

Testimony of Under Secretary Mark W. Menezes
U.S. Department of Energy
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Committee on Appropriations
Subcommittee on Energy and Water Development
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Chairwoman Kaptur, Ranking Member Simpson, and Members of the Subcommittee, it is an honor to appear before you today to discuss the President's FY 2020 Budget Request for the Department of Energy's (the Department or DOE) applied energy programs.

Accompanying me today in the front row are our Assistant Secretaries from the Department's applied energy offices.

Protecting our energy infrastructure from cyber and other attacks, advancing domestic energy production, pursuing advancements in nuclear energy technologies, focusing on early-stage research & development (R&D) at our National Laboratories, supporting renewable energy technologies and advancements in energy storage, and protecting our Nation's electric grid, are some of the many goals and commitments we are making in the FY 2020 Budget Request.

These advancements and breakthroughs are happening because of the innovative research being done at our 17 National Laboratories. I have had the opportunity to visit a few of the laboratories over the past seventeen months since being confirmed, and have witnessed first-hand the outstanding work done by the dedicated workforce across the nation.

Across the applied energy programs, this budget proposes approximately \$2.3 billion in funding for energy independence and innovation, and emphasizes intradepartmental collaboration, joint capabilities, integration, and development of energy sector and advancing energy storage, security, reliability, and resilience. This early stage R&D will focus the intellectual capacity of our scientists and engineers on the development of energy technologies that the ingenuity and capital of America's entrepreneurs and businesses can convert into commercial applications and products to improve the lives and security of all Americans.

Through coordination with our labs, R&D efforts reduce costs to the taxpayer while at the same time providing an enhanced technology transfer program to transfer breakthroughs from the National Laboratories to the private sector. This private-public effort is the mission of the Office of Technology Transitions (OTT), which expands the commercial impact of the DOE R&D portfolio, advancing U.S. economic, energy, and national security interests. OTT is helping to ensure access to the cutting edge results of DOE's early stage research across the DOE complex, program offices, and National Laboratories. It pursues this mission by facilitating industry and other partnerships. To accelerate these interests, last year DOE authorized the National Laboratories to use Agreements for Commercializing Technology (ACT). Adding to existing available agreements, laboratories will have fewer barriers for potential business partners to access lab expertise and capabilities.

Crosscutting Initiatives

The President has requested \$267.7 million in FY 2020 for the Grid Modernization Initiative focusing on grid integration and reliability, allowing energy loads to be combined with generation from all power sources to optimize the use of existing assets. In the FY 2020 request, as part of this effort, \$157.6 million (\$104.6 million from EERE, \$48.5 million from OE and \$4.5 million from FE) is for R&D to support a new Advanced Energy Storage Initiative which builds on and expands EERE's Beyond Batteries initiative from FY 2019, and focuses on advances in controllable loads, hybrid energy systems, and new approaches to energy storage. The Advanced Energy Storage Initiative, part of DOE's grid modernization efforts, also considers energy storage holistically and coordinates across the applied energy offices to enhance the flexibility of both generation and demand, thereby increasing the reliability and resilience of energy systems.

The Harsh Environment Materials Initiative (HEMI) is a new coordinated effort within the Offices of Fossil Energy R&D (FE), Nuclear Energy (NE), and Energy Efficiency and Renewable Energy (EERE) to use common investments. This effort will coordinate interrelated R&D in materials, sensors, and component manufacturing R&D for advanced thermoelectric power plants between FE and NE. For example, NE's budget includes \$23 million for the Nuclear Energy Enabling Technologies (NEET) Transformational Challenge Reactor program, which enhances the development of breakthrough technologies that provide the ability to manufacture small/micro advanced reactor components using additive manufacturing techniques. Investments will also be aligned with EERE's Advanced Manufacturing Office R&D in materials and manufacturing process research, as well as flexible combined heat and power systems.

Office of Cybersecurity, Energy Security, and Emergency Response (CESER)

The President's FY 2020 Budget Request provides \$156.5 million for the Office of Cybersecurity, Energy Security, and Emergency Response (CESER). The Secretary has conveyed that one of his highest priorities is to support the security of our Nation's critical energy infrastructure. CESER leads the Department's efforts to secure our Nation's energy infrastructure against all hazards, reduce the risks of and impacts from cyber events and other disruptive events, and assist with restoration activities. Among the most critical missions at the Department is to develop science and technology protections that advance at a pace that stays ahead of evolving natural and man-made threats. A resilient and secure energy infrastructure will ensure Americans have energy where and when they need it.

Unfortunately, cyberattacks pose an increasing threat to the Nation's networks, data, facilities, and infrastructure. A secure (able to protect system assets and critical functions from unauthorized and undesirable actors) and resilient (able to maintain critical functions during a disruption) power grid is critical to U.S. economic competitiveness and leadership, and to the safety and security of the Nation. We need to understand increasingly sophisticated cyber threats and develop the tools to stay ahead of those threats across our energy infrastructure.

DOE's role in energy sector cybersecurity is established in statute and executive action. In 2015, Congress passed the Fixing America's Surface Transportation (FAST) Act (P.L. 114-94), codifying

DOE as the Sector-Specific Agency (SSA) for cybersecurity for the energy sector, consistent with existing policy. In preparation for, and in response to, cybersecurity threats, the Federal government's operational framework is provided by Presidential Policy Directive-41 (PPD-41). A primary purpose of PPD-41 is to clarify the roles and responsibilities of the Federal government during a "significant cyber incident," which is described as a cyber incident that is "likely to result in demonstrable harm to the national security interests, foreign relations, or economy of the United States or to the public confidence, civil liberties, or public health and safety of the American people." With the formation of CESER, the Department's role as the SSA is strengthened and the Department has undertaken its responsibilities with the highest degree of dedication and commitment.

CESER will allow more coordinated preparedness and response to emerging cyber and physical threats and natural disasters and support the Department's national security responsibilities. To work toward this critical objective, the FY20 budget invests in the development of tools needed to protect the U.S. energy sector against threats and hazards, mitigate the risks and the extent of damage from cyberattacks and other disruptive events, and improve system survivability through the development of techniques for more rapid restoration of capabilities.

CESER will work in an integrated manner with private industry, as well as Federal, state, and local jurisdictions and other DOE offices, to enable industry to enhance the security and survivability of U.S. energy infrastructure through investments across:

- R&D to deliver game-changing tools and technologies that help utilities secure today's energy infrastructure from advanced cyber threats and design next-generation future systems that are built from the start to automatically detect, reject, and withstand cyber incidents, regardless of the threat.
- Cybersecurity Tools and Development to strengthen the energy sector's cybersecurity posture through public and private sector partnerships that leverage DOE-supported tools, guidelines, outreach, training, and technical assistance.
- Emergency Preparedness and Response to pursue enhancements to the security and survivability of energy infrastructure, and facilitating faster recovery from disruptions to energy supply.

Program Highlights

The Cybersecurity for Energy Delivery Systems (CEDS) program seeks to reduce the risk of energy disruptions due to cyber events. CESER's mission to enhance the security and survivability of the Nation's energy infrastructure cannot be achieved without both near and long-term activities to strengthen cyber security across the Nation. The request reflects the critical need to prioritize efforts to strengthen energy infrastructure against cyber threats and mitigate vulnerabilities, focusing on enhancing the speed and effectiveness of cyber threat and vulnerability information sharing, establishing a national cyber supply chain assessment capability in partnership with industry, and accelerating game-changing R&D.

The Infrastructure Security and Energy Restoration (ISER) FY20 budget request is \$70 million, an increase of \$51 million from the FY19 enacted level. The request supports on-going efforts,

maintains capability to respond to energy sector emergencies through a regionalized volunteer delivery model, and improves the Federal national energy infrastructure threat monitoring and visualization capabilities provided by the Department's outage management tool. ISER will strengthen its efforts with state, local, tribal, and territorial partners to ensure their energy assurance plans integrate cyber information sharing mechanisms and are aligned with energy sector industry efforts.

Office of Electricity (OE)

OE leads the Department's efforts to strengthen, transform, and improve electricity delivery infrastructure so that consumers have access to reliable, secure, and clean sources of energy. OE provides solutions to market, institutional and operational failures that go beyond any one utility's ability to solve. To accomplish this critical mission, OE works with private industry and Federal, state, local, and tribal 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 national security. The goal for the future grid is to deliver reliable, affordable, and clean electricity to consumers where, when, and how they want it. Within the next decade, proactive, coordinated, and innovative steps are needed to address four critical challenges:

- Increasing challenges to the reliability and security of the electric 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, and local jurisdictions, OE programs work in an integrated manner in partnership with industry and other stakeholders as well as other DOE offices, to enhance key characteristics of the U.S. electric transmission and distribution systems.

Timely action is needed to perform the early-stage R&D that will enable industry to deploy a reliable electric power grid that supports the vitality of other critical sectors that depend on electricity, such as telecommunications, banking and finance, water, and public health and safety. A reliable and resilient power grid is critical to U.S. economic competitiveness, leadership, and, most importantly, national security.

Within the FY 2020 request is \$182.5 million for OE to fund:

- R&D -- pursuing early-stage research for technologies to improve grid reliability, efficiency, flexibility, and functionality.
- Modeling and Analytics -- developing core analytic, assessment, and engineering capabilities

that can evolve as the technology and policy needs mature to support decision making within the Department and for stakeholders; analyses explore complex interdependencies among infrastructure systems, such as between electricity and natural gas systems.

- Institutional Support and Technical Assistance -- building capacity in the industry and convening stakeholders to coordinate efforts to transform the electric grid; providing technical assistance to states and regions to improve policies, utility incentives, state laws, and programs that facilitate the modernization of the electric infrastructure.
- Coordination of Federal Transmission Permits -- streamlining permits, special use authorizations, and other approvals required under Federal law to site electric transmission facilities.

Program Highlights

The Transmission Reliability and Resilience program 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. The FY 2020 request supports the development of new modeling-based capability for monitoring the long-term resilience of our grid and identifying opportunities to improve resilience and mitigate risks associated with the energy systems interdependencies. Within this program, OE will lead an ambitious effort to develop the North American Energy Resilience Model (NAERM). The NAERM will ensure reliable and resilient energy delivery across multiple sectors, spanning multiple organizations and authorities, while considering a range of large-scale, emerging threats. A collaboration between DOE, its National Laboratories, and industry, the NAERM will develop a comprehensive resilience modeling system for the North American energy sector infrastructure, including the United States and portions of Canada and Mexico. \$70.5 million is requested for Transmission Reliability and Resilience, including \$30.0 million for NAERM and \$8.5 million for sensors and data analytics.

The Resilient Distribution Systems program focuses on the development of innovative technologies, tools, and techniques to modernize the distribution portion of the electric delivery system. Results from the research in Advanced Distribution Management Systems, microgrids, and Dynamic Controls and Communications (DC&C) will enable industry to strengthen the resilience of electric infrastructure against adverse effects of future extreme weather phenomena and other unforeseen natural and man-made occurrences. \$27.9 million is requested for Resilient Distribution Systems, a reduction of \$12.1 million from the FY 2019 appropriation that is primarily due to the completion of funding for two Congressionally-directed projects, sensing intelligent machines and low-cost distribution sensors, which were fully funded in FY 2019.

The Energy Storage program focuses on accelerating the development of new materials and device technologies that can lead to significant improvements in the cost and performance of utility-scale energy storage systems and accelerate the adoption of energy storage systems into grid infrastructure. The request supports materials research on the next generation of battery chemistries, development of new materials and new device technologies for efficient power conversion, development of optimal design and control architectures for energy storage integration into the grid infrastructure, and development of open source models and software tools for system level energy storage planning and evaluation. \$48.5 million is requested for Energy Storage, including \$5.0 million for design and

construction planning of a Grid Storage Launchpad project aimed at accelerating materials development, testing, and independent evaluation of battery materials and battery systems for grid applications.

The Transformer Resilience and Advanced Components (TRAC) program supports modernization, hardening, and resilience of the grid by addressing the unique challenges facing transformers and other critical grid components that are responsible for carrying and controlling electricity from where it is generated to where it is needed. TRAC will continue research to support innovative concepts and designs for solid-state power substations, including advanced materials and system architectures. Research to improve asset monitoring capabilities and equipment performance under stress will enhance the portfolio of solutions available to industry to increase grid security, reliability, and resilience.

The Transmission Permitting and Technical Assistance (TPTA) program's mission is to promote a secure and resilient electricity system through regulatory and policy solutions. TPTA evaluates existing laws, policies, and regulations to better understand the regulatory landscapes, and provides technical assistance to Federal, state, tribal, territorial, and regional entities in their efforts to address the changing dynamics and uncertainties in the energy environment. TPTA also implements a number of legal authorities and seeks to improve transmission infrastructure by facilitating better coordination between Federal agencies for transmission lines that require multiple Federal authorizations and by permitting transmission facilities crossing U.S. international borders. \$9.0 million is requested for TRAC to build on material research and design innovations for next-generation grid hardware, moving towards prototypes for technologies and concepts related to solid-state power substations and advanced conductors.

In FY 2020, TPTA will focus its technical assistance work to provide stakeholders an in-depth understanding of how to best modify existing market structures or build new resilience into the electricity subsector system. As potential infrastructure investments are identified to improve resilience and mitigate risks associated with energy systems interdependencies, TPTA will provide institutional support, such as evaluating regulatory and market-based policies, to help States and tribes make infrastructure investments that contribute to national security. TPTA will also continue to carry out its regulatory responsibilities and evaluate regulatory reform to reduce Federal burden associated with investing in our Nation's electricity infrastructure. \$7.0 million is requested for TPTA, which is level with the FY19 appropriation.

Office of Nuclear Energy (NE)

The President's FY20 budget request provides \$824 million for the Office of Nuclear Energy. As the major source of reliable, resilient and clean baseload electricity, nuclear energy is a vitally important strategic national asset for the United States. It is an essential element of our Nation's diverse energy portfolio helping to sustain the U.S. economy and support our national goals. A strong domestic nuclear industry enabled by the existing nuclear fleet and enhanced by game-changing advanced nuclear technologies is critical to our Nation's energy security, national security, environmental sustainability, and economic prosperity.

The United States pioneered the development and peaceful use of nuclear power to produce around-the-clock, emissions-free electricity. As a result of U.S. leadership in nuclear energy, American citizens have benefitted from this clean source of electricity for nearly 7 decades. Nuclear power plants have served as bedrocks to communities across the country, providing jobs to hundreds of thousands of Americans. Today, nuclear energy is the third largest source of domestic electricity generation and is the largest source of clean energy. As baseload electricity sources, nuclear power plants also contribute to the reliability and resilience of the electric grid and can provide price stability.

However, the U.S. nuclear energy sector is now under historic downward pressure. As a result of market challenges and state policy decisions, a number of nuclear reactors are retiring prior to their license expiration. Since 2013, seven reactors have retired prematurely and 12 more are scheduled to retire. In response, the President, on June 29, 2017, announced that we would conduct a complete review of U.S. nuclear energy policy to help find new ways to revive and expand this crucial energy resource. This Civil Nuclear Review is underway, and outcomes are informing how the Administration can best enable a revitalization of the nuclear sector. The FY 2020 Budget Request reflects some of these outcomes as evidenced by the Department's efforts to pursue the Versatile Advanced Test Reactor (VATR) and demonstrate the capability of U.S. technology to produce high-assay low-enriched uranium (HALEU).

The Department of Energy believes it is not too late to reverse the downward trajectory of our Nation's nuclear energy sector. In fact, we have much to build on. The United States, for example, still has the largest fleet of reactors in the world. We lead the world in efficient operation of our fleet and we have the world's leading nuclear safety regulatory authority. We are still the world's leader in innovation, demonstrated by the burgeoning number and variety of U.S. advanced reactor designs. Coupled with this are our world class DOE National Laboratories and U.S. universities.

In support of the President's direction for the future of the nuclear industry, the FY 2020 Budget Request emphasizes activities to revive and expand the U.S. nuclear energy sector. Within NE, we focus our technical work in three major mission areas: revitalizing the nation's existing nuclear fleet, developing advanced nuclear reactor concepts, and supporting fuel cycle technologies and associated infrastructure. Utilizing the Department's greatest strengths, we are emphasizing early-stage R&D with universities and National Laboratories, mobilizing and expanding our unique National Laboratory capabilities, and implementing targeted R&D partnerships with the U.S. nuclear industry.

Revitalizing the Existing Nuclear Fleet

NE is working to ensure the long-term economic viability of our existing nuclear reactor fleet by partnering with industry to develop the technical basis for the continued reliable and economic operation of the current fleet of nuclear plants, as well as developing technical solutions to enhance the economics and performance of nuclear power plants. This includes developing technologies such as accident tolerant fuels, \$36 million in the FY20 request, which have the potential to significantly increase the performance of our nation's current fleet of reactors, while reducing costs.

The FY 2020 Budget Request also includes \$30.2 million for cost-shared efforts to extend the life of the existing commercial nuclear reactor fleet through early-stage research in areas such as materials

aging and degradation, safety margin characterization, safety technologies, instrumentation and controls. We are focused on cost-shared, private-public partnerships to resolve the U.S. industry's highest priority and highest uncertainty technical issues that are not currently being addressed. By continuing to support improvements to the efficiency, productivity, and operating lifetimes of our Nation's nuclear fleet through technology R&D, the Department is helping industry realize its full potential in contributing to our Nation's energy independence, security, and emission-free, reliable supply of electricity.

Developing Advanced Reactor Technologies

In parallel with our work to extend the operating lives and improve the performance of the existing fleet, NE is working to advance our Nation's next generation of advanced nuclear reactors. For example, the Budget Request includes \$100 million towards a Versatile Advanced Test Reactor (VATR). For the United States to regain a global leadership role in the development of the next generation of advanced reactors, a fast spectrum test reactor will be an important experimental tool, providing the capability to perform tests in an extreme environment. The VATR is one of the Department's highest priorities, and will accelerate innovation in advanced fuels and materials for U.S. vendors and help pave the path to U.S. global leadership in advanced nuclear R&D.

In addition, the FY 2020 request includes \$85 million for advanced reactor concepts that have the potential to deliver improved performance and efficiency, enhanced versatility such as load following and multipurpose roles, passive designs, reduced costs, enhanced resource utilization and waste minimization, and non-electric and hybrid applications. These design features, if proven and commercialized, could represent truly transformational nuclear energy sector impacts.

NE is conducting early-stage R&D into advanced reactor technologies that can improve resource utilization, reduce waste and produce electricity and high temperature process heat to improve the economic competitiveness and enhance safety and environmental contributions of nuclear energy. Research into advanced reactor technologies will address high-value fundamental research for long-term concepts, early-stage R&D needs of promising mid-range concepts, early-stage development of innovative technologies that benefit multiple advanced reactor concepts, and stimulation of new ideas for transformational future concepts.

Through cost-shared, early-stage R&D and related technical assistance, the Department will help accelerate the timeline for commercialization of new, advanced, and more financeable reactor technologies. These advanced reactor technologies will help revive and expand the domestic nuclear industry and advance America's leadership role in the global nuclear sector.

Further, the FY 2020 Budget Request includes \$23.5 million to continue the Transformational Challenge Reactor (TCR) effort. The TCR is a revolutionary platform to demonstrate our ability to reduce the deployment costs and timelines for designing and constructing nuclear energy systems. These innovations will be demonstrated using breakthrough technologies allowing us to manufacture advanced small and micro-reactor components by combining additive manufacturing techniques and digital predictive analysis capabilities to deliver a new approach to nuclear design and qualification for advanced reactor technologies.

Supporting Nuclear Fuel Cycle Capabilities

The Department is also working to support the civilian nuclear fuel cycle and associated infrastructure. We recently took an important step toward revitalizing our fuel cycle R&D capabilities when Idaho National Laboratory (INL) resumed operations at the Transient Reactor Test Facility (TREAT), which had been shut down since 1994. This capability is an important asset to nuclear scientists and engineers as they work to increase the safety and performance of current and future nuclear reactors.

Activities in FY 2020 will continue operation of TREAT, investments at the Advanced Test Reactor (ATR) and the Materials and Fuels Complex (MFC) to improve reliability and availability, and performance of construction activities for the Sample Preparation Laboratory, which will address gaps in advanced Post-Irradiation Examination (PIE) capabilities vital to nuclear R&D.

Lastly, many U.S. advanced reactors developers have identified HALEU (uranium enriched in U-235 to greater than 5% but less than 20%) as a fuel requirement. Currently, the U.S. lacks a sustainable domestic supply of HALEU. The request therefore includes \$40 million for the Civil Nuclear Enrichment subprogram, initiated in FY19, aimed at demonstrating the capability to produce HALEU utilizing U.S. centrifuge technology. These activities support industry's demonstration of advanced reactors, including micro reactors.

The Administration is fully committed to nuclear energy as a vital component of our Nation's energy system. The FY 2020 Budget Request leverages private-public partnerships and our world-class National Laboratory system to support a revitalized nuclear sector. It focuses on early-stage R&D to support the development of a new class of U.S. advanced nuclear reactors, an innovative and responsive nuclear energy supply chain, and advanced nuclear energy fuel cycle technologies, positioning the U.S. for energy dominance in the 21st century.

Office of Energy Efficiency and Renewable Energy (EERE)

The President's FY 2020 Budget Request provides \$696 million for EERE to help promote America's energy dominance through technologies that will make our energy more affordable, reliable, and efficient. EERE funds early-stage research to spur private-sector research, development, and commercialization of critical energy technologies in sustainable transportation, renewable power, and energy efficiency. The FY 2020 Budget Request focuses EERE resources toward early-stage R&D, where the Federal role is strongest, and reflects an increased reliance on the private sector to fund later-stage research, development, and commercialization of energy technologies. It emphasizes energy technologies best positioned to advance American energy independence and domestic job-growth in the near to mid-term. Knowledge generated by EERE early-stage R&D supports U.S. industries, businesses, and entrepreneurs to develop and deploy innovative energy technologies and gives them the competitive edge needed to excel in the rapidly changing global energy economy. Industry deployment of these technologies can increase energy affordability, create jobs, improve energy security, and offer Americans a broad range of energy choices.

The President's request is also focused on sustaining the National Renewable Energy Laboratory's (NREL) world-class R&D environment by maintaining and, where necessary, upgrading its equipment and facilities. The FY 2020 Budget Request includes a \$22 million to accelerate the expansion of the diverse capabilities of the National Wind Technology Center (NWTC) campus at NREL, creating a fully integrated, large-scale experimental research campus (Flatirons Campus). This expanded campus includes building an enhanced grid/Energy Systems Control Center and a High-Speed Data Link that connects the NWTC campus to the Energy Systems Integration Facility at NREL's main campus and to other National Laboratories. The mission of the NWTC will expand to support a fully integrated, large-scale experimental research platform, including a Beyond Megawatt Scale Extreme Fast Charging Station to research, integrate, and evaluate electric vehicle fast-charging station impacts on the grid. These investments support research for DOE's Grid Modernization Initiative, which includes reliably integrating variable generation into the electric grid. These expanded capabilities will allow DOE to test a suite of technologies supported under the Advanced Energy Storage Initiative and leverage the NWTC's future power capacity of 19.9MW with the capabilities of NREL's Energy Systems Integration Facility.

Sustainable Transportation

EERE's Sustainable Transportation portfolio supports analysis-based, early-stage research that supports industry efforts to accelerate the development and widespread use of a variety of technologies to make our transportation energy more affordable, efficient, and secure. Broadly, Vehicle, Bioenergy, and Hydrogen and Fuel Cells Technology programs within EERE pursue four key parallel solution pathways: (1) fuel diversification, replacing conventional fuels with cost-competitive, domestically produced alternatives; (2) vehicle efficiency, using less fuel to move people and freight; (3) energy storage, delivering durable, reliable, resilient and affordable energy storage technology R&D across sectors, and (4) improving the overall energy efficiency and efficacy of the transportation or mobility system. The pathways and activities also include those necessary to address statutory requirements and the supporting advanced data-driven, technical, economic, and interdisciplinary systems analyses critical to informing R&D investment priorities.

Renewable Power

In the Renewable Power portfolio, EERE will perform early-stage research to support solar, wind, water, and geothermal industries to develop, and ultimately deploy, low-cost novel power generation technologies. The overarching objective of the Renewable Power portfolio is to lower costs and improve the reliability of renewable energy technologies, which would support the adoption of affordable renewable energy options, allow for regional optimization, maximize the use of domestic resources, and contribute to a resilient, reliable, and secure electricity grid. The Renewable Power technology sector pursues three key parallel solution pathways: (1) Technology Innovation; (2) Validation and Analysis; and (3) Systems Integration, including efforts coordinated through the Grid Modernization Initiative. Through investments in DOE labs, industry, and academia, EERE's Renewable Power technology offices will continue to lead the world in developing domestic, clean, reliable energy choices in power generation, which strengthen the U.S. economy while increasing energy security.

Energy Efficiency

EERE's Energy Efficiency portfolio will build on the considerable progress made over the last 40 years and pursue early-stage R&D targeted at high impact technology areas such as advanced lighting, space heating and cooling, building envelopes, and manufacturing materials and processes. The overall goal of the energy efficiency portfolio is to strengthen the body of knowledge that supports businesses, industry, and the Federal Government to improve the affordability, energy productivity, and resilience of our homes, buildings, and manufacturing sectors. The knowledge generated by this research can support a foundation for economic growth and job creation as American businesses and families develop and deploy new energy-efficiency and manufacturing technologies. The request will also assist Federal agencies in their energy and water management and provides funding needed to meet legal requirements for appliance standards and building energy codes.

Office of Fossil Energy (FE)

The FY 2020 Budget Request provides \$750 million for FE. This request is guided by the principles of energy dominance, security, and strong domestic energy production and is promoted by the FE R&D portfolios and the Office of Petroleum Reserves portfolios.

Within the request, the President's FY 2020 budget provides \$562 million for FE R&D to enable the reliable, efficient, affordable, and environmentally-sound use of fossil fuels. The request develops transformational energy technologies as part of the Administration's all-of-the-above energy portfolio that enables greater private-sector participation in driving market outcomes to enhance America's competitiveness. These investments will enable industry to commercialize and deploy advanced technologies necessary to support a secure and reliable power grid. This request also includes funding for the National Energy Technology Laboratory, the nation's pre-eminent fossil energy laboratory.

Advanced Coal Energy Systems & CCUS

Within FE R&D, the Advanced Coal Energy Systems & Carbon Capture, Utilization and Storage (CCUS) program invests in early-stage energy technologies that improve the affordability, competitiveness, and environmental performance of advanced coal technologies; improve electric grid reliability and resilience; and increase the domestic and international accessibility to American energy resources. The program prioritizes investments that will improve the efficiency and performance of the existing coal fleet; advance technologies under the Coal FIRST (Flexible, Innovative, Resilient, Small, Transformative) initiative to enable flexible, small, coal plants of the future that have near-zero emissions; reduce the cost of CCUS technologies; and promote new market opportunities for CO₂ and coal utilization.

Oil and Natural Gas

In the area of oil and natural gas research, the President's request provides \$29.7 million across three programs. The request provides \$19 million for the Unconventional Fossil Energy Technologies program, which includes field-based and laboratory research on improving the

efficiency of oil and natural gas production in the Nation's shale plays. The request also provides \$8.7 million for research focused on evaluating the occurrence, nature, and behavior of naturally occurring gas hydrates. This funding will support continued gas hydrates field work on the Alaska North Slope. The request includes \$2 million for a new Natural Gas Infrastructure program that would focus on early-stage, foundational research to enhance the operational efficiency of natural gas delivery infrastructure, which will be further developed and commercialized by industry.

National Energy Technology Laboratory

The National Energy Technology Laboratory (NETL) works hand-in-hand with the FE R&D portfolios to plan, administer, and execute world-class fossil energy research and development. The FY 2020 request for NETL supports its capabilities in science and technology development and commercialization, including: Computational Science and Engineering; Materials Engineering & Manufacturing; Geological & Environmental Systems; and Systems Engineering & Analysis. The request also funds NETL's technical program management; and staff that provide Acquisition, Finance and Legal functions to FE. The request also funds NETL's research sites and maintains the Laboratory's three-campus footprint in Morgantown, WV; Pittsburgh, PA; and Albany, OR. These sites include approximately 240 acres of land, including 116 buildings with over 1,100,000 square feet of space.

Strategic Petroleum Reserve

The President's request provides \$188 million for the Office of Petroleum Reserves, with \$174 million for the operation of the Strategic Petroleum Reserve (SPR) and \$14 million for ongoing federal responsibilities at the Naval Petroleum Reserves. The SPR is a critical national asset which provides an insurance policy against potential interruptions in U.S. petroleum supplies, whether originating from domestic or international supply disruptions, natural disasters, sabotage, or acts of terrorism, and to meet the U.S. obligations under the International Energy Program. The \$174 million is to support the Reserve's operational readiness and drawdown capabilities. From the sale of 1 million barrels of gasoline blendstock from the Northeast Gasoline Supply Reserve (NGSR), \$27 million would go to the SPR Petroleum Account to help fund future sales of SPR crude oil mandated by law. The request also includes \$450 million for the Energy Security and Infrastructure Modernization Fund, which is offset by revenue raised through sales of SPR crude oil.

The Budget Request also proposes to disestablish the Northeast Home Heating Oil Reserve (NEHHOR). In its two decades of existence, the NEHHOR has not been used for its intended purpose, and the Administration believes the continued taxpayer-funded expense of maintaining the reserve is unwarranted, particularly as the existing commercial storage contracts are up for renewal in March 2020. The Budget Request also proposes to disestablish the NGSR. The NGSR has not been used since its establishment, and is not considered to be cost efficient or operationally effective. Proceeds of the combined sales of the NEHHOR and NGSR (estimated at \$130 million in receipts, net of the \$27 million retained for mandatory sale drawdown costs) will be contributed to deficit reduction.

Conclusion

The President's FY 2020 Budget Request positions DOE to utilize the world's best enterprise of National Laboratories, scientists and engineers to create, push innovation and continue to advance technologies and research in fields that support American prosperity, security and competitiveness. Thank you for the opportunity to testify before you today, and I look forward to answering your questions.