ENERGY PROGRAMS

ENERGY EFFICIENCY AND RENEWABLE ENERGY

Appropriation, 2019	$2,379,000,000
Budget estimate, 2020	343,000,000
Recommended, 2020	2,651,713,000
Comparison:	
Appropriation, 2019	+272,713,000
Budget estimate, 2020	+2,308,713,000

Energy Efficiency and Renewable Energy (EERE) programs include research, development, demonstration, and deployment activities that advance energy efficiency and renewable energy technologies, as well as federal energy assistance programs. Since the early 1970s and in partnership with business, industry, universities, research labs, and stakeholders, EERE has helped develop affordable, renewable energy and energy efficiency technologies. EERE is on the forefront of clean energy innovation, implementing a range of strategies aimed at reducing U.S. reliance on fossil fuels that is saving American families and businesses money, creating jobs, and reducing pollution.

The EERE program is divided into three portfolios: sustainable transportation, renewable energy, and energy efficiency. The sustainable transportation portfolio, which consists of the vehicles, bioenergy, and hydrogen and fuel cell programs, advances the development of plug-in electric and other alternative fuel vehicles, high-efficiency advanced combustion engines, and the replacement of oil with clean domestic transportation fuels. The renewable energy portfolio, which consists of the solar, wind, water, and geothermal programs, aims to develop innovative technologies to make renewable electricity generation cost competitive with traditional sources of energy. The energy efficiency portfolio, which consists of the advanced manufacturing, buildings, and federal energy assistance programs, seeks cost-effective solutions to reduce energy consumption in plants, buildings, and homes.

The Department is reminded that the research and development (R&D) policy contained in the front matter of Title III of this report specifically applies to each program within EERE. The Department shall provide the Committee with the specific breakdowns for R&D stages for both funds that are allocated according to this report and any funds that are not allocated by this report for each program.

The Committee directs EERE to offer technical and other programmatic assistance to Puerto Rico to support investment in innovative technologies to effectively reduce power system emissions, efficiently treat wastewater, produce biofuels, and generate power from solid waste, and to assist Puerto Rico in assessing the viability of a subsea electric cable interconnection and the use of micro grids.

The Committee recognizes the importance of the Department's work on the Energy-Water Nexus and as part of that effort, the Committee encourages the Department to enter into an interdepartmental agreement with the Department of Agriculture for research that explores how to integrate ongoing research projects at the various national laboratories and the Agricultural Research Service. The Department is directed to provide to the Committee not later than 120 days after enactment of this Act a report on re-

search collaborations with the Department of Agriculture, including at national laboratories. This report shall also address how the Department's expertise in energy efficiency for industrial processes, lighting systems, materials science, and advanced soil science can benefit food insecure communities and greenhouse and four-season production platforms.

Zero Emissions Energy Credit.—The Committee notes that the fiscal year 2018 Act directed the Department to produce a report to evaluate the effects of a Zero Emissions Energy Credit. The Committee expects a timely delivery of the report.

Energy Star.—The Committee supports the Department's ongoing role in the Energy Star program in its current structure. The Department is directed to support the Environmental Protection Agency's efforts to reexamine Energy Star guidelines and standard operating procedures to ensure transparency, predictability, and consistency for all stakeholders.

Energy Storage.—The Committee supports the Department's ongoing role in advancing energy storage R&D and encourages continued collaboration with the Office of Science, Office of Fossil Energy, and Office of Electricity on these efforts.

SUSTAINABLE TRANSPORTATION

The Vehicle, Bioenergy, and Hydrogen and Fuel Cell Technologies programs fund activities that can reduce American exposure to future high oil prices. Annually, vehicles transport 11 billion tons of freight or about $35,000,000,000 worth of goods each day and move more than three trillion vehicle miles. Research into cutting-edge technologies that will increase the fuel economy of gasoline and diesel fuel vehicles—the vast majority of today's fleet—will allow Americans to spend less on fuel while traveling the same distance. Research into next-generation automotive and fuel cell technologies that power vehicles with domestic energy sources such as natural gas, electricity, biofuels, and hydrogen can likewise dramatically lower the impact of future high gas prices on Americans. The Committee directs the Vehicle, Bioenergy, and Hydrogen and Fuel Cell Technologies offices to continue to work closely to develop common metrics to evaluate and compare the costs and energy consumption of advanced transportation technologies with existing technologies. The Department is directed to provide to the Committee not later than 180 days after enactment of this Act a report describing research and development activities applicable to two-stroke opposed piston engines within the Vehicle Technologies Office and how this research differs from ongoing work within the Department and other agencies.

Vehicle Technologies.—Within available funds, the recommendation includes $163,200,000 for Batteries and Electric Drive Technology; not less than $38,100,000 for electric drive research and development, of which $7,000,000 is to enable extreme fast charging and advanced battery analytics; and not less than $35,000,000 for Materials Technology, of which $30,000,000 is for early-stage research on multi-materials joining, propulsion materials, and carbon fiber-reinforced composites. Not less than $12,500,000 is provided for the Co-Optimization of Engine and Fuels Multi-Laboratory Consortium. The Committee provides $20,000,000 to continue the

SuperTruck II program to further improve the efficiency of heavy-duty class 8 long- and regional-haul vehicles.

The Committee directs the Department to continue to support the Clean Cities program, including providing competitive grants to support alternative fuel, infrastructure, and vehicle deployment activities. Within available funds, the recommendation provides $42,300,000 for Deployment through the Clean Cities program. When issuing competitive grants in support of these activities, the Department is encouraged to focus on awards that range from $500,000 to $1,000,000 each and include at least one Clean Cities coalition partner. The Committee encourages the Department to ensure balance in the award of funds to achieve varied aims in fostering broader adoption of clean vehicles and installation of supporting infrastructure. The Committee encourages continued outreach and deployment activities of renewable natural gas and natural gas powered vehicles.

Within available funds, the Committee includes not more than $10,000,000 for medium- and heavy-duty on-road natural gas engine research and development, including energy efficiency improvements, emission after-treatment technologies, fuel system enhancements, and new engine development. The recommendation also includes, within available funds, $10,000,000 to continue to support improving the energy efficiency of commercial off-road vehicles, including not more than $5,000,000 for fluid power systems. The Department is directed to provide to the Committee not later than 120 days after enactment of this Act a report on the potential for efficiency in these areas.

The Committee encourages continued research and development as appropriate in advanced combustion and vehicle engine technology efficiency in propane engines used for light- and medium-duty applications.

Bioenergy Technologies.—Within available funds, the Committee encourages the Department to continue to address issues regarding the use of biomass and waste, such as municipal solid waste, refuse derived fuels, wet wastes, waste gasses, and mixed wastes incorporating agriculture and forest residues, as feedstocks for biofuels and biochemical products. The Committee encourages continued research on the conversion of fuels and chemicals to electricity. The recommendation provides not less than $30,000,000 for feedstock supply and logistics, of which $5,000,000 is for upgrades at the Biomass Feedstock National User Facility to extend its capabilities and maximize benefits. The recommendation provides $35,000,000 for advanced algal systems.

Within available funds for Conversion Technologies, the recommendation provides $20,000,000 to continue the Agile Biology Foundry.

Within available funds for Demonstration and Market Transformation, not less than $12,500,000 is provided for the Co-Optimization of Engine and Fuels Multi-Laboratory Consortium.

The Committee is appreciative of research that the Bioenergy Technologies Office has supported regarding wet and gaseous waste streams in waste-to-energy projects. The Committee remains interested in understanding how further research and development activities can support baseload power generation using municipal solid waste-to-energy technologies, including to lower the energy

costs of wastewater treatment plants. The Department is reminded that the fiscal year 2018 Act required, not later than 180 days after the enactment of that Act, a report on research and development activities that can improve the economic viability of municipal solid waste-to-energy facilities. The Committee looks forward to receiving this report promptly.

The Committee encourages continued coordination with the Office of Fossil Energy on research and development of technologies for carbon capture and use.

Hydrogen and Fuel Cell Technologies.—The Committee recognizes the progress in breakthrough research and cost reduction for stationary, vehicle, motive, and portable power applications of fuel cell and hydrogen energy technology. Within available funds, $7,000,000 is to enable integrated energy systems using high and low temperature electrolyzers with the intent of advancing the H2@Scale concept and $10,000,000 to cost share the Office of Nuclear Energy hydrogen demonstration project. Within available funds, the Committee recommends $35,000,000 for Technology Acceleration activities, of which $5,000,000 is for industry-led manufacturing. The Committee recommends not less than $7,000,000 for safety, codes, and standards. The Committee remains supportive of H2@Scale activities that enable wide-scale hydrogen production and use in the United States to enable resiliency of power generation and transmission.

The Committee encourages the Department to continue its work on high temperature electrolysis coupled with thermal systems.

RENEWABLE ENERGY

The Solar Energy, Wind Energy, Water Power, and Geothermal Technologies programs fund applied research, development, and demonstration to reduce the cost of renewable energy to economically competitive levels. Research into innovative technologies, such as photovoltaic and concentrating solar technologies, offshore wind, hydropower, and ground heat, can expand energy production from our domestic resources and reduce our dependence on foreign oil. Research efforts have led to affordability and growth in adoption of renewable energy alternatives. Wind has become the cheapest energy source in many regions of the country and since 2008, the average price of wind energy has dropped by 75 percent. In little more than a decade, solar technology now powers more than nine million homes in the United States.

Solar Energy.—The Committee recommends not less than $55,000,000 for Concentrating Solar Power research and development, of which $5,000,000 is provided for a demonstration on advanced thermal desalination technologies.

The Committee recommends not less than $72,000,000 for Photovoltaic Research and Development to develop new or improved high-performance photovoltaic modules and architectures, and to achieve greater than 40 percent cell efficiencies.

The Committee recommends $35,000,000 for Balance of System Cost efforts focused on developing best practices for reducing the time and costs for permitting, inspecting, and interconnecting distributed solar and storage projects installed behind the customer's meter. Within these available funds, $1,000,000 is for the Solar Ready Vets program and $5,000,000 is for the National Community

Solar Partnership program to provide technical assistance to low and moderate income individuals, businesses, non-profit organizations, and state, local, and tribal governments to increase use of community solar installations.

The Committee recommends not less than $49,500,000 for Systems Integration and not less than $30,000,000 for Innovations in Manufacturing Competitiveness.

The Department is encouraged to support the development and demonstration of solar arrays that can withstand extreme weather events, earthquakes, and which are hardened from electromagnetic attacks. The solar arrays shall operate in grid-connected mode and as stand-alone resources.

The recommendation provides $20,000,000 for a competitive funding opportunity to improve photovoltaic cell technologies including thin-film solar cell technologies and cadmium telluride solar cell technologies, and to overcome grid integration challenges and reduce the costs of solar adoption.

Wind Energy.—The Department shall focus on innovative technologies that will lead to the next generation of offshore wind energy. The Committee encourages the Department to expand on the National Offshore Wind strategy published in 2016 by assessing how to set up supply chain, infrastructure, transmission, and grid integration to enable efficient logistics for the offshore wind industry. This should include how to plan for effective transmission of electricity from offshore wind plants to the onshore grid, how to develop regional networks of ports and other infrastructure to address offshore wind logistical issues, how to design and construct offshore wind support structures using U.S. labor, and strategic approaches to addressing supply chain and long-term workforce needs.

The Committee provides not less than $5,000,000 for the Department's work on distributed wind technologies and encourages continued investment in research.

The recommendation provides $1,000,000 for the Wind for Schools program.

Water Power.—Within available funds, the recommendation provides $82,000,000 for marine and hydrokinetic research, development, and deployment activities, including research into mitigation of marine ecosystems impacts of these technologies. The Committee supports the Department's emerging focus on bringing marine energy to meet near-term opportunities in the blue economy, thereby accelerating marine energy grid readiness. The recommendation provides not more than $10,000,000 to support research and development, testing, and partnership activities for the new Powering the Blue Economy initiative. The Committee encourages the Department to use existing core capabilities within its national laboratories to execute this work, in partnership with universities and industry.

Within available funds, the Committee provides $35,000,000 for a balanced portfolio of competitive solicitations to support industry and university-led research, development, and deployment to validate the performance, reliability, maintainability, environmental impact, and cost of marine energy technology components, devices, and systems at a variety of scales, of which not more than

$10,000,000 is for the Testing Expertise and Access for Marine Energy Research program.

Within available funds, not more than $10,000,000 is provided to address infrastructure needs at marine energy technology testing sites. The Department shall continue its coordination with the U.S. Navy on marine energy technology development for national security applications at the Wave Energy Test Site and other locations.

The recommendation provides $43,000,000 for conventional hydropower, of which not less than $6,600,000 is for the purposes of section 242 of the Energy Policy Act of 2005. The Committee provides $5,000,000 for a competitive funding opportunity for industry-led research, development, and deployment of cross-cutting energy converter technologies for run-of-river and tailrace applications to better utilize underdeveloped low-head and other hydropower resources.

The Committee recognizes the need for the Department to advance an array of technologies related to hydropower research and development. Within available funds, not less than $1,000,000 is provided to explore using existing government assets, including infrastructure operated by the U.S. Army Corps of Engineers and any necessary agreements that would be required to establish a hydropower research and development test facility. The Department is directed to brief the Committee not later than 180 days after enactment of this Act on the potential for this type of test facility.

Geothermal Technologies.—Within available funds, $5,000,000 is for the completion of the Frontier Observatory Research in Geothermal Energy project, which will facilitate necessary technology development and expand the understanding of subsurface dynamics. The Department is directed to continue its efforts to identify prospective geothermal resources in areas with no obvious surface expressions. Within available funds, not more than $10,000,000 is provided for at least one demonstration project in an area with no obvious surface expressions, including to develop technologies for distribution of heat through district heating systems. The Department is encouraged to issue a solicitation for near-field enhanced geothermal systems demonstrations. The Department is encouraged to work with the Department of the Interior on opportunities to improve geothermal permitting.

ENERGY EFFICIENCY

The Advanced Manufacturing, Building Technologies, Federal Energy Management, and Weatherization and Intergovernmental programs advance cost-effective solutions to reduce energy consumption through increased efficiency. Research into cutting-edge technologies that enhance manufacturing processes, develop advanced materials, and reduce energy use in buildings, homes, and factories can serve the national interest by greatly reducing our energy needs, while also giving American manufacturers an advantage to compete in the global marketplace. The Committee encourages the Department to plan a workshop including behavioral and social scientists to explore ways to improve the adoption rate of energy efficient technologies. The Committee also encourages the Department to continue growing this body of adoption research. The Department is directed to provide the Committee not later than 60 days after enactment of this Act a report that details how the De-

partment would integrate such a program into the Department's ongoing research programs.

Advanced Manufacturing.—The Committee provides not less than $4,205,000 for improvements in the steel industry; $25,000,000 for the Critical Materials Institute; $20,000,000 for the Energy-Water Desalination Hub; and $20,000,000 for the Manufacturing Demonstration Facility (MDF) and the Carbon Fiber Test Facility. Within available funds for the MDF, not more than $5,000,000 is for the development of additive systems and automation technologies that have the potential to deposit multiple materials allowing for hybrid material solutions.

Within available funds, the recommendation provides not less than $95,000,000 for Advanced Manufacturing Research and Development.

The Committee provides $28,000,000 for the two Clean Energy Manufacturing Innovation Institutes. The Committee is concerned that recent efforts to establish a Clean Energy Manufacturing Innovation Institute focused on cybersecurity in the manufacturing industry will be duplicative of efforts already undertaken by Department of Defense manufacturing institutes. The Committee directs the Department to coordinate with the Department of Defense prior to the award of this institute to ensure it is not duplicative of previous or ongoing work carried out by the Department of Defense. The Department shall provide a briefing to the Committee outlining the unique mission and work intended for this institute once the award is made but prior to the beginning of operation of the institute.

The Committee supports the Department's ongoing efforts to work on bio-based composites, bio-derived materials, and nano/microcellulose research.

The Committee provides $20,000,000 for process-informed science, design, and engineering of materials and devices in harsh environments, including nuclear environments, and $5,000,000 for dynamic catalyst science coupled with data analytics.

Within available funds for the Industrial Technical Assistance program, the Committee recommends $12,000,000 to provide ongoing support for the Combined Heat and Power (CHP) Technical Assistance Partnerships (TAP) and related CHP Technical Partnership activities, including $5,000,000 for TAPs and $7,000,000 for related CHP activities which includes research and development opportunities. The Committee recommends $11,000,000 to expand the technical assistance provided by the Industrial Assessment Centers.

The Committee encourages the Department to expand its existing voluntary technical assistance initiative to assist energy-intensive manufacturing facilities in the United States to achieve energy savings and reduce costs. The Department is encouraged to prioritize assistance to manufacturing facilities that use the most primary energy on an annual basis and to ensure a diversity of facilities by geographic region.

The Committee recognizes the great potential for energy savings in water and wastewater treatment systems, which are among the country's largest industrial electricity users. The Committee appreciates the Department's work on technical assistance in this area and provides $5,000,000 to expand the technical assistance pro-

vided for water and wastewater treatment. The Department shall brief the Committee not later than 120 days after enactment of this Act on its plan to expand technical assistance in this area. In addition, the Committee provides $20,000,000 for research and development on technologies to achieve energy efficiency of water and wastewater treatment plants, including the deployment of alternative energy sources, as appropriate.

The Committee notes that drying processes consume approximately 10 percent of the process energy used in the manufacturing sector. The recommendation provides up to $10,000,000 for the issuance of a competitive solicitation for university or industry-led teams to improve the efficiency of industrial drying processes and foster new and innovative drying technologies.

The Committee directs the Department to continue its focus on manufacturing energy efficiency and electrification to support industrial greenhouse emission reductions. The Department shall develop decarbonization roadmaps in key technology areas to guide research and development at the Department to achieve significant, economical greenhouse gas emission reductions by 2050, including energy efficiency, process electrification, industrial electrification technologies, and carbon capture. Roadmaps should be developed in consultation with external stakeholders and relevant offices within the Department.

The Committee supports the Department's continued efforts to accelerate development of manufacturing processes needed for clean energy materials to go from discovery to scale-up with the goal of lowering battery energy storage costs and spurring job creation.

The Committee encourages the Department to make recommendations on ways to increase the collection and recycling rates of aluminum among municipalities and collection sites, to include ways to deploy new technologies, educate consumers, and demonstrate if increasing collection and recycling might offset the costs of recycling other materials.

Building Technologies.—The Committee directs the Department to maintain existing transactive control research efforts and provides not less than $30,000,000 for building-grid integration research and development consistent with a transactive energy system and in coordination with the Office of Electricity's transactive energy systems program, including development of advanced transactive control methodologies and field validation and testing in existing buildings. The Committee includes not less than $40,000,000 for Commercial Buildings Integration, not less than $30,000,000 for Residential Buildings Integration, not less than $110,000,000 for Building Energy Research and Development, and $25,000,000 for solid-state lighting. If the Secretary finds solid-state lighting technology eligible for the twenty-first century lamp prize, specified under section 655 of the Energy Independence and Security Act of 2007, $5,000,000 is provided in addition to funds recommended for lighting research and development. The Committee encourages that funds for Residential Buildings Integration be used for a comprehensive program to successfully integrate the results of early-stage research and development into U.S. residences to fully deliver innovative energy technologies, practices, and information to American consumers and companies.

The Committee includes not less than $55,000,000 for Equipment and Buildings Standards, of which not less than $10,000,000 is for Building Energy Codes.

The Committee appreciates the Department's work in mass composite timber technology and high-performance building insulation and sensor technologies. The Committee recommends early stage research and development of technology to impact commercial building by developing, building, and evaluating cross-laminated timber wall systems with attention to their energy content and energy efficiency.

The Committee notes that natural gas plays an important role in meeting the energy needs of U.S. homes and commercial buildings. The Committee encourages the Department to continue to explore research and development that can advance future natural gas systems and appliances to meet consumer demand for high efficiency and environmentally friendly products. The Committee recommends continued research, development, and market transformation programs on energy efficiency efforts related to the direct use of natural gas in residential applications, including gas heat pump heating and water heating, on-site combined heat and power, and natural gas appliance venting.

Not later than 30 days after enactment of this Act, the Department shall provide a briefing to the Committee on the status of the joint stakeholder proposal for an energy efficiency standard for dedicated purpose pool pump motors. The briefing shall include a timeline for implementation of the recommendations in the joint stakeholder proposal.

The Committee supports the continued efforts by the Building America Program and encourages robust funding for these activities.

Federal Energy Management Program.—Within available funds, $2,000,000 is provided to establish a Performance Based Contract National Resource Collaborative Initiative to provide expertise to state and local governments to facilitate the expansion of performance-based contracts nationwide. The initiative shall be coordinated with the Office of Weatherization and Intergovernmental Programs. The Department is directed to provide to the Committee not later than 120 days of enactment of this Act a report that includes the types of technical and financial expertise the Department is suited to provide and an analysis of the available infrastructure work that can be accomplished through performance-based contracts over a 10-year period and the resources necessary to achieve this goal.

The recommendation provides $2,000,000 for the Department to continue its work through the Assisting Federal Facilities with Energy Conservation Technologies (AFFECT) program.

Weatherization and Intergovernmental Programs.—The Committee rejects the proposed elimination of the Weatherization Assistance Program and provides $290,000,000. The Committee directs the Department to ensure a timely distribution of Weatherization Assistance Program funds. The Committee also encourages the Department to continue its oversight of grantees to ensure that funds are dispersed to weatherization providers in a timely manner.

The Committee provides $500,000 for training and technical assistance to continue the Sustainable Wastewater Infrastructure of the Future Accelerator.

The Committee believes that community-scale weatherization efforts could focus on individual homes or units as part of a broader, innovative "neighborhood" approach to weatherization. The Department is directed to provide to the Committee not later than 120 days of enactment of this Act a report that analyzes the feasibility of community-scale weatherization efforts. The report shall explore if states or subgrantees administering weatherization funds are currently weatherizing multiple homes as part of an integrated, community, or neighborhood approach.

The Committee notes that the Department and the Department of Housing and Urban Development (HUD) have a Memorandum of Understanding in place to streamline the weatherization eligibility process for residents in publicly-assisted units. Further interagency coordination could assist with information dissemination that can lead to identification of individuals who are eligible for weatherization services. The Department shall brief the Committee not later than 120 days after enactment of this Act regarding efforts to collaborate with partners at the Department of Health and Human Services Low Income Home Energy Assistance Program, the HUD Lead Hazard Control and Healthy Homes Program, and the Department of Veterans Affairs.

The Committee recognizes that lead exposure is exacerbated by outdated windows and window panes. The Committee encourages the Department to explore the possibility of including health benefits from eliminated lead exposure in the calculation of the savings-to-investment ratio and how it will impact the program. Similarly, the Department is encouraged to further explore how replacing leaded windows with lead free windows can be incorporated in the savings-to-investment ratio.

The Committee rejects the proposed elimination of the State Energy Program and provides $70,000,000.

CORPORATE SUPPORT

The Program Direction, Strategic Programs, and Facilities and Infrastructure budgets provide the necessary resources for program and project management across all of EERE's technology programs, for the adoption of technologies to market, and for the operation and upkeep of the National Renewable Energy Laboratory.

Facilities and Infrastructure.—The Committee supports the budget request for planned upgrades to the National Wind Energy Technology Center. The Department is encouraged to demonstrate a commitment to operations and maintenance of facilities that support the Department's critical missions within EERE.

Program Direction.—The Committee acknowledges that the Department is taking steps to hire staff and encourages an aggressive strategy to ensure that EERE is appropriately staffed to carry out and oversee the funds provided by the Committee.

CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE

Appropriation, 2019	$120,000,000
Budget estimate, 2020	156,500,000
Recommended, 2020	150,000,000
Comparison:	
Appropriation, 2019	+30,000,000
Budget estimate, 2020	−6,500,000

The Cybersecurity, Energy Security, and Emergency Response program leads the Department's efforts to secure the nation's energy infrastructure against all hazards, reduce the risks of and impacts from cyber events, and assist with restoration activities. A reliable and resilient power grid is critical to the nation's economic competitiveness and leadership.

The recommendation includes the proposed movement of the energy delivery system testing and analysis laboratory initiative from Cybersecurity for Energy Delivery Systems to Infrastructure Security and Energy Restoration to operationalize the results of the research and development initiative.

The Committee places a high priority on ensuring the protection of the grid against cyberattacks and extreme weather events caused by climate change. The Committee appreciates the Department's enhanced focus on these activities. Many different actors, governmental and private, play a role in preventing and responding to threats to the nation's energy infrastructure. The Committee expects the Department to continue coordinating its efforts with all stakeholders to ensure the highest priority areas are being addressed effectively in its ongoing efforts to protect the grid.

Cybersecurity for Energy Delivery Systems.—Within available funds, $10,000,000 is for research and development on concepts to simplify and isolate automated systems and remove vulnerabilities that could allow unauthorized access to the grid through digital software systems. The Committee recommends $5,000,000 for the DarkNet project to explore and develop opportunities for transitioning the nation's critical infrastructure off the internet and shielding the nation's electricity infrastructure from disruptive cyber penetration.

Within available funds, $4,000,000 is provided for university-based research and development of scalable cyber-physical platforms for resilient and secure electric power systems that are flexible, modular, self-healing, and autonomous.

The Committee encourages the Department to continue its focus on the development of private-sector partnerships to secure industrial control systems across multiple critical infrastructure entities without duplicating existing private sector capabilities. The Committee encourages continued investment in collaborative threat detection and intelligence partnerships that makes industrial control systems threat analytics and data accessible to the greater industrial control systems community. The Committee also encourages the Department to collaborate with other federal agencies on these efforts to ensure they are further contributing to the overall success of the federal critical infrastructure security mission.

Infrastructure Security and Energy Restoration.—Within available funds, not less than $14,500,000 is to operationalize the results of the energy delivery system testing and analysis laboratory initiative, not less than $18,000,000 is for preparedness and situa-

tional awareness, and not less than $5,000,000 is for emergency response and recovery.

The Department is directed to provide to the Committee a report that provides a rationale for establishing any new testing capabilities designed to examine the vulnerabilities of the energy sector from threats such as electromagnetic pulse and geomagnetic disturbances and an inventory of existing capabilities that could serve this function. The report shall be provided not later than 90 days after enactment of this Act and prior to any funds being obligated for the establishment of any new testing capabilities.

ELECTRICITY

Appropriation, 2019	$156,000,000
Budget estimate, 2020	182,500,000
Recommended, 2020	200,000,000
Comparison:	
Appropriation, 2019	+44,000,000
Budget estimate, 2020	+17,500,000

The Office of Electricity advances technologies and provides operational support to increase the efficiency and technological advancement of the nation's electricity delivery system. The power grid employs aging technologies at a time when power demands and the deployment of new energy technologies are imposing new stresses on the system. This program aims to develop a modern power grid by advancing resilient power distribution systems, intelligent and high-efficiency grid components, and energy storage systems.

The Department is directed to continue the ongoing work between the national laboratories, industry, and universities to improve grid reliability and resiliency through the strategic goals of the Grid Modernization Initiative (GMI). The Department is encouraged to include all applied energy programs to ensure broad energy system resilience and modernization. Further, the Committee supports the Grid Modernization Laboratory Consortium and supports continued updates to and implementation of the Grid Multi-Year Program Plan to ensure coordination across program office investments in foundational and program-specific GMI projects. The Committee directs the Department to emphasize national energy system resilience modeling and improved grid cyber resilience to address emerging national resilience challenges of the grid and related energy systems, planned investments in energy storage to improve grid flexibility and resilience, and advanced sensors and control paradigms that promise to improve energy system resilience of the future smart grid.

Transmission Reliability and Resilience.—Within available funds, the Committee directs not less than $500,000 for the Department to select an appropriate transmission line to be outfitted with advanced non-contact sensors to monitor and collect data from each conductor and stringing section of the target line for 12 months. The Department shall submit to the Committee a summary report of the results and benefits that may be produced from such transmission line monitoring. The Department is further directed to provide to the Committee not later than 180 days after enactment of this Act a report outlining the barriers and opportunities for technologies that provide increased, more efficient, or more effective de-

livery over the existing transmission network. The report should examine the reliability, resilience, and economic benefits of technologies such as power flow control, topology optimization, and dynamic line ratings. The Committee supports advancement of the North American Energy Resiliency Model as it was described in the Department's briefing to the Committee. If the Department proposes any changes to or additional work regarding the Model, the Department shall brief the Committee prior to taking any action.

Resilient Distribution Systems.—Within available funds, the Committee directs the Department to continue efforts to support the integration of sensors into the nation's electric distribution systems, fundamental research and field validation of microgrid controllers and systems, and transactive energy concepts, including studies and evaluations of energy usage behavior in response to price signals. The Committee places a high priority on addressing the challenges facing the electric power grid by developing the innovative technologies, tools, and techniques to modernize the distribution portion of the electricity delivery system. Resilient Distribution Systems pursues strategic investments to improve reliability, resilience, outage, recovery, and operational efficiency, building upon previous and ongoing grid modernization efforts.

Energy Storage.—Within available funds, the Department is directed to establish a crosscutting program to lower the cost of long duration grid-scale energy storage. The program shall build off the Department's prior research and development efforts in storage, include a suite of technologies capable of providing storage-like functions, and focus R&D efforts on technical, regulatory, and market issues necessary to achieve both existing grid-scale storage cost and performance targets, as well as targets for increased grid reliability, resiliency, or others as appropriate. This initiative should leverage the energy storage work being conducted within the Offices of Science, Energy Efficiency and Renewable Energy, Nuclear Energy, and Fossil Energy where appropriate. The Committee directs continued support to alternative chemistries including flow batteries using earth-abundant materials, continued work with industry to support safety, and expanded assistance for energy storage field validation and demonstration, with an emphasis on renewable generation integration. The recommendation includes $3,500,000 to accelerate support for low-cost flow batteries that use earth-abundant materials by improving materials and designing prototypes for one or more field demonstration projects. Within available funds, the Committee directs not less than $5,000,000 to establish a grid storage launch pad aimed at accelerating materials development, testing, and independent evaluation of battery materials and battery systems for grid applications. The Department is further directed to provide to the Committee not later than 90 days after enactment of this Act a report that sets appropriately aggressive yet achievable cost and performance targets, enumerates emerging energy storage applications, and outlines a strategy for coordinating and aligning energy storage R&D across the Department.

Transformer Resilience and Advanced Components.—The Department is encouraged to continue to support research and development for advanced components and grid materials for low-cost, power flow control devices, including both solid state and hybrid

concepts that use power electronics to control electromagnetic devices and enable improved controllability, flexibility, and resiliency.

NUCLEAR ENERGY

Appropriation, 2019	$1,326,090,000
Budget estimate, 2020	824,000,000
Recommended, 2020	1,317,808,000
Comparison:	
Appropriation, 2019	−8,282,000
Budget estimate, 2020	+493,808,000

Nuclear power generates approximately one-fifth of the nation's electricity and continues to be an important zero carbon-emissions energy source. The Nuclear Energy program invests in research, development, and demonstration activities that develop the next generation of clean and safe reactors, further improve the safety and economic viability of our current reactor fleet and contribute to the nation's long-term leadership in the global nuclear power industry.

NUCLEAR ENERGY RESEARCH AND DEVELOPMENT

The Committee is concerned about the Department's use of flexibility in funds previously provided and has therefore included additional control points for fiscal year 2020. The Department is directed to submit its fiscal year 2021 budget request using this budget structure.

The fiscal year 2018 Act directed the Department to provide the Committee with a report detailing all current programs and projects within the Office of Nuclear Energy, whether the Department plans to continue to support each program or project, and the expected out-year funding through completion of the program or project. The Committee is still awaiting this report and directs the Department to provide this report not later than 30 days after enactment of this Act. The Department may provide a briefing in lieu of a report, after consultation with the Committee.

The fiscal year 2018 Act directed the Department to provide a report that sets aggressive, but achievable goals to demonstrate a variety of private-sector advanced reactor designs and fuel types by the late 2020s to the Committee not later than 180 days after the enactment of the Act. The Committee is still awaiting that report and directs the Department to provide the report not later than 90 days after enactment of this Act.

Nuclear Energy University Program.—Since 2009, the Department has allocated up to 20 percent of funds appropriated to Nuclear Energy Research and Development programs to fund university-led R&D and university infrastructure projects through an open, competitive solicitation process using formally certified peer reviewers. The Department is directed to continue this practice and is encouraged to spend not less than $40,000,000 for the Nuclear Energy University Program to support R&D activities performed at U.S. colleges and universities.

Integrated University Program.—The Committee recommends $5,000,000 to continue the Integrated University Program, which is critical to ensuring the nation's nuclear science and engineering workforce in future years.

Nuclear Energy Enabling Technologies.—Within available funds, $45,000,000 is for Crosscutting Technology Development, of which $10,000,000 is for work on advanced sensors and instrumentation, not less than $10,000,000 is for collaboration with the Office of Science to accelerate the characterization, development, and qualification of advanced materials suitable for either high-radiation or heat above 750 Celsius, and $10,000,000 is for hybrid integrated energy systems; $40,000,000 is for the Nuclear Science User Facilities, of which $10,000,000 is for nuclear energy computation system and support, $10,000,000 is for the Nuclear Materials Discovery and Qualification initiative, and $2,000,000 is for preliminary engineering and design of a secure, separate, and shielded beamline at the NSLS-II at Brookhaven National Laboratory to examine radioactive materials; and $40,000,000 is for Nuclear Energy Advanced Modeling and Simulation. The Department is encouraged to transfer the analysis previously conducted under the Consortium for Advanced Simulation of Light Water Reactors innovation hub to the Nuclear Energy Advanced Modeling and Simulation program.

Reactor Concepts Research, Development, and Demonstration.—Within available funds, $100,000,000 is for Advanced Small Modular Reactor Research and Development to support technical, first-of-its-kind engineering and design and regulatory development of next generation light water and non-light water small modular reactors, of which $10,000,000 is for the Joint Use Modular Program; $105,000,000 is for Advanced Reactor Technologies, of which $20,000,000 is for a new solicitation for at least two new public-private partnerships focused on advancing non-light water reactor designs towards demonstration phase, $25,000,000 is for MW-scale reactor research and development, $34,000,000 is for fuel and graphite qualification, and $5,000,000 is to establish the National Reactor Innovation Center; and $65,000,000 is for Versatile Advanced Test Reactor R&D to pursue conceptual design and other activities necessary to achieve Critical Decision–1 (CD–1), Alternative Selection and Cost Range. The Department is directed to provide the Committee the CD–1 documentation immediately following the Department's approval of CD–1 for the Versatile Advanced Test Reactor. The Department is encouraged to identify ways to reduce the cost and address the timeline of the Versatile Advanced Test Reactor, including the potential for international collaboration and cost-sharing. In support of the current fleet of reactors to ensure safe and reliable operations, the Committee includes $55,000,000 for the Light Water Reactor Sustainability program, of which $11,000,000 is for a for a hydrogen production demonstration.

Fuel Cycle Research and Development.—Within available funds, the recommendation provides $95,000,000 for the Advanced Fuels Program, of which not less than $75,600,000 is for accident tolerant fuels development. The Committee encourages the Department to evaluate accident tolerant fuel irradiation testing capability gaps resulting from the closure of the Halden reactor. The Committee encourages the Department to support safety and security advancements in nuclear fuels even beyond accident tolerant and to support small factory-produced next-generation reactors designed to use these fuels. Within available funds, the recommendation provides $60,000,000 for Material Recovery and Waste Form Develop-

ment, of which at least $45,000,000 is for highly enriched uranium recovery to support needs for high-assay low enriched uranium for advanced reactor fuel. Within available funds, the recommendation provides $40,000,000 for Civil Nuclear Enrichment to demonstrate the ability to produce high-assay low enriched uranium to support the anticipated fuel requirements for new advanced reactor designs, as proposed in the budget request.

The recommendation provides $62,500,000 to continue Used Nuclear Fuel Disposition research and development activities. The Committee is aware of the Department's ongoing research and development efforts regarding the safe transportation of spent nuclear fuel and directs the Department to study the behavior of spent fuel under transportation conditions and opportunities to improve safety of spent fuel rods during transportation.

The Blue Ribbon Commission on America's Nuclear Future observed that "any comprehensive and forward-looking strategy for managing the back end of the nuclear fuel cycle in the United States needs to consider the potential impact not only of current technology but of further technology advances in the decades ahead," particularly because "expanded deployment of reprocess and recycle technologies would clearly affect the quantity and composition of nuclear material slated for final disposition." The Committee recognizes that large uncertainties exist about the merits and commercial viability of different nuclear fuel cycles and technology options, and accordingly, the Committee directs the National Academies of Sciences, Engineering, and Medicine to evaluate the merits and viability of different nuclear fuel cycles and technology options, including both existing and future technologies. As recommended by the Blue Ribbon Commission, such evaluation must "account for linkages among all elements of the fuel cycle (including waste transportation, storage, and disposal) and for broader safety, security, and non-proliferation concerns."

The recommendation provides $47,500,000 for Integrated Waste Management Storage, of which $25,000,000 is directed for interim storage activities, including the initiation of a robust consolidated interim storage program, including site preparation activities at stranded sites, to evaluate the re-initiation of regional transport compacts, and transportation coordination.

IDAHO FACILITIES MANAGEMENT

INL Operations and Infrastructure.—Within available funds, the recommendation includes $280,000,000 for INL Operations and Infrastructure to support the reliability and sustainability of the Materials and Fuels Complex (MFC) and the Advanced Test Reactor (ATR).

The Department is directed to brief the Committee not later than 60 days after enactment of this Act on the funding levels required for operations and maintenance of activities at the MFC and ATR. The briefing should include an accounting of how funds have been spent for the previous three fiscal years and how funds will be spent for the current fiscal year. The briefing should also include information for the next four fiscal years on the funding levels required for optimal operations for each facility and funding levels required for multi-year infrastructure improvements.

The fiscal year 2018 Act directed the Department to provide to the Committee not later than 180 days after enactment of the Act a list of the current and planned users for the ATR for the next three years, the operating cost attributed to each user, and the source of funds that will be applied to cover the costs for each user. The Committee is still awaiting this report and directs the Department to meet this reporting requirement not later than 90 days after enactment of this Act.

IDAHO SITEWIDE SAFEGUARDS AND SECURITY

The Committee recommends $137,808,000 for Idaho Sitewide Safeguards and Security, the same as the budget request.

FOSSIL ENERGY RESEARCH AND DEVELOPMENT

Appropriation, 2019	$740,000,000
Budget estimate, 2020	562,000,000
Recommended, 2020	740,000,000
Comparison:	
Appropriation, 2019	– – –
Budget estimate, 2020	+178,000,000

Fossil energy resources, such as coal, oil, and natural gas, generate a significant portion of the nation's electricity and will continue to contribute to those needs for the foreseeable future. The Fossil Energy Research and Development program funds research, development, and demonstration activities to improve existing technologies and to develop next-generation systems in the full spectrum of fossil energy areas. The activities funded within this program advance the nation's position as a leader in energy technologies and ensure the safe, reliable, efficient, and environmentally sound use of fossil energy resources.

Consistent with direction provided in fiscal years 2018 and 2019, the Committee does not support the closure of any National Energy Technology Laboratory (NETL) site and provides no funds to plan, develop, implement, or pursue the consolidation or closure of any of the NETL sites.

Fossil Energy R&D Advisory Committees.—The Department is directed to exercise its existing authority to formally solicit input and feedback on program direction, research priorities, and other matters through the establishment of relevant advisory committees. The Department shall brief the Committee not later than 90 days after enactment of this Act on the status of fossil energy federal advisory committees.

COAL—CCS AND POWER SYSTEMS

Carbon capture, utilization, and storage is a series of processes that captures carbon dioxide emissions from sources and either reuses or stores it so it will not enter the atmosphere. The potential for these technologies is considerable, and the use of these technologies will decrease the costs for mitigating climate change in addition to deploying clean energy and energy efficient technologies.

The Committee supports the integrated carbon and energy management activities of the Offices of Nuclear Energy and Energy Efficiency and Renewable Energy and provides $5,000,000 for Hybrid Carbon Conversion activities within Fossil Energy.

The Committee encourages the Department to continue to support the Clean Energy Research Consortium: Advanced Coal Technology Consortium program.

The Committee acknowledges the economic and environmental benefits that could be produced by expanding the scope of carbon capture and carbon utilization research to a wider range of sources. The Department is directed to provide to the Committee not later than 90 days after enactment of this Act an implementation plan, in coordination with the Office of Science and Bioenergy Technologies Office, that responds to the recommendations of the National Academies studies "Negative Emissions Technologies and Reliable Sequestration: A Research Agenda" and "Gaseous Carbon Waste Streams Utilization: Status and Research Needs." The implementation plan should include recommendations for program structures that could best support and maximize the impact of expanded research, development, and demonstration efforts in three areas: decarbonization of the industrial sector, direct air capture, and carbon use.

Carbon Capture.—The Committee encourages the Department to focus its efforts on improving the efficiency and decreasing the costs of carbon capture technologies, demonstrating carbon capture technologies, and identifying how these technologies can be integrated with business models and operations. This focus includes small- and large-scale pilot testing of technologies moving through the program pipeline and retrofit activities on the existing fleet. The Department is directed to use funds within Carbon Capture for research and development across a broad range of technology and fuel applications as it determines to be merited. Within available funds, not less than $7,000,000 is for carbon capture research that benefits natural gas power systems. Within available funds, the Committee recommends $4,000,000 for research and optimization of carbon capture technologies for use at industrial facilities, which may include developments in process equipment and chemistry, capture of process emissions, and systems integration. The Committee recommends not less than $10,000,000 for research, development, and demonstration projects that benefit direct air capture technologies, which capture carbon dioxide from dilute sources at a significant scale, in coordination with the Bioenergy Technologies Office.

Carbon Storage.—Within available funds, the Committee recommends $30,000,000 for Carbon Use and Reuse for research and development activities to support valuable and innovative uses of captured carbon, including biological utilization by the conversion of carbon dioxide to higher-value products such as chemicals, plastics, building materials, curing for cement, and the integration of carbon utilization technologies with fossil fuel power plants, such as biological conversion systems. The recommendation includes $6,000,000 for a competitive solicitation to conduct tests of technologies for carbon dioxide absorption integrated with algae systems for capturing and re-using carbon dioxide to produce renewable materials, giving priority for teams with university participants.

Advanced Energy Systems.—Within available funds, $30,000,000 is for Solid Oxide Fuel Cells to focus on hydrogen production and storage as well as research and development to enable efficient,

cost-effective electricity generation with minimal use of water and the use of abundant domestic coal and natural gas resources with near-zero atmospheric emissions of carbon dioxide and other pollutants. Moreover, central power generation applications of solid oxide fuel cells can be integrated with carbon capture and storage efforts to contribute to a secure energy future. The fiscal year 2019 Act directed the Department to provide an update on the status of the Solid Oxide Fuel Cell Program by submitting a report to the Committee not later than 180 days after enactment of the Act. The Committee looks forward to receiving the report expeditiously.

Within available funds, the Committee recommends $30,000,000 for Advanced Turbines. The Committee urges the Department to fund research and development activities to improve the efficiency of gas turbines used in power generation systems, working cooperatively with industry, universities, and other appropriate parties.

Within available funds, the Department is directed to support research and development activities that focus on expanding the Department's external agency activities to develop and test advanced concept coal to liquid fuels technologies. Within available funds, the Department is directed to conduct early-stage research and development to enable the conversion of coal pitch and coal to carbon fiber and other value-added carbon products for alternative advanced uses of coal.

Cross Cutting Research.—Within available funds, the recommendation includes $40,000,000 for materials R&D, including $21,000,000 for the Advanced Ultrasupercritical Program to fabricate, qualify, and develop domestic suppliers capable of producing components from high temperature materials; water management R&D; and sensors and controls. Within available funds, the recommendation includes $23,000,000 for the Department to continue its ongoing external agency activities to develop and test advanced separation technologies and accelerate the advancement of commercially viable technologies for the recovery of rare earth elements and minerals from U.S. coal and coal byproduct sources. The Committee expects research to support pilot-scale and experimental activities for near-term application.

NETL Coal Research and Development.—The recommendation includes the budget request's proposal to move the Critical Materials Initiative to Cross Cutting Research.

Supercritical Transformational Electric Power (STEP) Generation.—Within available funds, the recommendation provides not more than $9,800,000, consistent with the original scope of work, to complete the necessary design and construction of the 10–MW pilot and to conduct the necessary testing for the facility. The recommendation provides additional funds for competitively-awarded research and development activities, coordinated with the Offices of Nuclear Energy and Energy Efficiency and Renewable Energy, to advance the use of supercritical power cycles.

NATURAL GAS TECHNOLOGIES

Research.—Within available funds, the recommendation provides $15,000,000 for Environmentally Prudent Development, including $7,000,000 for the Risk Based Data Management System.

Within available funds, the recommendation provides $15,000,000 for Emissions Mitigation from Midstream Infrastruc-

ture and $7,000,000 for Emissions Quantification from Natural Gas Infrastructure. The Department is encouraged to explore technologies that curtail methane gas emissions from flaring and venting in shale formations. The Department is directed to provide to the Committee not later than 60 days after enactment of this Act a report on its efforts in this area. The Committee encourages coordination with industry and the Pipeline and Hazardous Materials Safety Administration on methane leak detection technology development. The Committee remains supportive of investment in smart pipeline sensors and controls, internal pipeline inspection and repair, and composite and advanced material science technologies. The Committee encourages the Department to consider expanded use of gas pressure monitoring, both real time and hourly, in distribution systems to improve system integrity and safety. Further deployments of methane detection sensors closer to the consumer would add to overall safety.

Within available funds, the Department is encouraged to coordinate with other federal agencies and states to maximize the benefits of U.S. unconventional natural gas liquids production.

Within available funds, the Committee encourages the Department to perform methane hydrate research as recommended in the 2016 Secretary of Energy Advisory Board Report of the Task Force on Methane Hydrates.

Within available funds, the Committee encourages the Department to advance research and technology development opportunities between universities, industry, and the national laboratories to develop novel engineered systems that convert light hydrocarbons derived from shale gas and oil to more valuable compounds for use as fuels, chemical intermediaries, and other products.

UNCONVENTIONAL FOSSIL ENERGY TECHNOLOGIES

The Committee recognizes the Department's continued investment into research and development on unconventional fossil energy technologies, including research that develops improved enhanced recovery technologies.

The Committee recognizes the need to foster the sustainability of the petroleum engineering workforce. The Department is directed to provide to the Committee not later than 60 days after enactment of this Act a report that outlines the Department's efforts to maintain a stable petroleum engineering workforce and knowledge base and future activities the Department can undertake to strengthen it.

The Committee is pleased with the Department's progress to date on studying the volatility of crude oil from varying locations, including the Bakken Shale in North Dakota, and accurately assessing and characterizing volatility before transporting. The Committee directs the Department to continue this research in partnership with the Department of Transportation to improve the safety of crude oil transported by rail in this country. The Committee directs the Department to provide briefings after the completion of each research task to the Committee on the findings from the research and necessity for any additional research tasks.

NETL INFRASTRUCTURE

Within available funds, the recommendation provides $6,000,000 for NETL's Supercomputer, Joule.

NAVAL PETROLEUM AND OIL SHALE RESERVES

Appropriation, 2019	$10,000,000
Budget estimate, 2020	14,000,000
Recommended, 2020	14,000,000
Comparison:	
Appropriation, 2019	+4,000,000
Budget estimate, 2020	– – –

The Naval Petroleum and Oil Shale Reserves no longer serve the national defense purpose envisioned in the early 1900s, and consequently the National Defense Authorization Act for Fiscal Year 1996 required the sale of the government's interest in the Naval Petroleum Reserve 1 (NPR–1). To comply with this requirement, the Elk Hills field in California was sold to Occidental Petroleum Corporation in 1998. Following the sale of Elk Hills, the transfer of the oil shale reserves, and transfer of administrative jurisdiction and environmental remediation of the Naval Petroleum Reserve 2 (NPR–2) to the Department of the Interior, the Department retained one Naval Petroleum Reserve property, the Naval Petroleum Reserve 3 (NPR–3) in Wyoming (Teapot Dome field). The Department issued a disposition plan for NPR–3 in June 2013 and began implementation of the plan in fiscal year 2014. Transfer of NPR–3 to a new owner occurred in fiscal year 2015.

STRATEGIC PETROLEUM RESERVE

Appropriation, 2019	$235,000,000
Budget estimate, 2020	174,000,000
Recommended, 2020	214,000,000
Comparison:	
Appropriation, 2019	–21,000,000
Budget estimate, 2020	+40,000,000

The mission of the Strategic Petroleum Reserve is to store petroleum to reduce the adverse economic impact of a major petroleum supply interruption to the United States and to carry out obligations under the international energy program.

The recommendation includes funding to address facilities development and operations, including physical security and cavern integrity, and to maintain 1,000,000 barrels of gasoline blendstock in the Northeast Gasoline Supply Reserve. The recommendation includes legislative language to direct the Secretary to draw down and sell crude oil from the Strategic Petroleum Reserve, with proceeds to be deposited into the Energy Security and Infrastructure Modernization Fund for use in carrying out the Life Extension II project. This drawdown and use of proceeds is in accordance with section 404 of the Bipartisan Budget Act of 2015.

No funding is requested for the establishment of a new regional petroleum product reserve, and no funding is provided for this purpose. Further, the Department may not establish any new regional petroleum product reserves unless funding for such a proposed regional petroleum product reserve is explicitly requested in advance in an annual budget submission and approved by Congress in an appropriations Act.

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
ENERGY PROGRAMS					
ENERGY EFFICIENCY AND RENEWABLE ENERGY					
Sustainable Transportation:					
Vehicle technologies	344,000	73,400	370,000	+26,000	+296,600
Bioenergy technologies	226,000	40,000	256,000	+30,000	+216,000
Hydrogen and fuel cell technologies	120,000	44,000	144,000	+24,000	+100,000
Subtotal, Sustainable Transportation	690,000	157,400	770,000	+80,000	+612,600
Renewable Energy:					
Solar energy technologies	246,500	67,000	270,000	+23,500	+203,000
Wind energy technologies	92,000	23,700	103,692	+11,692	+79,992
Water power technologies	105,000	45,000	125,000	+20,000	+80,000
Geothermal technologies	84,000	28,000	90,000	+6,000	+62,000
Subtotal, Renewable Energy	527,500	163,700	588,692	+61,192	+424,992
Energy Efficiency:					
Advanced manufacturing	320,000	80,500	360,000	+40,000	+279,500
Building technologies	226,000	57,000	248,000	+22,000	+191,000
Federal energy management program	30,000	8,400	34,000	+4,000	+25,600
Weatherization and Intergovernmental Programs:					
Weatherization:					
Weatherization assistance program	254,000	---	290,000	+36,000	+290,000

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
Training and technical assistance	3,000	---	3,500	+500	+3,500
Subtotal, Weatherization	257,000	---	293,500	+36,500	+293,500
State Energy Program Grants	55,000	---	70,000	+15,000	+70,000
Subtotal, Weatherization and Intergovernmental Program	312,000	---	363,500	+51,500	+363,500
Subtotal, Energy Efficiency	888,000	145,900	1,005,500	+117,500	+859,600
Corporate Support:					
Facilities and infrastructure:					
National Renewable Energy Laboratory (NREL)	97,000	107,000	110,000	+13,000	+3,000
Program direction	162,500	122,000	163,521	+1,021	+41,521
Strategic programs	14,000	---	14,000	---	+14,000
Subtotal, Corporate Support	273,500	229,000	287,521	+14,021	+58,521
Subtotal, Energy efficiency and renewable energy	2,379,000	696,000	2,651,713	+272,713	+1,955,713
Use of prior year balances	---	-353,000	---	---	+353,000
TOTAL, ENERGY EFFICENCY AND RENEWABLE ENERGY	2,379,000	343,000	2,651,713	+272,713	+2,308,713

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE					
Cybersecurity for energy delivery systems (CEDS).....	89,500	75,000	95,000	+5,500	+20,000
Infrastructure security and energy restoration.....	19,000	70,000	42,000	+23,000	-28,000
Program direction.....	11,500	11,500	13,000	+1,500	+1,500
TOTAL, CYBERSECURITY, ENERGY SECURITY, AND EMERGENCY RESPONSE.....	120,000	156,500	150,000	+30,000	-6,500
ELECTRICITY					
Transmission reliability.....	39,000	70,500	54,400	+15,400	-16,100
Resilient distribution systems.....	40,000	27,900	50,000	+10,000	+22,100
Energy Storage:					
Research.....	46,000	43,500	57,000	+11,000	+13,500
Construction: 20-OE-100 Grid Storage Launchpad.....	---	5,000	5,000	+5,000	---
Subtotal, Energy Storage.....	46,000	48,500	62,000	+16,000	+13,500
Transformer resilience and advanced components.....	7,000	9,000	7,000	---	-2,000
Transmission permitting and technical assistance.....	7,000	7,000	7,000	---	---
Program direction.....	17,000	19,600	19,600	+2,600	---
TOTAL, ELECTRICITY.....	156,000	182,500	200,000	+44,000	+17,500

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
NUCLEAR ENERGY					
Research and development:					
Integrated university program	5,000	---	5,000	---	+5,000
STEP R&D	5,000	---	5,000	---	+5,000
Nuclear energy enabling technologies:					
Crosscutting Technology Development	50,000	17,400	45,000	-5,000	+27,600
Nuclear Energy Advanced Modeling and Simulation	31,000	30,000	40,000	+9,000	+10,000
Energy Innovation Hub for Modeling and Simulation	27,585	---	---	-27,585	---
Nuclear Science User Facilities	44,000	27,600	40,000	-4,000	+12,400
Transformational Challenger Reactor	---	23,450	---	---	-23,450
Subtotal, Nuclear energy enabling technologies	152,585	98,450	125,000	-27,585	+26,550
Reactor concepts RD&D:					
Advanced Small Modular Reactor R&D	100,000	10,000	100,000	---	+90,000
Light Water Reactor Sustainability	47,000	30,150	55,000	+8,000	+24,850
Advanced Reactor Technologies	111,500	75,000	105,000	-6,500	+30,000
Versatile Advanced Test Reactor R&D	65,000	100,000	65,000	---	-35,000
Subtotal, Reactor concepts RD&D	323,500	215,150	325,000	+1,500	+109,850
Fuel cycle research and development:					
Material Recovery and Waste Form Development	38,000	6,000	60,000	+22,000	+54,000
Civil Nuclear Enrichment	---	40,000	40,000	+40,000	---
Advanced Fuels	125,000	36,000	95,000	-30,000	+59,000
System Analysis and Integration	8,500	---	8,500	---	+8,500

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
Materials Protection, Accounting and Control Technology	6,000	3,000	5,000	-1,000	+2,000
Used Nuclear Fuel Disposition R&D	63,915	5,000	62,500	-1,415	+57,500
Integrated Waste Management System	22,500	---	47,500	+25,000	+47,500
Subtotal, Fuel cycle research and development	263,915	90,000	318,500	+54,585	+228,500
International nuclear energy cooperation	3,000	---	2,500	-500	+2,500
Subtotal, Research and development	753,000	403,600	781,000	+28,000	+377,400
Infrastructure:					
Radiological facilities management:					
Space and defense infrastructure	20,000	---	---	-20,000	---
Research reactor infrastructure	9,000	9,000	9,000	---	---
Subtotal, Radiological facilities management	29,000	9,000	9,000	-20,000	---
Idaho facilities management:					
Idaho operations and infrastructure	288,000	204,000	280,000	-8,000	+76,000
Construction:					
16-E-200 Sample preparation laboratory	30,000	5,242	30,000	---	+24,758
Subtotal, Idaho facilities management	318,000	209,242	310,000	-8,000	+100,758
Subtotal, Infrastructure	347,000	218,242	319,000	-28,000	+100,758

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
Idaho sitewide safeguards and security	146,090	137,808	137,808	-8,282	---
Program direction	80,000	64,350	80,000	---	+15,650
TOTAL, NUCLEAR ENERGY	1,326,090	824,000	1,317,808	-8,282	+493,808
FOSSIL ENERGY RESEARCH AND DEVELOPMENT					
Coal CCS and Power Systems:					
Carbon Capture	100,671	39,800	125,000	+24,329	+85,200
Carbon Storage	98,096	29,000	102,000	+3,904	+73,000
Advanced Energy Systems	129,683	185,300	107,000	-22,683	-78,300
Cross Cutting Research	56,350	72,825	88,255	+31,905	+15,430
NETL Coal Research and Development	54,000	60,500	38,000	-16,000	-22,500
STEP (Supercritical CO2)	22,430	---	24,000	+1,570	+24,000
Transformational Coal Pilots	25,000	---	20,000	-5,000	+20,000
Subtotal, Coal CCS and Power Systems	486,230	387,425	504,255	+18,025	+116,830
Natural Gas Technologies:					
Research	51,000	10,730	48,000	-3,000	+37,270
Unconventional fossil energy technologies from petroleum - oil technologies	46,000	19,000	30,000	-16,000	+11,000
Program direction	61,070	61,045	61,045	-25	---
Special recruitment programs	700	700	700	---	---

DEPARTMENT OF ENERGY
(Amounts in thousands)

	FY 2019 Enacted	FY 2020 Request	Bill	Bill vs. Enacted	Bill vs. Request
NETL Research and Operations	50,000	40,000	50,000	---	+10,000
NETL Infrastructure	45,000	43,100	46,000	+1,000	+2,900
TOTAL, FOSSIL ENERGY RESEARCH AND DEVELOPMENT	740,000	562,000	740,000	---	+178,000
NAVAL PETROLEUM AND OIL SHALE RESERVES	10,000	14,000	14,000	+4,000	---
STRATEGIC PETROLEUM RESERVE					
STRATEGIC PETROLEUM RESERVE	235,000	174,000	214,000	-21,000	+40,000
Sale of crude oil	-300,000	-450,000	-450,000	-150,000	---
Use of sale proceeds	300,000	450,000	450,000	+150,000	---
TOTAL, STRATEGIC PETROLEUM RESERVE	235,000	174,000	214,000	-21,000	+40,000
SPR PETROLEUM ACCOUNT					
SPR Petroleum Account	10,000	---	10,200	+200	+10,200
Sale of NGSR refined petroleum product	---	-96,000	---	---	+96,000
Use of NGSR refined petroleum product sale proceeds	---	27,000	---	---	-27,000
TOTAL, SPR PETROLEUM ACCOUNT	10,000	-69,000	10,200	+200	+79,200
NORTHEAST HOME HEATING OIL RESERVE					
NORTHEAST HOME HEATING OIL RESERVE	10,000	---	10,000	---	+10,000