration Project	78,133	79,611	92,411	12,800	16.1%
Energy Technology Engineering Center	11,000	18,200	11,000	-7,200	-39.6%
Moab	45,000	45,000	47,653	2,653	5.9%
Other Sites	4,889	4,987	4,987	0	0.0%
Headquarters Operations	12,979	14,179	12,979	-1,200	-8.5%
Technology Development	25,000	25,000	25,000	0	0.0%
Uranium/Thorium Reimbursement Program	11,000	5,250	21,284	16,034	305.4%
Program Direction	298,500	281,119	275,285	-5,834	-2.1%
Excess Facilities	0	10,000	0	-10,000	-100.0%
Subtotal, Environmental Management by Site					
Adjustments	**7,187,306**	**7,467,000**	**6,174,672**	**-1,292,328**	**-17.3%**
Use of Prior Year Balance (Defense Environmental Cleanup)	-7,577	**0**	**0**	0	0.0%
Rescission of Prior Year Balances	-4,600	**0**	-109,000	-109,000	0.0%
Use of Prior Year Balance (15-D-401 Containerized Sludge Removal)	0	-11,800	**0**	11,800	-100.0%
Total, Environmental Management by Site	**7,175,129**	**7,455,200**	**6,065,672**	**-1,389,528**	**-18.6%**

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**

  At the Savannah River Site, the FY 2021 supports the Liquid Waste Program, to achieve additional risk reduction by stabilization and immobilization of high activity radionuclides through vitrification into canisters at the Defense Waste Processing Facility and disposition of decontaminated salt waste in Saltstone Disposal Units. The mission of the Saltstone Disposal Unit #7 project is to construct a cylindrical reinforced concrete tank designed to contain approximately 30,000,000 gallons of Saltstone grout, which is the waste from the disposition of the decontaminated salt solution resulting from salt waste processing. The mission of the Saltstone Disposal Units #8 and #9 project is to construct two cylindrical reinforced concrete tanks designed to contain approximately 30,000,000 gallons of Saltstone grout each. The Salt Waste Processing Facility is poised to complete commissioning activities in FY 2020; therefore, FY 2021 activities anticipate full-year, 24-7 operations. The Request also includes funding of $25M for construction of the Advanced Manufacturing Collaborative Facility.

  The increase over the FY 2020 Enacted level is attributed to Salt Waste Processing Facility operations after completing the Salt Waste Processing Facility line item project, an increase in preparation of tanks for waste removal and feed preparation in support of Salt Waste Processing Facility operations at planned rates, an increase in Saltstone Disposal Unit projects due to construction in Saltstone Disposal Units 8&9, an increase in the area of Regulatory Commitments due to focus on preparation of old-style tanks for waste removal and closure activities of ancillary facilities in F-Tank Farm supporting feed preparation for Salt Waste Processing Facility and Defense Waste Processing Facility, completion of new DOE directed scope to re-establish characterization capabilities for transuranic waste in E-Area by 3 quarter FY 2021, including modifications to transuranic waste Pad 4 and installation of equipment.

- **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. The Office of River Protection's FY 2021 budget request represents planned efforts for continued progress toward important cleanup required by the Amended Consent Decree and Tri-Party Agreement. The request is designed to maintain safe operations of the tank farms to protect workers, the public, and the environment; meet regulatory commitments; and enable the development and maintenance of infrastructure necessary to enable waste treatment operations. The fiscal year 2021 request also includes funding for the Waste Treatment and Immobilization Plant ($609,924,000). The mission of the Waste Treatment and Immobilization Plant Project is to construct a treatment facility to blend waste from the tank farms with molten glass, which is placed into stainless steel canisters suitable for long-term storage of high-level waste and disposal of low-level waste. Specifically, the FY 2021 request will support final development and implementation of operational procedures, completion of refurbishments, and completion of handover of all facility systems to conduct cold commissioning of the Low-Activity Waste Facility.

  The decrease from the FY 2020 Enacted level focuses the Department's priority on accomplishing Direct Feed Low Activity Waste activities.

- **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 2021 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, and prepare for startup of the Integrated Disposal Facility to support Direct Feed Low Activity Waste commissioning and startup.

  The decrease from the FY 2020 Enacted level reflects the planned completion of structural stabilization activities for the 324 Building; the completion of various infrastructure and risk mitigation activities; continuing design of modifications to

the Waste Encapsulation and Storage Facility necessary to begin moving the cesium-strontium capsules to dry storage; as well as focused operation of groundwater remediation systems along the Columbia River.

- **Oak Ridge**
  The FY 2021 budget request continues cleanup activities at the Oak Ridge site, including slab and soil remediation at the East Tennessee Technology Park, continued investment in mercury characterization and remediation technologies, planning for construction of the Outfall 200 Mercury Treatment Facility at the Y-12 National Security Complex, as well as design for the On-Site Disposal Facility to support Y-12 National Security Complex and Oak Ridge National Laboratory.

  The decrease from the FY 2020 Enacted level is attributed to funding received in FY 2020 to address infrastructure at ORNL and to study various technologies to remediate mercury from soils, and preparing Building 2026 to process the remaining Uranium-233 material at Oak Ridge National Laboratory as well as completion of major facilities demolition at the East Tennessee Technology Park.

- **Idaho**
  At the Idaho Site, the FY 2021 funding supports Integrated Waste Treatment Unit operations and additional treated sodium bearing waste storage capacity. The request will support completing buried waste exhumation activities at Idaho. Additionally, this request supports continued progress in characterizing, packing and shipping stored contact-handled and remote-handled transuranic waste, as well as spent nuclear fuel activities such as continued progress to meet the Idaho Settlement Agreement milestone of all spent nuclear fuel out of wet storage by 2023, by transferring the remaining two fuel types out of Chemical Processing Plant Building-666. The Advanced Mixed Waste Treatment Facility will continue Resource Conservation & Recovery Act closure activities.

  The decrease from the FY 2020 Enacted level is attributed to completion of treatment and characterization of all contact-handled transuranic non-sludge waste at Advanced Mixed Waste Treatment Facility. Also attributed to funding received in FY 2020 to continue IWTU activities into FY 2021 as the facilities enter stable operations following ongoing facility modifications and testing. Assuming stable IWTU operations, continue progress on buried waste exhumation as well as planned decommissioning and decontamination progress of the Subsurface Disposal Area (SDA) waste exhumation facilities.

- **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 2021 request supports disposal facility operations, regulatory and environmental compliance actions, the Central Characterization Project to perform transuranic waste characterization/certification activities to maintain progress toward legacy transuranic waste milestones at generator sites, transuranic waste transportation capabilities, and continued progress on repairing or replacing infrastructure, modernizing underground equipment to zero-emission battery-electric vehicles or very low emission Tier IV Final diesel powered equipment, and two line-item capital asset projects.

  The decrease from the FY 2020 Enacted level is attributed to proposed completion of line item Safety Significant Confinement Ventilation System in FY 2020 and turnover in FY 2021.

- **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 2021 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 materials, and surveillance and maintenance. This budget request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility.

The decrease from the FY 2020 Enacted level primarily due to significant progress on one-time discrete subcontracted projects, including construction of an Emergency Operations Center; dismantlement of the C-531, C-535, and C-537 switchyards; and railroad repairs and replacement of end-of-life equipment.

- **Portsmouth**
  The FY 2021 budget continues decontamination and decommissioning activities. This budget request also supports the safe operation of the Depleted Uranium Hexafluoride Conversion facility. The FY 2021 Budget Request includes funding the On-Site Waste Disposal Facility, Line Item Capital Project #1 (15-U-408) to receive the debris from the X-326 Process Building, at $46,639,000 and includes funding the On-Site Waste Disposal Facility, Line Item Capital Project #2 (20-U-401) to receive the debris from the X-333 Process Building, at $16,500,000. The mission of these projects is to construct an on-site facility for the disposal of debris generated from the demolition of the Portsmouth Gaseous Diffusion Plant and associated facilities.

  The decrease from the FY 2020 Enacted level reflects a reduction to operations activities primarily offset by increases for two Capital Line-Item construction projects. This aligns the sequencing of On-Site Waste Disposal Facility cell construction with planned Process Building demolition.

- **Los Alamos National Laboratory**
  FY 2021 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 design will be initiated for the proposed remedies. Installation of New Mexico Environment Department approved groundwater remedies for the Royal Demolition Explosives plume in Cañon de Valle will continue. Implementation of the individual storm water permits will continue and investigation and cleanup of several aggregate areas will be completed. Demolition of slabs at Technical Area 21 will continue as well as retrieval and repackaging of the below-grade transuranic waste to include readiness activities and infrastructure needs in order to manage the processing and packaging of the waste at Area G. Consistent with the priorities established with the New Mexico Environment Department in the 2016 Consent Order, cleanup activities will continue to focus on surface water and groundwater management.

  The decrease from the FY 2020 Enacted level reflects initiation, startup, and operations of contact handled transuranic waste retrieval, treatment, and disposition activities with prior year balances.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Legacy Management					
Legacy Management	140,575	142,767	293,873	+151,106	+106%
Program Direction	18,302	19,262	23,120	+3,858	+20%
Total, Legacy Management	**158,877**	**162,029**	**316,993**	**154,964**	**+96%**

Appropriation Overview

Legacy Management (LM) provides for 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 (PD).

Program Highlights

The majority of LM's activities are long-term solutions and focus on maintaining the Department's environmental, legal, regulatory, and community commitments of the Cold War. Management of long-term solutions at closure sites by LM enables other DOE programs to focus on risk reduction and site closure. By the end of FY 2021, LM will have responsibility for long-term stewardship of 102 sites, which includes the transition of Tonopah Test Range Site in Nevada and East Tennessee Technology Park in Tennessee. LM's long-term stewardship will include conducting long-term surveillance and maintenance of environmental remedies (e.g., groundwater monitoring and disposal cell maintenance) to protect human health and the environment, modernization and digitization of physical and electronic record systems, responding to over 1,800 annual requests for information, pursuing beneficial reuse and disposal of the Department's properties, managing pension plan contributions and post-retirement benefits (e.g., medical and life insurance) for former contractor workers from seven sites. Additionally, to address increased external entities interaction and communication plans for LM's long-term solutions also includes community interaction and outreach, and conducting Department's environmental justice activities.

LM's FY 2021 Budget Request will also support administration of an interagency agreement to address abandoned defense related uranium mines, execution of the Department's Uranium Leasing Program, conducting applied studies and technology development to reduce scope and costs, and closure activities (planning and community outreach) at the Grand Junction, CO Disposal Site. LM's FY 2021 Budget Request also includes $150,000,000 to support the reform proposal to consolidate the administration for Formerly Utilized Sites Remedial Action Program (FUSRAP) under a single agency, the U.S. Department of Energy Office of Legacy Management (LM). The $150,000,000 will support cleanup activities performed by the U.S Army Corps of Engineers (USACE) at FUSRAP sites. Per the reform proposal, LM will be responsible for the administration of FUSRAP, USACE will continue to conduct cleanup of FUSRAP sites, and LM will continue to conduct LTS&M after cleanup activities are completed. Similar to the approach the Environmental Protection Agency (EPA) and USACE executes the Superfunds program, this alignment will enhance LM and USACE's partnership and lead to operational efficiencies required for more complex FUSRAP sites.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
National Nuclear Security Administration					
Federal Salaries and Expenses	410,000	434,699	454,000	+19,301	+4.4%
Weapons Activities	11,100,000	12,457,097	15,602,000	+3,144,903	+25.2%
Defense Nuclear Nonproliferation	1,930,000	2,164,400	2,031,000	-133,400	-6.2%
Naval Reactors[a]	1,788,618	1,648,396	1,684,000	+35,604	+2.2%
Total, National Nuclear Security	**15,228,618**	**16,704,592**	**19,771,000**	**+3,066,408**	**+18.4%**

[a]Funding does not reflect the mandated transfer of $85.5 million in FY 2019 and $88.5 million in FY 2020 to the Office of Nuclear Energy for operation of the Advanced Test Reactor.

Appropriation Overview

The **National Nuclear Security Administration (NNSA)** FY 2021 Budget Request is $19,771,000,000 to fund NNSA's mission to support the security and safety of our nation. NNSA's FY 2021 Budget Request pursues five major national security endeavors:

- Maintain a safe, secure, and effective nuclear weapons stockpile;
- Reduce global nuclear threats and keep materials out of the hands of terrorists;
- Strengthen key science, technology and engineering capabilities in support of certification, assessment, and current and future life extension programs;
- Provide safe and effective integrated nuclear propulsion systems for the U.S. Navy; and,
- Modernize the Nuclear Security infrastructure. Key to all of these efforts is providing the necessary federal oversight for growing mission requirements.

Major Out-year Priorities and Assumptions

NNSA's FYNSP topline for FY 2022 – FY 2025 is $83.3 billion, which 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 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Federal Salaries and Expenses					
Federal Salaries and Expenses	410,000	434,699	454,000	+19,301	+4.4%
Total, Federal Salaries and Expenses	**410,000**	**434,699**	**454,000**	**+19,301**	**+4.4%**

Appropriation Overview

The **National Nuclear Security Administration (NNSA) Federal Salaries and Expense** (FSE) funds recruiting, training, and retention of federal staff to perform program and project management and oversight of approximately $17.6 billion in Weapons Activities (WA) and Defense Nuclear Nonproliferation (DNN) funding across the nuclear security enterprise. FSE provides for the salaries and benefits of 1,858 Federal Full-time Equivalents (FTEs) – 1,836 paid from FSE and 22 paid through the Working Capital Fund. FSE also provides space and occupancy needs, travel costs, support service contractors, training, and other related expenses. Seventy-seven percent of FSE funds are for federal salaries and benefits.

NNSA workforce consists of a diverse cadre of scientists, engineers, project and program managers, 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 WA and DNN accounts. The workforce is also comprised of mission support staff including management and program analysis, contracting, security administration, miscellaneous administration, human resource management, emergency management, information technology management, budget analysis, accounting, legal services (general and patent attorney, paralegal specialist), operations research, miscellaneous clerk and assistant, public affairs, quality assurance, general business and industry, government information specialists, industrial hygiene, industrial property management, equal employment opportunity, grants management, environmental protection specialist, safety and occupational health management, logistics management, computer engineering, records and information management, telecommunications, writing and editing, computer science, procurement clerical and technician, inventory management, financial management, psychology, safety and electrical engineering, and architecture.

NNSA staff are located throughout the United States, reflecting NNSA's work with the nuclear security enterprise. The staff is 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 also manages the Department of Energy's (DOE) Overseas Presence business line in the DOE Working Capital Fund (WCF), including 22 DOE staff in 20 foreign countries. NNSA supervises both federal employees and locally employed staff, and reimburses the Department of State for International Cooperative Administrative Support Services (ICASS) and Capital Security Cost Sharing (CSCS) charges.

Program Highlights

The $454,000,000 request for an increase of 83 additional FTEs and associated support expenses.

The NNSA workforce is critical to the success of the Nation's nuclear security enterprise. The right number of people, with the right skills, is key to meeting growing mission requirements and commitments as described in the 2018 Nuclear Posture Review including modernizing the nuclear deterrent, recapitalizing the aging infrastructure, and continuing to meet the requirements of nonproliferation and counterterrorism programs.

Multiple staffing studies and evaluations have recommended increases to NNSA staff over the Future-Years Nuclear Security Program (FYNSP)) suggesting that NNSA may need to eventually hire approximately 2,100 FTEs in the coming years. NNSA will use a variety of innovative methods to grow and shape the professional staff including the use of recruitment events and expanded excepted service hiring authority. The NNSA will also continue to monitor the evolving need for

federal oversight in support of the nuclear modernization missions and adjust future staffing plans accordingly. NNSA will also use partnerships with academic alliances to grow the workforce with early identification and recruitment of top science, technology, engineering, and math talent.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Weapons Activities					
Stockpile Management	3,403,790	3,680,051	4,284,244	+604,193	+16.4%
Production Modernization	1,041,924	1,565,523	2,457,900	+892,377	+57.0%
Stockpile Research, Technology, and Engineering	2,174,294	2,553,119	2,782,131	+229,012	+9.0%
Infrastructure and Operations	3,140,328	3,199,544	4,383,577	+1,184,033	+37.0%
Secure Transportation Asset	278,639	292,660	390,074	+97,414	+33.3%
Defense Nuclear Security	690,638	775,000	826,895	+51,895	+6.7%
Information Technology and Cybersecurity	221,175	300,000	375,511	+75,511	+25.2%
Legacy Contractor Pensions	162,292	91,200	101,668	+10,468	+11.5%
Subtotal, Weapons Activities	**11,113,080**	**12,457,097**	**15,602,000**	**+3,144,903**	**+25.2%**
Use of Prior Year Balances	-13,080	0	0	0	N/A
Total, Weapons Activities	**11,100,000**	**12,457,097**	**15,602,000**	**+3,144,903**	**+25.2%**

Appropriation Overview

Programs funded within the Weapons Activities appropriation support the Nation's nuclear stockpile and its attendant nationwide infrastructure of science, technology, engineering, and production capabilities without resuming nuclear explosive testing. Weapons Activities provides for the maintenance and refurbishment of nuclear weapons to continue sustained confidence in their safety, reliability, and military effectiveness; continued investment in scientific, engineering, and manufacturing capabilities to enable production and certification of the enduring nuclear weapons stockpile; and manufacture of nuclear weapon components. Weapons Activities also provides for continued maintenance and investment in the National Nuclear Security Administration (NNSA) nuclear complex to be more responsive and resilient. This increase reflects investments to the infrastructure needed to sustain the U.S. nuclear stockpile. Over the past several decades, the U.S. nuclear weapons infrastructure has suffered the effects of age and underfunding.

NNSA's laboratories, plants, and sites employ approximately 50,000 people across the Enterprise, 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 2021 Stockpile Stewardship and Management Plan (SSMP).

The FY 2021 Request is presented in a new structure that consolidates various funding sources, aligns current and future workload, and improves transparency for interaction with Congress regarding program execution and funding requests. The Request supports the current stockpile, warhead modernization programs to include life extension programs (LEP) and modifications, production facilities and capabilities modernization efforts, and the scientific tools necessary to execute these efforts. This scope is consistent with the *2018 Nuclear Posture Review* (NPR).

Program Highlights

- **Stockpile Management**
  Maintains a safe, secure, and militarily effective nuclear weapons stockpile. Activities include: sustaining the current active stockpile to include the Annual Assessment Process, surveillance, minor alterations and limited life component exchanges; extending the expected life of the stockpile weapons to include life extension programs, and major modifications and alterations; providing safe and secure dismantlement of nuclear weapons and components; and providing sustainment of needed manufacturing capabilities and capacities, including process improvements, quality assurance, and investments focused on increased efficiency of production operations. The FY 2021 Request includes increases for the W80-4 LEP and the W87-1 Modification Program to maintain first production unit schedules of FY 2025 and FY 2030, respectively. Funding is also requested to begin Phase 1 (concept and Assessment Refinement activities) for the W93.

- **Production Modernization**
  Focuses on the production capabilities for nuclear weapons, including primaries, canned subassemblies (which includes multiple materials and components), radiation cases and non-nuclear components needed to sustain the nuclear stockpile near- to long-term. This includes the equipment, facilities, and personnel required to reestablish the Nation's capability to produce 80 pits per year (ppy). FY 2021 funding will also support pit production activities at the Savannah River Site for the implementation of the Savannah River Plutonium Processing Facility (SRPPF) to include maturing the conceptual design, site and facility preparation, long lead procurement, and personnel hiring to meet ongoing and future pit production needs. Production Modernization also supports qualification of explosive, pyrotechnic, and propellant materials for supplying the NNSA's nuclear security enterprise NSE across five management and operating (M&O) sites; implements the program necessary to produce tritium in support of the nuclear weapons stockpile and other national programs; funds modernization of uranium operations, delivery of canned subassemblies and components needed to maintain the stockpile, as well as support to the U.S. Nuclear Navy, and Nonproliferation programs; supports the restart and modernization of lapsed depleted uranium (DU) alloying and component manufacturing capabilities for meeting short- and long-term mission requirements; maintains production of the Nation's enriched lithium supply; and provides funding to modernize production of non-nuclear components required for both the active stockpile and warhead modernization programs.

- **Stockpile Research, Technology, and Engineering**
  Provides the scientific foundation for science-based stockpile decisions and actions, including the capabilities, tools, and components needed to enable assessment of the active stockpile and certification of warhead modernization programs. Funding requested for FY 2021 supports the continued implementation of the Enhanced Capabilities for Subcritical Experiments (ECSE) and procurement of and LLNL site preparation for NNSA's first Exascale system to be delivered in 2022 and ready for program use in 2023. Both of these capabilities are required to meet W80-4 LEP and W87-1 Modification certification requirements. In addition to the procurement and implementation of NNSA's first Exascale machine, the funding supports the necessary development of the design and engineering codes needed to support stockpile decisions to operate on this new platform. Funding in this area also supports warhead component and production technology development and maturation needed for on-going, planned, and future warhead modernization programs. Two important activities in this area for FY 2021 include development of a new, more efficient production method for radiation cases and components within canned subassemblies. Programs within this funding area are also key to adequately train the workforce to gain skills, knowledge, and abilities for a safe, secure, and militarily effective stockpile now and into the future.

- **Infrastructure and Operations (I&O)**
  I&O maintains, operates, and modernizes the NNSA infrastructure in a safe and secure manner to support program execution while seeking to maximize return on investment and reduce enterprise risk. The program also plans, prioritizes, and constructs state-of-the-art facilities, infrastructure, and scientific tools. The FY 2021 Budget Request increases funding for Operations of Facilities, Safety and Environmental Operations, Maintenance and Repair of Facilities, Recapitalization, and both Programmatic and Mission Enabling Construction, which will support production of 30 ppy at LANL, meet LEP schedules at KCNSC, and address requirements within the NPR for infrastructure modernization. Furthermore, the funding will reduce deferred maintenance; execute Recapitalization projects to improve the condition and extend the design life of structures, capabilities, and systems to meet program demands; reduce future operating costs by replacing older facilities with new, efficient facilities; and reduce safety, security, environmental, and program risk. Specifically, the request supports an increase in Construction for projects such as the Uranium Processing Facility (UPF) and the Chemistry and Metallurgy Research Replacement (CMRR) project.

- **Secure Transportation Asset (STA)**
  STA supports safe, secure transport of the Nation's nuclear weapons, weapon components, and special nuclear material throughout the nuclear security enterprise to meet nuclear security requirements. The Program Direction in this account provides salaries and expenses 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. The Request supports modernizing STA transportation assets, including a replacement for STA's obsolete DC-9 aircraft; life extension of the Safeguards Transporter (until the Mobile Guardian Transporter

becomes operational in FY 2025); vehicle sustainment; replacement armored tractors, escort and support vehicles; upgrades of the Tractor Control Unit to accommodate for communications and security; and continued development and testing of the Mobile Guardian Transporter. Funding also supports a commitment to a stable human resources strategy to maintain the staff of Federal agents.

- **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 at our national laboratories, production plants, processing facilities, and the Nevada National Security Site. Employing more than 1,500 Protective Force officers, DNS secures more than 4,400 buildings and protects more than 50,000 personnel. The FY 2021 Request includes funding to fill positions in key security program areas required to implement a risk-based, layered protection strategy at the sites. The Request also supports sustaining operations of and implementing improvements to the classified network that supports the NNSA Special Access Program and implementation and operation of counter unmanned aircraft systems at sites possessing Category 0/I special nuclear material and provides funding to continue efforts to recapitalize security infrastructure. It also includes funding to support increased security needs associated with Pit Production efforts at Los Alamos National Laboratory and other known mission growth across the NNSA nuclear security enterprise

- **Information Technology (IT) and Cybersecurity**
  NNSA's Office for Information Management provides a range of IT and Cybersecurity support functions and activities; manages cybersecurity operations and program areas within NNSA's laboratories, plants, and sites; executes and coordinates Public Key Infrastructure and other Committee on National Security Systems requirements; and leverages IT Modernization efforts across the NNSA NSE to increase the efficiency and cost-effectiveness of NNSA IT services consistent with the DOE Strategies. The FY 2021 Request enables the development of integrated IT initiatives that provide an effective and secure technology infrastructure to provide adequate support to the NNSA NSE shared services. These initiatives will fundamentally redesign the NNSA IT environments to provide a more secure and agile set of capabilities including unified communication, agile cloud infrastructure, and next-generation collaboration services across the enterprise. Additionally, the NNSA IT and Cybersecurity Program will create a plan to utilize information technology research and development capabilities, operational technology, and artificial intelligence in order to implement tools and capabilities to secure future NNSA operations.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Defense Nuclear Nonproliferation Programs					
Material Management and Minimization	293,794	363,533	400,711	+37,178	+10.2%
Global Material Security	407,108	442,909	400,480	-42,429	-9.6%
Nonproliferation and Arms Control	129,703	140,000	138,708	-1,292	-0.9%
National Technical Nuclear Forensics R&D	0	0	40,000	+40,000	N/A
Defense Nuclear Nonproliferation R&D	575,570	533,163	531,651	-1,512	-0.3%
Nonproliferation Construction	220,000	299,000	148,589	-150,411	-50.3%
Total, Defense Nuclear Nonproliferation Programs	**1,626,175**	**1,778,605**	**1,660,139**	**-118,466**	**-6.7%**
Nuclear Counterterrorism and Incident Response	319,185	372,095	377,513	+5,418	+1.5%
Legacy Contractor Pensions	28,640	13,700	14,348	+648	+4.7%
Use of Prior Year Balances	-25,000	0	-21,000	-21,000	N/A
Subtotal, Defense Nuclear Nonproliferation	**1,949,000**	**2,164,400**	**2,031,000**	**-133,400**	**-6.2%**
Prior Year Balance Rescission	-19,000	0	0	0	N/A
Total, Defense Nuclear Nonproliferation	**1,930,000**	**2,164,400**	**2,031,000**	**-133,400**	**-6.2%**

Appropriation Overview

The National Nuclear Security Administration's (NNSA) nonproliferation, counterproliferation, and counterterrorism activities extend the nation's defenses far beyond America's borders. These programs contribute to keeping the United States 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 incidents and accidents domestically and abroad. NNSA shares knowledge, accrued through the United States' long experience in managing special nuclear materials, with partners around the world to achieve international nonproliferation and nuclear security goals. NNSA uses the unique technical and scientific knowledge 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 allies, NNSA plays a critical role in enhancing global stability and constrains the range of potential threats facing the nation, our allies, and partners.

This appropriation funds five existing programs and a new National Technical Nuclear Forensics initiative. These six programs, as part of a whole-of-government approach, provide policy and technical leadership to prevent or limit the spread of weapons of mass destruction (WMD)-related materials, technology, and expertise; develop technologies to detect nuclear proliferation; secure or eliminate inventories of nuclear weapons-related materials and infrastructure; and ensure that technically trained emergency management personnel are available to respond to nuclear and radiological incidents and accidents domestically and overseas. As part of the Department of Energy's (DOE) emergency response posture, Defense Nuclear Nonproliferation (DNN) maintains that a worldwide interoperable, secure, and trusted emergency communications infrastructure in place, in addition to maintaining the health of Emergency Management programs across the DOE.

DNN's mission is complementary to Defense Programs' Stockpile Stewardship Program at NNSA. Together, the programs form the basis of providing a strong nuclear defense, as called for in the 2018 Nuclear Posture Review (NPR). The 2017 National Security Strategy (NSS) and NPR 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 report *Prevent, Counter, and Respond–A Strategic Plan to Reduce Global Nuclear Threats*[a] and in the Office of Defense Nuclear Nonproliferation's Strategic Vision for FY 2020 – FY 2024.

[a] https://www.energy.gov/nnsa/downloads/prevent-counter-and-respond-strategic-plan-reduce-global-nuclear-threats-npcr

This environment is characterized by the persistent threat of state and non-state actors seeking to obtain nuclear and radioactive materials; state actors potentially undermining arms control agreements to which the United States is adherent; and nonproliferation regimes. There is also an increased risk of the availability of nuclear and radioactive materials as a result of the global expansion of commercial nuclear power and possible spread of fuel cycle technology, increased opportunities for illicit nuclear material trafficking and sophisticated procurement networks, and technology advances (including cyber-related tools) 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 Request supports the conversion or shutdown of research reactors and isotope production facilities that use highly enriched uranium (HEU), the continued support of non-HEU-based Molybdenum-99 (Mo-99) production facilities in the United States, the removal and disposal of weapons-usable nuclear material, the continuation of activities to expedite the removal of plutonium from the state of South Carolina and implement the dilute and dispose strategy for plutonium disposition, and costs to downblend HEU.

- **Global Material Security (GMS)**
  GMS directly contributes to national security efforts to reduce global nuclear security threats. The FY 2021 Budget Request supports programs to prevent terrorists and other actors from obtaining nuclear and radioactive material to use in an improvised nuclear device (IND) or a radiological dispersal device (RDD) by working with partner countries to improve the security of vulnerable materials and facilities and to improve partners' capacity to detect, disrupt, and investigate illicit trafficking of these materials. GMS works with countries in bilateral partnerships and with multilateral partners such as the International Atomic Energy Agency (IAEA) and International Criminal Police Organization (INTERPOL). As part of an ongoing strategic analysis process, GMS is also exploring innovative approaches, technologies, and tools to adapt to emerging threats. GMS supports national security priorities to reduce global nuclear security threats, and is a key component of NNSA's integrated nonproliferation, counterterrorism, and emergency response strategies.

- **Nonproliferation and Arms Control (NPAC)**
  NPAC supports activities to prevent the proliferation of WMD by state and non-state actors. The Request supports 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.

- **National Technical Nuclear Forensics Research and Development (NTNF R&D)-New Initiative**
  NTNF R&D develops and maintains advanced technical nuclear forensics analysis capabilities at the National Laboratories that can support time-critical decisions in the event of a nuclear or radiological incident and assist in determining the origin of interdicted materials or devices. NNSA uses this expertise at the National Laboratories to maintain a field response capability in the event of an incident requiring nuclear forensics analysis capabilities. The Request also supports the establishment of this program in FY 2021 as NNSA takes on a more active leadership role in NTNF.

- **Defense Nuclear Nonproliferation Research and Development (DNN R&D)**
  DNN R&D is the key component for the innovation of United States' 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 uses the unique facilities and scientific skills of DOE, academia, and industry to perform research, conduct technology demonstrations, develop prototypes, and produce and deliver sensors for integration into operational systems. The Request supports planned activities for early detection of proliferation-related R&D and continued production of nuclear detonation detection satellite payloads. The Request also supports continued efforts 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 meet future nonproliferation goals and unanticipated threats.

- **Nonproliferation Construction (supports Material Management and Minimization)**
  Nonproliferation Construction consolidates construction costs for DNN projects. The Request supports the implementation of the dilute and dispose strategy, with the continuation of preliminary design for the Surplus Plutonium Disposition (SPD) project, as well continuation of early site preparations and long lead procurements. The SPD project will add additional glovebox capacity at the Savannah River Site to accelerate plutonium dilution and aid in the removal of plutonium from the state of South Carolina. With use of available prior year balances, termination activities for the Mixed Oxide Fuel Fabrication Facility (MOX) project will be completed in FY 2021.

- **Nuclear Counterterrorism and Incident Response Program (NCTIR)**
  The NCTIR program sustains the United States' nuclear counterterrorism activities and operational nuclear incident and accident response capabilities, while supporting DOE's all-hazards emergency management system. The Counterterrorism and Counterproliferation (CTCP) subprogram provides the nation's technical capability to understand and defeat nuclear devices, including INDs and lost or stolen foreign nuclear weapons. This knowledge in turn informs United States Government policies, agencies, and key Department of Defense mission partners on terrorist and proliferant state nuclear threats and related contingency planning. In support of this mission, the FY 2021 Request for NCTIR supports programs to strategically manage and deploy expert scientific teams and equipment to provide a technically trained, rapid response to nuclear or radiological incidents and accidents worldwide and to educate international partners to effectively respond to nuclear or radiological incidents in their countries.

  Additionally, NCTIR operates the DOE/NNSA's Emergency Operations (EO) subprogram which administers and directs the implementation and integration of emergency management programs across the Department. EO develops, coordinates, issues, and administers all DOE and NNSA emergency management policy, technical guidance and support. EO implements, manages, and coordinates readiness assurance, training, and exercise programs to ensure the DOE is prepared to respond and recover from all-hazards emergencies. EO executes DOE and NNSA Continuity of Operations, Continuity of Government, and Enduring Constitutional Government programs to advance the National Continuity Policy. EO provides 24/7/365 operations and communications support for DOE/NNSA Emergency Management Enterprise and senior leadership.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Naval Reactors					
Naval Reactors Development	514,951	516,205	590,306	+74,101	+14.4%
Columbia-Class Reactors Systems Development	138,000	75,500	64,700	-10,800	-14.3%
S8G Prototype Refueling	250,000	170,000	135,000	-35,000	-20.6%
Naval Reactors Operations and Infrastructure	525,764	553,591	506,294	-47,297	-8.5%
Program Direction	48,709	50,500	53,700	+3,200	+6.3%
Construction	311,194	282,600	334,000	+51,400	+18.2%
Total, Naval Reactors[a]	**1,788,618**	**1,648,396**	**1,684,000**	**+35,604**	**+2.2%**

Appropriation Overview

The Naval Reactors (NR) appropriation includes funding for activities that respond directly to the National Security Strategy of the United States, and are central to the Department of Energy's (DOE) and the National Nuclear Security Administration's pursuit of its Strategic Vision goal of Nuclear Security. Specifically, NR is responsible for U.S. Navy nuclear propulsion work, beginning with reactor plant technology development and design, continuing through reactor plant operation and maintenance, and ending with final disposition of naval spent nuclear fuel.

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 over 40 percent of the Navy's major combatants. 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, NR has three major DOE initiatives—the *Columbia*-Class Reactor System Development, the Land-based S8G Prototype Refueling Overhaul, and the Spent Fuel Handling Recapitalization Project.

NR supports the 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 President's 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 budget 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. The Spent Fuel Handling Recapitalization Project will also support the 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 2021 Request supports facility and systems maintenance and regulatory requirements across the Program's four DOE sites, environmental remediation, and necessary general plant projects to recapitalize aging infrastructure and equipment.

- **Naval Reactors Development**
  The FY 2021 Budget Request supports the Advanced Test Reactor at the Idaho National Laboratory, reactor core material development, radioactive test and evaluation efforts, and reactor core examinations.

[a] Funding does not reflect the mandated transfer of $85.5 million in FY 2019 and $88.5 million in FY 2020 to the Office of Nuclear Energy for operation of the Advanced Test Reactor.

- **S8G Prototype Refueling**
  The funding decrease reflects the project's revised funding profile. This profile extends into 2022 to reflect expected delays to completion since the last budget request.

- ***Columbia*-Class Reactor Systems Development**
  The decrease from FY 2020 is consistent with the planned project profile and supports FY 2021 production, analysis, and testing execution.

- **Construction**
  The increase from FY 2020 supports additional resources aligned to the FY 2020 Spent Fuel Handling Recapitalization Project Performance Baseline Revision.

- **Program Direction**
  The FY 2021 Request places NR in a position to execute its mission and provide federal oversight of the program's DOE laboratories.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Departmental Administration					
Office of the Secretary	5,395	5,119	5,582	+463	+9.0%
Congressional & Intergovernmental Affairs	6,200	4,395	5,616	+1,221	+27.8%
Use of Prior Year Balances	-2,000	0	0	0	N/A
Chief Financial Officer	48,912	52,000	53,591	+1,591	+3.1%
Economic Impact & Diversity	10,169	10,169	9,931	-238	-2.3%
International Affairs	0	26,825	0	-26,825	N/A
Artificial Intelligence and Technology Office	0	2,500	0	-2,500	N/A
Chief Information Officer	131,624	140,200	134,778	-5,422	-3.9%
Subtotal, DA	**200,300**	**241,208**	**209,498**	**-31,710**	**-13.1%**
Other Departmental Administration					
Management	55,385	54,358	57,258	+2,900	+5.3%
Project Management Oversight and Assessments	15,005	12,596	15,577	+2,981	+23.7%
Chief Human Capital Officer	26,125	24,316	26,191	+1,875	+7.7%
Office of Small & Disadvantaged Business Utilization	3,170	3,337	3,402	+65	+1.9%
General Counsel	33,075	32,575	35,111	+2,536	+7.8%
Office of Policy	10,010	7,000	7,631	+631	+9.0%
Use of Prior Year Balances	-7,500	0	0	0	N/A
International Affairs	22,878	0	0	0	N/A
Public Affairs	6,594	4,000	5,954	+1,954	+48.9%
Office of Technology Transitions	8,505	14,080	12,639	-1,441	-10.2%
Subtotal, Other DA	**173,247**	**152,262**	**163,763**	**+11,501**	**+7.6%**
Strategic Partnership Projects (SPP**)**	40,000	40,000	40,000	0	0.0%
Total, Departmental Administration (Gross)	**413,547**	**433,470**	**413,261**	**-20,209**	**-4.7%**
Defense-Related Administrative Support (DRAS)	-151,689	-179,092	-183,789	-4,697	+2.6%
Subtotal, Departmental Administration	**261,858**	**254,378**	**229,472**	**-24,906**	**-9.8%**
Miscellaneous Revenues					
Revenues Associated with SPP	-40,000	-40,000	-40,000	0	0.0%
Other Revenues	-56,000	-53,378	-53,378	0	0.0%
Subtotal, Miscellaneous Revenues	**-96,000**	**-93,378**	**-93,378**	**0**	**0.0%**
Total, Departmental Administration (Net)	**165,858**	**161,000**	**136,094**	**-24,906**	**-15.5%**

Appropriation Overview

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

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

Program Highlights

In FY 2021, the overall decrease for the DA appropriation can be attributed to the Office of International Affairs and the Artificial Intelligence and Technology Office being requested under a separate appropriation.

In FY 2021, DA program increases are intended to strengthen enterprise-wide management and mission support functions. Highlights include:

- **Office of the Secretary (OSE):** Funding will support leadership and policy direction at the Department. In FY 2021, additional funding is being requested to support an arctic energy coordinator position at the Department.
- **Office of the Chief Financial Officer (CFO):** Funding will continue to support the effective management and financial integrity of DOE programs, activities and resources by developing, implementing, and monitoring DOE-wide policies and systems in budget formulation and execution, finance and accounting, internal controls and financial policy, corporate financial systems, and strategic planning. In FY 2021, CFO is requesting additional funds for the Program Management Improvement and Accountability Act (PMIAA) functions, which include staff transferring from the Office of Enterprise Assessments.
- **Office of the Chief Information Officer (OCIO):** Funding will support the President's Management Agenda priorities of IT Modernization, Cybersecurity, and Accountability and Transparency. Modernizing DOE's IT infrastructure, services, and operations to a level consistent with the capacity, flexibility, and resiliency required of a modern, secure enterprise is a priority in this budget. The proposed modernization initiatives included in the FY 2021 budget request will continue to reduce cybersecurity risk through improved cybersecurity technology, scale capacity commensurate with demand, and establish IT enterprise capabilities allowing for commercial/managed service implementation of IT services with engineered and inherent cybersecurity capabilities.
- **Project Management Oversight and Assessments (PM):** Funding will support leadership and policy direction to DOE. In FY 2021, additional funding is being requested to enhance the department's capability to address GAO high-risk concerns for the management of capital asset projects, per PM's responsibilities under PMIAA.
- **Office for Human Capital (HC):** Funding will support current operational levels and maintain HC's customer service mission. The FY 2021 request includes funding to support improvements and enhancements of HR IT systems, to include transitioning to a fully integrated IT platform and developing a dashboard to leverage data and analytics to improve efficiencies in services as well as customer communications.
- **General Counsel (GC):** Funding will support staffing levels necessary to provide legal services to all DOE program offices. In FY 2021, GC is requesting additional funds for an intellectual property (IP) information system, which will allow GC to manage the invention and patent information and data, and utilize such information to provide effective legal services to Departmental elements.
- **Office of Congressional and Intergovernmental Affairs (CI):** Funding will support staff operational levels in the program, as carryover balances will be largely depleted by FY 2021.
- **Office of Policy (OP):** OP serves as the principal policy office advising the Secretary of Energy. On January 28, 2020, the Secretary of Energy announced that OP will be restructured to the Office of Strategic Planning and Policy (OSPP) as a direct report to the Office of the Secretary. OSPP will provide a more efficient and effective approach to the analysis, formulation, development, and advancement of all policy within the Department. DOE will provide additional information on the restructuring once implementation plans are finalized.
- **Office of Technology Transitions (OTT):** Funding will support OTT's statutory requirements, allow OTT to effectively operate the Tech-to-Market functions consolidated in OTT in FY 2018, and enable OTT to effectively interface with DOE R&D programs, National Laboratories, and external stakeholders. The FY 2021 Request includes an increase in FTEs to allow OTT to fulfill Congressional and Administration direction to increase Departmental engagement for the transition of new and emerging technologies to the U.S. markets.

($K)

	FY 2019 Enacted	FY 2020 Enacted[1]	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Artificial Intelligence and Technology Office	0	2,500	4,912	2,412	+96.48%
Total, Artificial Intelligence and Technology Office	**0**	**2,500**	**4,912**	**+2,412**	**+96.48%**

[1] For FY 2020 AITO was funded within the Departmental Administration account

Appropriation Overview

The Artificial Intelligence and Technology Office (AITO) was created on September 5th, 2019, to serve as the Department's hub for the development, coordination and execution of the agency's efforts as a world-leading enterprise in scientific and technological discovery and to accelerate the development, delivery, and adoption, of AI. AITO will serve as the central body responsible for coordinating and overseeing DOE's AI efforts. AITO will engage programs, functional offices, sites, and associated National Laboratories in the development and oversight of funded AI projects for transparency and shared learning. AITO will lead Department-wide efforts to evaluate the scope and effectiveness of DOE's AI programs and identify gaps that are not being addressed. AITO will develop and lead collaborative solutions across the Department that support the missions of DOE's programs and capitalize on the expertise across the agency.

Program Highlights

In FY 2021, AITO will focus on the Department's AI activities, to include: the development and delivery of innovative AI hardware, software and approaches that can advance DOE goals; the identification and acceleration of AI workforce development solutions; the identification of gaps within current mission relevant operations to support the Secretary's vision; and, the development of interagency and international collaborations to enhance the research, application and adoption of AI technologies.

In FY 2021, AITO will build on its foundation by hiring additional staff to support execution of its cross-cutting mission. AITO will organize and lead working groups and committees, in partnership with other entities, to determine DOE AI priority issues. AITO will serve as the focal point for communicating the central role DOE holds in the development of AI and enabling technologies to both internal and external audiences, including Congress, industry stakeholders and international partners through workshops, inter-agency coordination and private sector engagement. AITO will serve as DOE's AI center to build, strengthen, and expand strategic multi-sector partnerships with the private sector, academia, national laboratories, other agencies, international partners and entities in ways that support U.S. competitiveness in AI. In FY 2021, AITO will institutionalize the AI Exchange (AIX) database as a vital tool to enhance the cross-cutting benefits of AI, to replicate successful AI solutions and to eliminate duplication of efforts.

($ K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs. FY 2020 Enacted $	FY 2021 Request vs. FY 2020 Enacted %
Office of Enterprise Assessments					
Enterprise Assessments	24,068	24,068	26,949	+2,881	+12%
Program Direction	52,702	54,711	54,635	-76	+0%
Total, Office of Enterprise Assessments	**76,770**	**78,779**	**81,584**	**+2,805**	**+3.5%**

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 Department's science and energy research, and environmental cleanup activities, and nuclear weapons complex by conducting independent assessments of security and safety performance throughout the Department, taking enforcement action for contractor violations of security and safety regulations, and providing training programs that institutionalize enterprise security and safety lessons learned. EA activities complement, although do not replace, the responsibility of DOE line management for compliance with security and safety requirements to manage the Department's programs effectively.

EA is organizationally independent of the DOE entities that develop and implement security and safety policy and programs and therefore is more able to provide objective and timely information to DOE senior leadership, contractor organizations, and other entities on the methods to appropriately protect national security material and information assets; and whether Departmental operations provide for the safety of its employees and the public. EA activities evaluate the Department's effectiveness in promoting protection strategies that are based on 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, to enhance the proficiency and competency of the Department's security and safety personnel.

Program Highlights

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), using limited notice safeguards and security performance tests to provide accurate, up-to-date assessments of DOE site security response capabilities; and evaluating actions to detect insider threats from individuals who may seek to compromise National security and/or the ability of the Department to meet its mission;
- Increasing the number of assessments performed and 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;
- Enhancing the effectiveness of the DOE enforcement function that holds contractor organizations accountable for noncompliance with worker safety and health, nuclear safety, and classified information security regulations; and
- Developing and providing training programs that promote the competency and proficiency of DOE federal and contractor employees and performing other related functions via the DOE National Training Center in Albuquerque, NM, that institutionalize security and safety data analytics and safety lessons learned in support of DOE security and safety performance.

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Office of Hearings and Appeals					
Office of Hearings and Appeals	**5,739**	**4,852**	**4,262**	**-590**	**-12%**
Subtotal, Office of Hearings and Appeals	**5,739**	**4,852**	**4,262**	**-590**	**-12%**
Use of Prior Year Balances	-2,000				
Total, Office of Hearings and Appeals	**3,739**	**4,852**	**4,262**	**-590**	**-12%**

Appropriation Overview

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 services such as mediation for a variety of matters. To reduce travel and other costs OHA uses video teleconferencing to conduct hearings at DOE field sites.

Program Highlights

Over the last nine years, OHA has reduced its case-processing time in all areas of jurisdiction without compromising the high quality of 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 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Office of the Inspector General					
Office of the Inspector General	51,330	54,215	57,739	+3,524	+6.5%
Total, Office of the Inspector General	**51,330**	**54,215**	**57,739**	**+3,524**	**+6.5%**

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 the 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 $32 billion in contracts. Recent OIG work has resulted in sizeable settlements of approximately $360 million by subcontractors in FY 2019.
- **Cybersecurity Oversight Efforts.** The OIG frequently partners with other agencies to address attacks impacting DOE.
- **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 $505 billion remained on the Government Accountability Office's Biennial High Risk List in 2019. The OIG routinely reviews the efficacy of the Department's environmental programs, which annually expend approximately $6.5 million.
- **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 DOE's contractors' incurred costs and compliance with CAS.
- **Data Analytics Program.** OIG will continue to expand its data collection and analysis efforts by establishing a centralized secure enclave to store and access data. The Data Analytics Program will use this data to identify trends or indications of fraud. The transition to GovCloud environment will increase collaboration, reduce analytical cycle time, and increase cyber investigative capability.
- **Office of Investigations Specific.** The OIG will establish a Tech Operations Directorate for acquiring and deploying technology in support of investigations. This includes deploying software to increase information sharing and collaboration within the department of other federal agencies. The OIG will initiate discussions with Department sites to determine viability for opening four new offices. The OIG will also add an additional Special Assistant U.S. Attorney to increase criminal prosecutions.
- **Office of Audits Specific.** OIG's Audit and Data Analytics' team will continue to perform Focused Audits to test the reliability of the Cooperative Audit Strategy and the path forward for audits performed on contract costs. Increase its workload on the oversight and review of contractor and subcontractor costs.
- **Office of Inspections Specific.** OIG's Inspection team will continue to focus on allegations received from OIG's Hotline, special inquiries raised by Congress or senior departmental officials and performance issues. Continue to expand the contractor whistleblower investigative capability and ensure compliance with 41 USC 4712, requiring OIGs to investigate whistleblower retaliation allegations.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
International Affairs					
Departmental Administration					
International Affairs	0	26,825	0	-26,825	N/A
Other Departmental Administration					
International Affairs	22,878	0	0	0	N/A
International Affairs					
Program Direction	0	0	22,575	+22,575	N/A
Program Support	0	0	10,384	+10,384	N/A
Total, International Affairs	**22,878**	**26,825**	**32,959**	**+6,134**	**+23%**

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 engagements, including R&D cooperation, 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 under the Foreign Investment Risk Review Modernization Act (FIRRMA) of 2018.

Program Highlights

In FY 2021, IA is funded under a new, separate appropriation to increase transparency and reflect the need for multi-year funding for programmatic activities.

IA's key initiatives in FY 2021 include:

- Fully supporting the U.S.-Israel Energy Center of Excellence and the Israel-U.S. Binational Industrial Research and Development (BIRD Foundation) Energy Program;
- Meeting current and evolving challenges arising from foreign acquisitions of U.S. businesses, foreign exploitation of certain investment structures, and implementation of FIRRMA;
- Promoting market opportunities for U.S. energy and technology exports of all types globally;
- Providing technical assistance to policy makers and stakeholders with the resources and technical tools to develop and deploy clean, reliable, and innovative energy solutions of all kinds in support of U.S. global energy, economic, and environmental goals;
- Continuing to perform international energy-sector work, on a reimbursable basis, on behalf of the Department of State and the United States Agency for International Development (USAID), such as the U.S.-China Clean Energy Research Center, the U.S. China Climate Change Working Group, Power Africa, Climate Renewable and Efficiency Deployment Initiative, Partnership for Resilient Infrastructure Investment in Pacific Island Countries, Capacity for Low-Emission Development Strategies Program, Clean Energy Initiatives, Economic Development and Emission Reductions, Sustainable Energy Supplied to the Economy, and the Clean Energy Cooperation; and
- Increasing engagement with key international partners through multilateral organizations.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
ARPA-E Projects	334,750	390,000	0	-390,000	-100%
Program Direction	31,250	35,000	21,256	-13,744	-39%
Subtotal, Advanced Research Projects Agency - Energy	**366,000**	**425,000**	**21,256**	**-403,744**	**-95%**
Cancelation of Prior Year ARPA-E Project Funds	0	0	-332,000	-332,000	N/A
Total, Advanced Research Projects Agency - Energy	**366,000**	**425,000**	**-310,744**	**-735,744**	**-173%**

Appropriation Overview

As defined by its authorization under the America COMPETES Act, the **Advanced Research Projects Agency-Energy (ARPA- E)** catalyzes transformational energy technologies to enhance the economic and energy security of the United States. ARPA-E funds high-potential, high-impact energy projects that are too risky to attract private sector investment that could though significantly advance the ways we generate, store, distribute and use energy. ARPA-E has developed a unique approach to federally funded technology development, and the Budget aims to adopt aspects of that approach to other offices within DOE's research and development organization rather than maintain an independent ARPA-E office. Specifically, the FY 2021 Budget proposes to eliminate ARPA-E while incorporating APRA-E's approach to technology development into the execution of applied energy office Small Business Innovation Research / Small Business Technology Transfer (SBIR/STTR) program funding.

ARPA-E focuses on energy technologies that can be meaningfully advanced with a targeted investment over a defined period of time. ARPA-E's rigorous program design, competitive project selection process, and hands-on engagement, ensure thoughtful expenditures while empowering America's energy researchers with funding, technical assistance, and market awareness.

Program Highlights

The FY 2021 Budget Request eliminates ARPA-E due to:

- The FY 2021 budget proposal includes no additional appropriations for ARPA-E projects and requests the cancellation of $332 million of unobligated balances.
- $21.256 million is requested for program direction to support close-out activities and oversight of existing projects.
- The SBIR/STTR Program Office will adopt best practices and lessons learned from ARPA-E to execute SBIR/STTR funds transferred from the applied programs in FY 2021.

($K)

	FY 2019 Enacted	FY 2020 Enacted	FY 2021 Request	FY 2021 Request vs FY 2020 Enacted	
				$	%
Federal Energy Regulatory Commission (FERC)					
Just and Reasonable Rates, Terms and Conditions	170,454	176,468	182,261	+5,793	+3.3%
Safe, Reliable, and Secure Infrastructure	130,347	132,286	142,757	+10,471	+7.9%
Mission Support through Organizational Excellence	69,099	73,246	79,332	+6,086	+8.3%
FERC Revenues	-369,900	-382,000	-404,350	-22,350	-5.9%
Subtotal, Federal Energy Regulatory Commission	**0**	**0**	**0**	**0**	**N/A**
Fees and Recoveries in Excess of Annual Appropriations	-16,000	-16,000	-9,000	+7,000	+43.8%
Total, Federal Energy Regulatory Commission	**-16,000**	**-16,000**	**-9,000**	**+7,000**	**+43.8%**

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 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 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 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's request provides continued funding for program contracts associated with statutorily required workload associated with hydropower and natural gas infrastructure, including environmental reviews, stakeholder engagement, and construction oversight.

  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 2021 request includes increased funding to advance the Commission's Part 12 inspection program and reviews of operational LNG 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. FERC promotes the reliable operation of the bulk-power system through oversight of the electric reliability organization (ERO). A Commission-certified 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 FERC-jurisdictional infrastructure. This is achieved through collaboration with federal and jurisdictional entities to identify, inform, assess, and address cyber and physical security threats and vulnerabilities, and to promote voluntary best practices that provide an important complement to FERC's related responsibilities for both regulatory requirements and enforcement. 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 sixty-seven percent 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 challenges of new and emerging knowledge/skill demands and the loss of institutional knowledge. The Commission's overall IT infrastructure must meet the demands and keep pace with the continual changes in the technology landscape; proactivity monitor and mitigate emerging cybersecurity threats; and adhere to federal requirements. In 2021, the Commission will make additional investments to continue its multi-year effort to update and modernize the Commission's information technology infrastructure and core mission and support systems to maintain a secure and reliable IT infrastructure to meet the needs of the Commission and provide innovative solutions to support employees. The Commission is also undergoing a multi-year renovation effort within its headquarters building. The renovation project will enable the agency to realize significant space savings. The 2021 request includes approximately $9.1 million to cover construction costs 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. The Commission achieves this by maintaining processes and public information services that promote transparency and open communication with respect to the conduct of the Commission's business. 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.