

SCIENCE

Appropriation, 2019	\$6,585,000,000
Budget estimate, 2020	5,545,972,000
Recommended, 2020	6,870,000,000
Comparison:	
Appropriation, 2019	+285,000,000
Budget estimate, 2020	+1,324,028,000

The Office of Science funds basic science research across national laboratories, universities, and other research institutions in support of American innovation and the Department’s energy-focused missions. Through research in physics, biology, chemistry, and other science disciplines, these activities expand scientific understanding and secure the nation’s leadership in energy innovation. This basic science research is crucial to enabling the nation to continue developing transformational energy technologies and to position itself to seize economic opportunities in the global energy markets of the future. The Office of Science is the nation’s largest supporter of basic research in the physical sciences.

The Office of Science includes the following programs: Advanced Scientific Computing Research, Basic Energy Sciences, Biological and Environmental Research, Fusion Energy Sciences, High Energy Physics, Nuclear Physics, Workforce Development for Teachers and Scientists, Science Laboratories Infrastructure, Safeguards and Security, and Program Direction. The Committee has placed a high priority on funding these activities in fiscal year 2020, given the private sector is not likely to fund research whose findings either have high non-commercial value or are not likely to be commercialized in the near or medium term. This work is vital to sustaining the scientific leadership of the United States and can provide the underpinnings for valuable intellectual property in the coming decades.

Collaborative research efforts between the Department and the National Institutes of Health (NIH) are developing breakthroughs in health research, including drug discovery, brain research, diagnostic technologies, imaging, and other biomedical research areas. The Department is encouraged to expand its relationships with NIH in order to work together more strategically to leverage the Department’s research capabilities, including instrumentation, materials, modeling and simulation, and data science. The facilities and equipment funded in this Act support application in many areas of biomedical research. The Department is directed to provide to the Committee not later than 90 days after enactment of this Act a plan that responds to the findings and recommendations in the Final Report of the Secretary of Energy Advisory Board Task Force on Biomedical Sciences. The plan shall include a reporting of successful collaborations between the Department and NIH to date and plans to expand on these efforts.

The Committee directs the Department to evaluate methods to educate new and existing minority and women-owned small businesses about SBIR and STTR grants. The fiscal year 2019 Act directed the Department to provide current and planned outreach efforts in this area 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. The Committee encourages the Department to consider the creation of regional technical

support centers as needed to assist newly-forming and existing minority and women-owned small businesses to secure a more proportional share of SBIR and STTR grants.

The Committee supports the Office of Science's coordinated and focused research program in quantum information science and technology. This emerging field of science promises to yield revolutionary new approaches to computing, sensing, and communication. The recommendation includes funding for quantum information science research and establishment of National Quantum Information Science Research Centers.

The Committee appreciates the Department's focus on the development of foundational Artificial Intelligence and Machine Learning capabilities, and the Committee directs the Department to apply those capabilities to the Department's mission.

ADVANCED SCIENTIFIC COMPUTING RESEARCH

The Advanced Scientific Computing Research program develops and hosts some of the world's fastest computing and network capabilities to enable science and energy modeling, simulation, and research.

Exascale Computing Project.—The recommendation includes \$188,735,000 for exascale activities.

High Performance Computing and Network Facilities.—In addition to the long-term exascale initiative, the Committee supports continued upgrade and operation of the Leadership Computing Facilities at Argonne National Laboratory and Oak Ridge National Laboratory and of the High Performance Production Computing capabilities at Lawrence Berkeley National Laboratory. The recommendation includes \$150,000,000 for the Argonne Leadership Computing Facility, \$225,000,000 for the Oak Ridge Leadership Computing Facility, and \$100,000,000 for the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory. Within available funds, the recommendation includes \$10,000,000 for the Computational Science Graduate Fellowship program and \$90,000,000 to support necessary infrastructure upgrades and operations for ESnet.

Mathematical, Computational, and Computer Sciences Research.—The Committee notes the importance of a strong research program in applied and computational mathematics to the Department's mission. 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. Within available funds, the recommendation includes not less than \$155,000,000 for Mathematical, Computational, and Computer Sciences Research.

Within available funds, the recommendation includes up to \$15,000,000 for research in memory advancements for accelerated architectures used to enhance Artificial Intelligence and Machine Learning.

BASIC ENERGY SCIENCES

The Basic Energy Sciences program funds basic research in materials science, chemistry, geoscience, and bioscience. The science breakthroughs in this program enable a broad array of innovation

in energy technologies and other industries critical to American economic competitiveness.

Research.—Within available funds, the recommendation provides \$24,088,000 for the Batteries and Energy Storage Innovation Hub, not less than \$15,000,000 for the Fuels from Sunlight Innovation Hub, \$139,000,000 for facilities operations of the nanoscience research centers, \$520,000,000 for facilities operations of the nation's light sources, \$285,000,000 for facilities operations of the high flux neutron sources, \$25,000,000 for the Experimental Program to Stimulate Competitive Research, and \$120,000,000 for the Energy Frontier Research Centers.

Within funds for operations of the nation's light sources, the Department is encouraged to invest in capital improvements at all of the light sources. It is imperative that these facilities continue to provide users with state-of-the-art capabilities to ensure U.S. science leadership and innovation.

The recommendation includes \$5,000,000 for NSRC Recapitalization and \$5,000,000 for NSLS-II Experimental Tools-II.

BIOLOGICAL AND ENVIRONMENTAL RESEARCH

The Biological and Environmental Research (BER) program supports advances in energy technologies and related science through research into complex biological and environmental systems.

The recommendation includes \$381,000,000 for Biological Systems Science. The recommendation provides \$100,000,000 for the Bioenergy Research Centers.

The Committee supports the Department's efforts to build programmatic bridges and leverage its resources among biological, earth, and environmental science programs to facilitate the seamless quantification and prediction of biological-environmental interactions from molecular to ecosystem scales. The Committee encourages the Department to expand its growing focus on the science of biology-based products to advance critical mission needs and to maintain international leadership. The Committee continues to support the Department's establishment of a national microbiome database collaborative and provides \$10,000,000 for microbiome research initiatives, including development and operation of the microbiome database.

The Committee directs the Department to give priority to optimizing the operation of BER user facilities.

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 modeling and computing. The recommendation provides \$15,000,000 for cloud-aerosol research and computing.

The Committee supports the Department's efforts to advance the understanding of coastal ecosystems, as initiated with the terrestrial-aquatic interfaces pilot in fiscal year 2019. The recommenda-

tions 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 recommendation includes not more than \$10,000,000 to restart the Department's Low-Dose Radiation Program.

Within available funds, the Department is directed to continue to support NGEE–Arctic, NGEE–Tropics, the SPRUCE field site, the Watershed Function Science Focus Area, and the AmeriFLUX project.

FUSION ENERGY SCIENCES

The Fusion Energy Sciences program supports basic research and experimentation aiming to harness nuclear fusion for energy production.

Research.—Within available funds, the recommendation provides \$20,000,000 for High Energy Density Laboratory Plasmas, including activities for LaserNetUS.

Within available funds, the recommendation includes \$4,000,000 for the Department to create a Fusion Public-Private Partnership Program to advance new U.S.-based fusion capabilities. The Department is directed to brief the Committee not later than 90 days after enactment of this Act on this program's technical objectives, eligibility requirements, and funding profile in future fiscal years. The Department is reminded that all activities within this program must be basic research and development.

The recommendation includes \$21,000,000 for the Materials Plasma Exposure eXperiment.

Construction.—The Committee recommends \$230,000,000 for the U.S. contribution to the ITER project. The Committee continues to believe the ITER project represents an important step forward for energy sciences and has the potential to revolutionize the current understanding of fusion energy.

HIGH ENERGY PHYSICS

The High Energy Physics program supports fundamental research into the elementary constituents of matter and energy and ultimately into the nature of space and time. The program focuses on particle physics theory and experimentation in three areas: the energy frontier, which investigates new particles and fundamental forces through high-energy experimentation; the intensity frontier, which focuses on rare events to better understand our fundamental model of the universe's elementary constituents; and the cosmic frontier, which investigates the nature of the universe and its form of matter and energy on cosmic scales.

Research.—Within available funds, the recommendation provides \$25,000,000 for the Sanford Underground Research Facility, not less than \$50,000,000 for Accelerator R&D, and \$97,975,000 for the HL–LHC Upgrade Projects.

The Committee strongly urges the Department to maintain a balanced portfolio of small, medium, and large scale experiments, and to ensure adequate funding for research performed at universities and the national laboratories. The Committee encourages the De-

partment to fund facility operations at levels for optimal operations.

NUCLEAR PHYSICS

The Nuclear Physics program supports basic research into the fundamental particles that compose nuclear matter, how they interact, and how they combine to form the different types of matter observed in the universe today.

Operations and Maintenance.—Within available funds, the recommendation provides \$10,000,000 for Electron Ion Collider R&D.

The Department is directed to give priority to optimizing operations within Medium Energy Nuclear Physics and at the Facility for Rare Isotope Beams.

Within available funds, the recommendation provides \$10,200,000 for the Gamma-Ray Energy Tracking Array, \$9,520,000 for the Super Pioneering High Energy Nuclear Interaction Experiment, and not less than \$2,500,000 for MOLLER.

WORKFORCE DEVELOPMENT FOR TEACHERS AND SCIENTISTS

The Workforce Development for Teachers and Scientists program ensures that the nation has the sustained pipeline of science, technology, engineering, and mathematics (STEM) workers to meet national goals and objectives.

The Committee recommends \$25,000,000 for Workforce Development for Teachers and Scientists. Within available funds, the Committee recommends not less than \$12,000,000 for the Science Undergraduate Laboratory Internship and not less than \$1,500,000 for the Community College Institute of Science and Technology. Within available funds, the Committee recommends not less than \$600,000 for outreach activities for the Department to widely publicize its opportunities and diversify the applicant pool, with an emphasis on targeted recruitment of individuals traditionally underrepresented in STEM.

The Committee recognizes and supports the Department's efforts, particularly through the national laboratories' scientists and engineers, to engage in a broad range of activities with K-12 STEM educators and students to help inspire and train the next generation of STEM students and professionals.

SCIENCE LABORATORIES INFRASTRUCTURE

The Science Laboratories Infrastructure program sustains mission-ready infrastructure and safe and environmentally-responsible operations by providing the infrastructure improvements necessary to support leading edge research by the Department's national laboratories.

The recommendation includes funding to complete the land and facilities acquisition for the Pacific Northwest National Laboratory, and the Committee encourages the Department to complete these purchases in fiscal year 2020.