

Testimony of Under Secretary for Science Paul Dabbar
U.S. Department of Energy
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Subcommittee
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Chairman 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 (“Budget Request” or “Budget”) for the Department of Energy (“the Department” or “DOE”).

This Budget is a request to the American people through their representatives in Congress to secure America’s future through energy independence, scientific innovation, and national security.

As such, it represents a commitment from all of us at DOE that we will honor the trust of our citizens with increased stewardship, accountability, and commitment to excellence. For too long, government success has been measured by how much we spend on it. This Budget Request makes clear that success will be measured by how effectively and efficiently government is able to manage the precious resources entrusted to them by the American taxpayer to achieve its mission.

I am committed to advance exascale and quantum computing; and address responsibilities for the cleanup and disposition of facilities.

The portion of the FY 2020 \$31.7 billion Budget Request for the Department of Energy (“Budget”) for which I oversee totals \$12.3 billion, a decrease of \$1.6 billion from the FY 2019 enacted level.

The Department’s world-leading science and technology enterprise generates the innovations needed to fulfill our missions. Through support of cutting-edge research at our 17 National Laboratories and at over 300 universities across the Nation, we are expanding the frontiers of scientific knowledge and laying the groundwork for new technologies to address our greatest challenges.

The National Laboratories are doing outstanding work in many areas. Each has a unique, rich history of innovation across a broad scope of scientific expertise, and the record of collaboration across the National Laboratory system – which makes its impact greater than the sum of its parts – has bettered the lives of millions across the globe.

For example, in 2018, the National Laboratories won 32 of the prestigious R&D 100 Awards, including technologies regarding new materials, protecting the environment, incorporating renewable energy reliably to the electric grid, and sophisticated cybersecurity tools. These are just a few examples of the work the National Laboratories have done just last year to push the boundaries of research, development, commercialization, and national security.

I am especially proud of the work the National Laboratories are doing in collaboration with other federal agencies, universities, doctors, and researchers to harness the power of our world-class supercomputers to maintain America's leadership in High Performance Computing (HPC), advance Exascale computing, and push for breakthroughs in Artificial Intelligence (AI). Working with the National Labs, we have completed two Innovation XLab Showcases, one on battery storage, the second on grid modernization.

The Budget supports, and makes for more efficient, programs focused on bringing technologies to the market in the Office of Technology Transitions, requesting a 7% increase from the FY 2019 enacted level. Through coordination with our Labs, these efforts will 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.

Leading World-Class Scientific Research

The Department of Energy is the Nation's largest Federal supporter of basic research in the physical sciences, and the President's FY 2020 Budget provides \$5.5 billion for the Office of Science to continue and strengthen American leadership in scientific inquiry. By focusing funding on early-stage research, this Budget will ensure that the Department's National Laboratories continue to be the backbone of American science leadership by supporting cutting-edge basic research, and by building and operating the world's most advanced scientific user facilities, which will be used by over 22,000 researchers in FY 2020.

Support for Core Research and Facilities

The Budget provides \$921 million for Advanced Scientific Computing Research, a decrease of \$15 million below the FY 2019 enacted level. This funding will continue supporting the Nation's world-class high-performance computers that make possible cutting-edge basic research, while devoting \$500 million in the Office of Science to reflect the Department's plan to deploy an exascale computing system in calendar year 2021. The FY 2020 Request also supports quantum computing R&D and core research in applied mathematics and computer science, and high-performance computer simulation and modeling.

The Budget also provides \$1.9 billion for Basic Energy Sciences, supporting core research activities in ultrafast chemistry and materials science and the Energy Frontier Research Centers. We will continue construction of the Advanced Photon Source Upgrade at the Argonne National Laboratory, and initiate the Advanced Light Source Upgrade project at the Lawrence Berkeley National Laboratory, and the Linac Coherence Light Source-II High Energy project at SLAC National Accelerator Laboratory. The operations of the light sources across the DOE science complex and supporting research across the Nation maintain U.S. world leadership in light sources and the science they make possible. The Budget also supports continued construction for Spallation Neutron Source Proton Power Upgrade and Second Target Station at Oak Ridge National Laboratory.

The Budget requests \$768 million for High Energy Physics, including \$100 million for construction of the Long Baseline Neutrino Facility and Deep Underground Neutrino Experiment at Fermilab, \$30 million below the enacted FY 2019 level. We will continue to

fund ongoing major items of equipment projects, including three new projects at the Large Hadron Collider: the High Luminosity Large Hadron Collider Accelerator Project; the High Luminosity ATLAS; and the High Luminosity CMS detector upgrade projects. By supporting the highest priority activities and projects identified by the U.S. high energy physics community, this program will pursue cutting-edge research to understand how the universe works at its most fundamental level.

The Budget for the Office of Science provides \$403 million for Fusion Energy Sciences, including \$296 million for domestic research and fusion facilities and \$107 million for the ITER project to continue to support delivery of the highest priority in-kind hardware systems contributions. For Nuclear Physics, the budget provides \$625 million to discover, explore, and understand nuclear matter, including \$40 million for continued construction of the Facility for Rare Isotope Beams and operations of facilities. For Biological and Environmental Research, the Budget includes \$494 million to support foundational genomic sciences, including the Bioenergy Research Centers, and to focus on increasing the sensitivity and reducing the uncertainty of earth and environmental systems predictions.

Advancing Exascale Computing

As I discussed last year, the Department's leadership in developing and building the world's fastest computers faced increasingly fierce global competition over the last decade. Maintaining the Nation's international primacy in high-performance computing is more critical than ever for national security, economic prosperity, and a continued leadership role in science and innovation.

I am proud to say that, as of the present day, the Department is actively sustaining America's leadership in this vital area. As of November, the world's two fastest supercomputers were located at DOE National Laboratories – Summit at Oak Ridge and Sierra at Lawrence Livermore. In fact, the Summit system achieved the global number one ranking as the world's fastest system in June 2016, was delivered nine months ahead of schedule and \$13.5 million below budget, and is another example of a DOE lab's continued project management excellence. In all, the Department currently owns five out of the world's top ten supercomputers. In addition, teams from DOE's Oak Ridge and Lawrence Livermore National Laboratories captured the 2018 Gordon Bell Prize, the most prestigious award for achievement in high performance computing software and applications. These coupled achievements in both hardware and software are significant, since it is by sustaining integrated capabilities in hardware, software, algorithms, and applications – along with basic research in applied mathematics – that America will maintain leadership in this critical field.

To cement America's leadership position, the Budget includes \$809 million to accelerate development of an exascale computing system, including \$500 million in the Office of Science (Science) and \$309 million in NNSA. This reflects the Department's plan to deploy an exascale machine for the Office of Science in calendar year 2021 at Argonne National Laboratory, a second machine with a different architecture in the 2021-2022 timeframe at Oak Ridge National Laboratory, and provides support for the procurement of and site preparation for a third exascale system, architecturally similar to the second machine at Oak Ridge, to be delivered to NNSA at Lawrence Livermore National Laboratory in FY 2023.

To achieve these goals, the Science/NNSA partnership will focus on hardware and software technologies needed to produce an exascale system, and the critical DOE applications needed to use such a platform. This world-leading exascale program will bolster our national security by supporting the nuclear stockpile, while also supporting the next generation of scientific breakthroughs not possible with today's computing systems.

Quantum Information Science

Even as we prepare to deploy exascale systems, we are pursuing research in Quantum Information Science (QIS), an emerging multidisciplinary area that has the potential to define the next frontier in information processing and a range of other fields. Our QIS effort is genuinely interdisciplinary, a \$168 million investment involving all six major DOE Office of Science program offices: Advanced Scientific Computing Research (ASCR), Basic Energy Sciences (BES), Biological and Environmental Research (BER), Fusion Energy Sciences (FES), High Energy Physics (HEP), and Nuclear Physics (NP).

The potential of QIS to contribute to a wide range of disciplines is striking. Quantum computing promises the capability to attack large problems that elude classical computing and to provide new insights into materials and chemistry through accurate modeling and simulation of quantum systems. In addition, QIS holds the potential of developing exquisitely sensitive quantum sensors, for applications ranging from biology to the effort to detect Dark Matter. Finally, QIS may hold the key to ultra-secure networking, at a time when cybersecurity is a mounting concern.

The Budget provides \$40 million to ASCR, BES and HEP to establish a new QIS center, which would integrate universities with National Laboratories, through investments across all six Science program offices. We are seeking to sustain U.S. leadership in this important and highly competitive area.

Artificial Intelligence/Machine Learning

Artificial Intelligence (AI), including Machine Learning (ML) defines another critical cross-disciplinary activity, with the potential to contribute to advances across multiple fields. This is another rapidly developing area in which it is vital for America to maintain a leadership role.

In a world awash with data, AI holds the promise of harnessing and deriving new insights from massive data sets. The massive quantities of data generated by DOE Office of Science user facilities such as X-ray lights sources are believed to provide a major opportunity for the development of new AI applications for data analysis. It is also believed that AI may provide a pathway to improving the performance of particle accelerators and other key facilities. The FY 2020 Budget provides \$71 million for AI/ML spread across all six Science program offices for both the application of AI/ML to research and the development of new AI/ML approaches and algorithms as well as \$48 million requested in the FY 2020 Budget for NNSA for AI.

Microelectronics

By virtue of its leadership in supporting high-performance computing, as well as its longstanding sponsorship of research in materials science, the DOE Office of Science has been

a major contributor over the decades to the development of microelectronics. Science has helped lay the fundamental scientific foundation for advances in these technologies, while partnering with industry in the development of new systems requiring new chips. This role is becoming increasingly important as we approach the end of Moore's Law and stand at the threshold of what is likely to be a new era in microelectronics. In an important new initiative, the FY 2020 Budget provides \$25 million for research efforts on microelectronics. The research will benefit from groundwork laid at an October 2018 DOE workshop on "Basic Research Needs in Microelectronics," bringing together top experts and co-sponsored by ASCR, BES, and HEP.

Biosecurity

Back in 1986, the Department provided the original impetus and idea for the Human Genome Project, and later partnered with the National Institutes of Health, to successfully complete the sequencing of a human genome in 2000. Since then the Department's Office of Science has remained on the cutting-edge of genomics-based system biology, making major contributions to the continued advancement of the relevant technologies. These dual use technologies have now advanced to a point where they pose new and unprecedented security challenges. To address this growing challenge, the FY 2020 Budget includes \$20 million for BER for research related to biosecurity.

Isotopes

One of the Department's important contributions to medicine and industry is the Isotope Development and Production for Research and Applications Program, known more simply as the DOE Isotope Program. The program, managed by Science's Office of Nuclear Physics, supports the production and development of production techniques, as well as radioactive and stable isotopes that are in short supply for research and industrial applications. In doing so, it provides a vital contribution to research, medicine, and industry. The Budget provides \$5 million to initiate a construction project for a U.S. Stable Isotope Production and Research Center at ORNL.

Fulfilling Legacy Cleanup Responsibilities

The mission of the Department's Environmental Management (EM) program is to complete cleanup of legacy nuclear weapons development and research sites. It is the largest program of its kind in the world and represents one of the top financial liabilities to the American taxpayer. EM is working collaboratively with regulators, federal, state, and local governments, and others toward a future that drives cleanup toward completion safer, sooner and at a responsible cost. As EM is put on a sustainable path forward, the FY 2020 Budget Request provides the resources necessary to build upon recent successes and bring a renewed sense of urgency to the program for meaningful and measurable progress at projects and sites throughout the cleanup complex.

The Budget Request includes \$6.5 billion for EM to address its responsibilities for the cleanup and disposition of excess facilities, radioactive waste, spent nuclear fuel, and other materials resulting from five decades of nuclear weapons development and production and Government-sponsored nuclear energy research. To-date, EM has completed cleanup activities at 91 sites in

30 states and Puerto Rico, and is responsible for cleaning up the remaining 16 sites in 11 states –some of the most challenging sites in the cleanup portfolio.

The Budget Request includes \$1.4 billion for the Office of River Protection at the Hanford Site for continued work at the Hanford Tank Farms and to make progress on the Waste Treatment and Immobilization Plant. This budget will continue progress toward important cleanup required by the Consent Decree and Tri-Party Agreement to include a milestone to complete hot commissioning of the Low Activity Waste Facility by December 31, 2023. The Budget also includes \$718 million to continue cleanup activities at Richland. The Budget continues River Corridor decontamination and decommissioning activities including remediation of the highly contaminated 300-296 waste site under the 324 Building. For Savannah River, the Budget provides \$1.6 billion, \$91 million above enacted FY 2019, to support activities at the site. This will include the Liquid Tank Waste Management Program, completing cold commissioning beginning operation of the Salt Waste Processing Facility, continued construction activities for Saltstone Disposal Unit #7 and #8/9 design and construction activities for Saltstone Disposal Unit #10-#12, and funding to support design and construction of the Advanced Manufacturing Collaborative facility.

The Waste Isolation Pilot Plant (WIPP) is essential for the disposition of transuranic defense-generated waste across the DOE complex, and the Budget provides \$398 million to safely continue waste emplacement at WIPP. The Budget Request will continue WIPP operations, including waste emplacements, shipments, and maintaining enhancements and improvements, and progress on critical infrastructure repair/replacement projects, including \$58 million for the Safety Significant Confinement Ventilation System and \$35 million for the Utility Shaft (formerly Exhaust Shaft). These steps will increase airflow in the WIPP underground for simultaneous mining and waste emplacement operations.

The Budget Request includes \$348 million to continue cleanup projects at the Idaho site, such as the Integrated Waste Treatment Unit, and to process, characterize, and package transuranic waste for disposal at offsite facilities. It provides \$429 million for Oak Ridge to continue deactivation and demolition of remaining facilities at the East Tennessee Technology Park, continue preparation of Building 2026 to support processing of the remaining U-233 material at the Oak Ridge National Laboratory, and support construction activities for the Outfall 200 Mercury Treatment Facility at the Y-12 National Security Complex and design for a new On-Site Waste Disposal Facility to support cleanup.

For Portsmouth, the Budget Request includes \$426 million to continue progress on the deactivation and decommissioning project at the Portsmouth Gaseous Diffusion Plant, safe operation of the Depleted Uranium Hexafluoride Conversion Facility, and construction activities at the On-Site Waste Disposal facility. At Paducah, the Budget Request includes \$277 million to continue ongoing environmental cleanup and depleted uranium hexafluoride (DUF6) conversion facility operations at the Paducah site. In addition, the FY 2020 Budget Request supports activities to continue the environmental remediation and further stabilize the gaseous diffusion plant.

The Budget continues funding of \$128 million to address specific high-risk contaminated excess facilities at Lawrence Livermore National Laboratory.

Together, these investments for EM will make significant progress in fulfilling our cleanup responsibilities while also beginning to address our high-risk excess facilities at NNSA sites.

Conclusion

In conclusion, I reaffirm my pledge that the Department of Energy, along with our National Laboratories, will continue to support the world's best enterprise of scientists and engineers who create innovations to drive American security, prosperity, and competitiveness. The President's FY 2020 Budget Request for the Department of Energy reflects the priorities to enhance our energy, economic, and national security today, while making strategic investments to accelerate the breakthroughs that will fuel America's tomorrow.

In the coming weeks and months, I look forward to working with you and your colleagues in Congress on the specific programs mentioned in this testimony. Thank you, and I look forward to answering your questions.