NON-DEFENSE ENVIRONMENTAL CLEANUP

Appropriations, 2019	$310,000,000
Budget estimate, 2020	247,480,000
Committee recommendation	318,000,000

The Committee recommends $318,000,000 for Non-Defense Environmental Cleanup, an increase of $70,520,000 above the budget request. Within available funds, $200,000 is made available for community assistance.

Small Sites.—The Committee recommends $127,000,000 for Small Sites. Within the available funds, the Committee recommends $31,000,000 to continue work at Lawrence Berkeley National Laboratory, $18,200,000 for ETEC, $45,000,000 for MOAB, $10,000,000 for excess Office of Science facilities, and $10,000,000 to continue work required pursuant to the agreement reached in 2012 between the Department, the Advisory Council on Historic Preservation, and State and local governments to complete the demolition of K–25 in exchange for preserving the historic contributions made by the K–25 site to the Manhattan Project.

URANIUM ENRICHMENT DECONTAMINATION AND DECOMMISSIONING FUND

Appropriations, 2019	$841,129,000
Budget estimate, 2020	715,112,000
Committee recommendation	906,695,000

The Committee recommends $906,695,000 for Uranium Enrichment Decontamination and Decommissioning [UED&D] activities, an increase of $191,583,000 above the budget request.

The Committee recommendation includes $195,693,000 for East Tennessee Technology Park to continue cleanup and demolition of all remaining facilities including the K–1200 complex and the K-1600 complex, and to conduct remedial actions, and site closure activities. The Committee also recommends $240,000,000 for Paducah, and $418,295,000 for Portsmouth. Additional funding of $60,000,000 above the budget request is recommended for the Portsmouth Site, and the Department shall not barter, transfer, or sell uranium during fiscal year 2020 to generate additional funding for Portsmouth cleanup that is in excess of the amount of funding recommended.

SCIENCE

Appropriations, 2019	$6,585,000,000
Budget estimate, 2020	5,545,972,000
Committee recommendation	7,215,000,000

The Committee recommends $7,215,000,000 for Science, an increase of $1,669,028,000 above the budget request. The recommendation includes $188,000,000 for program direction.

Distinguished Scientist Program.—The Committee recommends $4,000,000 to support the Department's Distinguished Scientist Program, as authorized in section 5011 of Public Law 110–69 to promote scientific and academic excellence through collaborations between institutions of higher education and national laboratories to be funded from across all Office of Science programs.

Quantum Information Science.—The Committee supports the Office of Science's coordinated and focused research program in quantum information science to support the Department's science, energy, and national security missions, as authorized in sections 401 and 402 of Public Law 115–368, the National Quantum Initiative. This industry of the future promises to yield revolutionary new approaches to computing, sensing, communication, data security, and metrology, as well as our understanding of the universe, and accordingly the Committee recommends $195,000,000 across the Office of Science programs to advance early-stage fundamental research in this field of science, including $120,000,000 for activities authorized in section 401 and $75,000,000 for the establishment of up to five National Quantum Information Science Research Centers authorized in section 402. To the greatest extent practical, this effort shall be undertaken in coordination with the National Science Foundation and the National Institute of Standards and Technology.

Artificial Intelligence and Machine Learning.—The Committee recommends $71,000,000 for Artificial Intelligence and Machine Learning across the following Office of Science Programs: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, and High Energy Physics. As the stewards of the leadership computing facilities, the Committee expects Advanced Scientific Computing Research to take a lead role in the Department's artificial intelligence and machine learning activities.

ADVANCED SCIENTIFIC COMPUTING RESEARCH

The Committee recommends $1,029,000,000 for Advanced Scientific Computing Research.

The Committee recommends $188,735,000 for the Exascale Computing Project. In addition, the Committee recommends $235,000,000 for the Oak Ridge Leadership Computing Facility, $165,000,000 for the Argonne Leadership Computing Facility, $115,000,000 for the National Energy Research Scientific Computing Center, and $90,000,000 for ESnet. The Committee recommends $42,000,000 for Research and Evaluation Prototypes, including $12,000,000 for the Computational Sciences Graduate Fellowship.

Maintaining international leadership in high performance computing requires a long term and sustained commitment to basic research in computing and computational sciences, including applied math, software development, networking science, and computing competency among scientific fields. The Committee is concerned that the Department is falling behind in its research capabilities and capacity, threatening continued U.S. leadership, and therefore provides no less than $160,000,000 for research.

The Committee appreciates the Department's focus on the development of foundational Artificial Intelligence and Machine Learning capabilities, and the Committee directs the Office of Science to apply those capabilities to the Office of Science's mission with a focus on accelerating scientific discovery in its Scientific User Facilities and large experiments.

BASIC ENERGY SCIENCES

The Committee recommends $2,325,000,000 for Basic Energy Sciences [BES].

The Committee recommends up to $130,000,000 for the Energy Frontier Research Centers to continue multi-disciplinary, fundamental research needed to address scientific grand challenges. The Committee continues to support the EPSCoR program and its goals of broadening participation in sustainable and competitive basic energy research in eligible jurisdictions. The Committee recommends $25,000,000 for EPSCoR and directs the Department to resume annual or at minimum, continue biennial implementation grant solicitations. Further, the Committee recommends $20,000,000 for direct air capture research. The Office of Science is directed to coordinate with the Office of Fossil Energy and the Office of Energy Efficiency and Renewable Energy to develop a coordinated program, as recommended by the National Academies, that supports research, development, and demonstration projects to advance the development and commercialization of direct air capture technologies on a significant scale.

The Committee recommends not less than $550,000,000 to provide for optimal operations at the five BES light sources and to adequately invest in the recapitalization of key instruments and critical infrastructure improvements, as well as staff and other resources necessary to deliver critical scientific capabilities to users. The Committee recommends $323,500,000 for high-flux neutron source operations which will allow for both Spallation Neutron Source [SNS] and High Flux Isotope Reactor [HFIR] to proceed with the most critical deferred repairs, replace outdated instruments, and make essential machine improvements. Within this amount, $18,500,000 is recommended for the DISCOVER Beamline at SNS. The Committee recommends not less than $140,000,000 to fully fund optimal operations at the five BES Nanoscale Science Research Centers and to adequately invest in the recapitalization of key instruments and infrastructure, and in staff and other resources necessary to deliver critical scientific capabilities to users.

The Committee recommends $24,088,000 for the Batteries and Energy Storage Hub, the Joint Center for Energy Storage Research [JCESR]. The Committee supports the continued research and development for JCESR, to ensure the outcome of basic research leads to practical solutions that are competitive in the marketplace. The Committee recommends $20,000,000 for the Fuels from Sunlight Hub.

The Committee encourages the Department to continue funding to support research and development needs of graduate and postgraduate science programs at Historically Black Colleges and Universities.

The Committee recommends $26,000,000 for exascale systems.

Within the amounts recommended for Construction, the Committee recommends $65,000,000 for the Proton Power Upgrade project at the Spallation Neutron Source, $40,000,000 for the Second Target Station, $82,000,000 for the Advanced Light Source Upgrade, $180,000,000 for the Advanced Photon Source Upgrade, and

$55,000,000 for the Linac Coherent Light Source Facility II–High Energy [LCLS–II–HE] .

Not less than $23,000,000 is recommended for Other Project Costs, of which $4,000,000 is for the High Energy Upgrade at LCLS–II; $17,000,000 is for the Second Target Station; and $2,000,000 is for the Advanced Light Source Upgrade. Further, not less than $10,500,000 is recommended for major items of equipment [MIE], including up to $5,500,000 for the National Synchrotron Light Source–II [NSLS–II] Experimental Tools-II MIE. Despite the NSLS–II becoming operational in 2014, the Department has constructed only half of the 60 beamlines that the NSLS–II can accommodate. The Department is encouraged to continue to support the construction of additional beamlines in future budget requests so the nation's scientists can more fully leverage the investment that has been made in the NSLS–II while it is the most powerful X-Ray light source in the Nation.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The Committee recommends $770,000,000 for Biological and Environmental Research. The Department is directed to give priority to optimizing the operation of Biological and Environmental Research User Facilities.

The Committee directs the Department to enhance investments in machine learning to advance the use of diverse and increasingly autonomous datasets to understand environmental and climate dynamics; rapidly incorporate datasets into predictive watershed, ecosystem and climate models; and project the onset of and track extreme events, such as atmospheric rivers and hurricanes.

The Committee recommends not less than $100,000,000 for the four Bioenergy Research Centers. The Committee directs the Department to maintain Genomic Science as a top priority and recommends $100,000,000 for Foundational Genomics Research. Further, the Committee recommends $55,000,000 for Biomolecular Characterization and Imaging Science, including $20,000,000 to advance the study of complex biological systems and synthetic biology using neutrons. Within available funds, the Department is directed to provide $15,000,000 to develop a multi-scale-genes to ecosystem-approach that supports a predictive understanding of complex systems important to bioenergy and biosecurity. The Committee recommends $80,000,000 for the Joint Genome Institute, an essential component for genomic research. The Committee supports the Department's establishment of a national microbiome database collaborative and provides $10,000,000 for the continuation of this effort.

Within available funding for Earth and Environmental Systems Sciences, the Committee recommends not less than $45,000,000 for Terrestrial Ecosystem Science, of which not less than $10,000,000 is for Next Generation Ecosystem Experiments Arctic; $8,300,000 is for the SPRUCE field site; $5,000,000 is to initiate planning and pilot studies for new Terrestrial Ecosystem Science manipulation experiments; $7,000,000 for Next Generation Ecosystem Experiments Tropics; $6,800,000 for Watershed Function SFA; and $5,100,000 for AmeriFLUX Long-Term Earth System Observations. Within available funding for Earth and Environmental Systems

Sciences, the Committee recommends not less than $25,000,000 for Subsurface Biogeochemical Research, including not less than $3,500,000 to support ongoing research and discovery related to mercury biogeochemical transformations in the environment.

The Committee recommends not less than $97,000,000 for Earth and Environmental Systems Modeling and directs the Department to expend appropriated funds for earth system modeling, and regional and global model analysis. The Committee further directs the Department to make land-energy interactions, land biogeochemistry, uncertainty quantification, and model evaluation (e.g., International Land Model Benchmarking) a priority within the regional and global modeling activities, and continue to support performance optimization of coupled systems for execution on high performance and exascale systems. The Committee recommends $15,000,000 to support the exascale computing initiative.

The Committee supports the Department's efforts to advance understanding of coastal ecosystems, as initiated with the terrestrial-aquatic interfaces pilot in fiscal year 2019, and provides $20,000,000 to build upon the current modeling-focused effort and to develop observational assets and associated research to study the nation's major land-water interfaces, including the Great Lakes, by leveraging national laboratories' assets as well as local infrastructure and expertise at universities and other research institutions.

The Committee encourages the Department to increase its funding for academia to perform independent evaluations of climate models using existing data sets and peer-reviewed publications of climate-scale processes to determine various models' ability to reproduce the actual climate.

The Committee continues to support the Department's funding for colleges and universities to examine and evaluate earth system models and validate their ability to reproduce earth systems. The Committee is aware of limitations in the ability to understand and predict earth systems behavior posed by uncertainties in interactions between clouds, aerosols, and climate, an area of research highlighted as a priority by the National Climate Assessment with implications for weather prediction, infrastructure planning, and national security. Reducing uncertainty in understanding cloud aerosol effects requires investment in new techniques such as controlled experiments along with observational studies, modeling and computing. The Committee recommends $15,000,000 for cloud-aerosol research, technology innovation and computing.

FUSION ENERGY SCIENCES

The Committee recommends $570,000,000 for Fusion Energy Sciences.

U.S. Contribution to the International Thermonuclear Experimental Reactor [ITER] Project.—The Committee recommends $180,000,000 for the domestic, in-kind contributions and related support activities of the ITER project.

The Department is encouraged to support optimal facility operations levels for DIII–D. The Committee recommends $30,000,000 for the Material Plasma Exposure eXperiment. The Committee supports the Matter in Extreme Conditions Petawatt Upgrade project

and recommends $14,400,000 in construction funding and $1,400,000 in other project costs funding. The Committee recommends $20,000,000 for LaserNetUS.

The Committee is aware of the increase in global investment in private fusion energy companies developing advanced technology approaches with a focus on commercialization. The U.S. has an opportunity to seize global leadership in this transformational energy sector and attract global industry stakeholders by building on the Department's laboratory capabilities and world class fusion science talent while partnering with these private fusion companies. The Committee supports the Department's recent creation of the Innovation Network for Fusion Energy [INFUSE] research and development program that is advancing enabling fusion energy commercialization technologies through partnerships with industry, labs and universities, and provides up to $20,000,000 over the budget request for the continuation of the INFUSE program.

In addition, the Committee directs the Department to create a Fusion Public—Private Partnership Cost Share Program that advances multiple fusion advanced reactor technologies which are ready for large-scale integrated performance demonstration. The Committee recommends up to $20,000,000 for this new program and directs the Department to commence a Funding Opportunity Announcement [FOA] this year with the intention of making awards to up to three private fusion energy companies pursuing diverse technological approaches to commercial fusion energy to support large-scale integrated performance prototype demonstrations within the next five years. The FOA should seek to attract leading private fusion energy companies to conduct these prototype demonstrations in partnership with, and at, the existing Office of Science laboratories to enhance leadership in these emerging advanced fusion technologies. The Department is directed to provide to the Committees on Appropriations of both Houses of Congress not later than 60 days after enactment of this act a briefing on this cost share program to include program objectives, eligibility requirements, as well as a funding profile for future fiscal years.

HIGH ENERGY PHYSICS

The Committee recommends $1,065,000,000 for High Energy Physics.

The Committee recommends up to $8,900,000 for the Large Synoptic Survey Telescope. The Committee recommends $175,000,000 for the Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment, including $171,000,000 to continue construction and $4,000,000 for other project costs funds. The Committee recommends $65,000,000 for the Proton Improvement Plan–II accelerator upgrade. The Committee recommends $35,000,000 for the Sanford Underground Research Facility. Further, the Committee recommends not less than $100,000,000 for the HL–LHC Upgrade projects.

NUCLEAR PHYSICS

The Committee recommends $736,000,000 for Nuclear Physics.

Within available funds, the Committee recommends $45,300,000 for construction of the Facility for Rare Isotope Beams [FRIB],

$1,000,000 for the Electron Ion Collider, and $30,000,000 for the U.S. Stable Isotope Production and Research Center.

The Committee also recommends $28,500,000 for early operations at FRIB. This funding is necessary to meet the planned levels as defined by the Department of Energy-Michigan State University cooperative agreement. Within major items of equipment and other project costs, the Committee recommends $1,500,000 for the Stable Isotope Production Facility; $10,200,000 for the Gamma-Ray Energy Tracking Array; $9,520,000 for sPHENIX; $5,330,000 for MOLLER; $5,000,000 for Ton-Scale Neutrino-less Double Beta Decay; $10,000,000 for the Electron Ion Collider; and $1,000,000 for the High Rigidity Spectrometer.

The Committee further recommends optimal operations at the Relativistic Heavy Ion Collider, Continuous Electron Beam Accelerator Facility, the Argonne Tandem Linac Accelerator System, and the Brookhaven Linac Isotope Producer Facility.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

The Committee recommends $25,000,000 for Workforce Development for Teachers and Scientists. Within available funds, the Committee recommends $11,750,000 for Science Undergraduate Laboratory Internships; $1,500,000 for Community College Internships; $3,500,000 for the Graduate Student Research Program; $1,700 for the Visiting Faculty Program; $1,200,000 for the Albert Einstein Distinguished Educator Fellowship; $2,900,000 for the National Science Bowl; $750,000 for Technology Development and Online Application; $600,000 for Evaluation Studies; and $600,000 for Outreach.

Further, not later than 60 days after enactment of this act, the Committee directs the Department to provide a report to the Committees on Appropriations of both Houses of Congress on how the Office of Science plans to comply with Executive Order 13853 to develop a pipeline to meet future needs in trade craft requirements and workforce development in coordination with the national laboratories.

SCIENCE LABORATORIES INFRASTRUCTURE

The Committee recommends $394,000,000 for Science Laboratories Infrastructure.

Within these funds, the Committee recommends $26,000,000 for nuclear operations at Oak Ridge National Laboratory. In future budget requests, the Committee directs the Office of Science to work with the Office of Nuclear Energy to demonstrate a commitment to operations and maintenance of nuclear facilities at Oak Ridge National Laboratory that support multiple critical missions.

ADVANCED RESEARCH PROJECTS AGENCY–ENERGY

Appropriations, 2019	$366,000,000
Budget estimate, 2020	−287,000,000
Committee recommendation	428,000,000

The Committee recommends $428,000,000 for the Advanced Research Projects Agency-Energy [ARPA–E], an increase of