

## SCIENCE

(dollars in thousands)

	FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted	
				\$	%
<b>Office of Science</b>					
Advanced Scientific Computing Research	1,068,000	1,033,108	1,152,682	+84,682	+7.93%
Basic Energy Sciences	2,534,000	2,503,632	2,582,285	+48,285	+1.91%
Biological and Environmental Research	908,685	835,644	945,225	+36,540	+4.02%
Fusion Energy Sciences	763,222	804,668	844,496	+81,274	+10.65%
High Energy Physics	1,166,000	1,196,301	1,230,768	+64,768	+5.55%
Nuclear Physics	805,196	771,203	833,091	+27,895	+3.46%
Isotope R&D and Production	109,451	153,551	183,900	+74,449	+68.02%
Accelerator R&D and Production	27,436	29,175	31,273	+3,837	+13.99%
Workforce Development for Teachers and Scientists	42,000	42,100	43,100	+1,100	+2.62%
Science Laboratories Infrastructure	280,700	293,918	295,180	+14,480	+5.16%
Safeguards and Security	184,099	200,000	195,000	+10,901	+5.92%
Program Direction	211,211	236,700	246,000	+34,789	+16.47%
<b>Total, Office of Science</b>	<b>8,100,000</b>	<b>8,100,000</b>	<b>8,583,000</b>	<b>+483,000</b>	<b>+5.96%</b>

### Appropriation Overview

The Office of Science (SC) is the nation’s largest Federal supporter of basic research in the physical sciences. The SC portfolio has two thrusts: direct support of scientific research and direct support of the design, development, construction, and operation of unique, open-access scientific user facilities. The SC basic research portfolio includes grants and contracts supporting over 29,000 researchers located at over 300 institutions and 16 DOE national laboratories, spanning all 50 states, District of Columbia, and U.S. territories. The portfolio of 28 scientific user facilities serves nearly 40,000 users per year. SC programs invest in basic research for the advancement of clean energy, to transform our understanding of nature, and to strengthen the connection between advances in fundamental science and technology (S&T) innovation.

The SC Request increases investments in Administration priorities including artificial intelligence (AI) and machine learning (ML), basic research on climate change and clean energy, the SC Energy Earthshots initiative, Microelectronics Science Research Centers, and accelerating fusion development in support of the Bold Decadal Vision for Commercial Fusion Energy. The SC Request also promotes the domestic establishment of critical isotope supply chains to reduce U.S. dependency on foreign supply and increase U.S. resilience. SC continues efforts to support underserved communities through increased investment in the Reaching a New Energy Sciences Workforce (RENEW) and Funding for Accelerated, Inclusive Research (FAIR) initiatives. As part of this increase, a RENEW graduate fellowship will support graduate studies for students who received their bachelor’s degree from emerging research institutions, underserved communities, Historically Black Colleges and Universities (HBCUs), and Minority Serving Institutions (MSIs).

The FY 2025 Request includes increased investment to support the 28 SC scientific user facilities, which are unique resources stewarded by DOE for the nation and made available to the scientific community free of charge, based on merit review to support the best scientific ideas. In FY 2025, DOE estimates that nearly 40,000 researchers will access these cutting-edge tools to push the frontiers of S&T, with nearly half doing research supported by other funding agencies, including the National Science Foundation, the National Institutes of Health, the National Aeronautics and Space Administration, and the Department of Defense, as well as from industry. These facilities have delivered extraordinary breakthroughs, such as powering our nation’s response to COVID by supporting rapid development of vaccines and helping usher new battery technologies to the marketplace. Further, these facilities are often the portal through which the next generation of researchers begin their engagement with DOE and its national laboratories, providing invaluable

opportunities for developing the diverse, equitable, and inclusive workforce our country needs to meet the major economic and national security challenges ahead.

### **Program Highlights**

#### ▪ **Advanced Scientific Computing Research (ASCR)**

ASCR advances science and U.S. competitiveness through investments in computational science, applied mathematics, computer science, networking, and software research as well as development and operation of multiple, large, high performance and leadership computing and high performance networking user facilities. The Request funds:

- Critical basic research investments in applied mathematics and computer science to combine the power of exascale computing and artificial intelligence for a new science era.
- Extended frontiers in AI for science, security, and technology that leverages the unique capabilities of the DOE ecosystem to expand responsible, trustworthy, and secure application of AI technologies.
- Next-generation facilities by maintaining facility operations and existing upgrade projects. The Request includes increased support for the planned advancement of the High Performance Data Facility (HPDF).
- Engage U.S. microelectronics vendors to advance DOE goals for next generation HPC including continued improvements in energy utilization, usability and interoperability for a wide range of use cases, including AI.

#### ▪ **Basic Energy Sciences (BES)**

BES supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels to provide the foundations for new energy technologies, to mitigate the environmental impacts of energy use, and to support DOE missions in energy, environment, and national security. The Request funds:

- Core research activities to support Administration Priorities on clean energy, including science underpinning the DOE Energy Earthshots, AI/ML, critical materials, microelectronics, Quantum Information Science (QIS), biopreparedness, and accelerator S&T.
- Continued support for the Energy Frontier Research Centers, Energy Earthshot Research Centers, the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hub programs, and the computational materials and chemical sciences programs.
- Continued operation of BES scientific user facilities: five x-ray light sources, two neutron scattering sources, and five research centers for nanoscale science. At 90 percent of the rebaselined funding levels, the support will balance high priority activities required for safe and reliable operations while maintaining strong user support.
- Five construction projects: the Linac Coherent Light Source-II High Energy, the Second Target Station, the Cryomodule Repair and Maintenance Facility, the NSLS-II Experimental Tools-III, and the High Flux Isotope Reactor Pressure Vessel Replacement projects.
- Planning of future Major Items of Equipment (MIEs) for beamlines at the Advanced Light Source, Advanced Photon Source, and the Stanford Synchrotron Radiation Lightsource.

#### ▪ **Biological and Environmental Research (BER)**

BER supports fundamental research to understand complex biological, biogeochemical, and physical principles of natural systems at scales extending from the genome of microbes and plants to the environmental, climate, and human processes at the scale of the planet Earth that advance understanding of the relationships between energy, the environment, and climate science, from local to global scales and ultimately advance U.S. energy systems and pathways. The Request funds:

- Enhanced research on climate science with a new climate initiative focused on rural climate-energy predictability.
- SC Energy Earthshots initiative, including the Energy Earthshot Research Centers, with a focus on translational research to lower risk and speed adoption of basic research for a carbon-neutral bioeconomy.
- Biopreparedness efforts for adding functionality to collaborative cyber infrastructure allowing distributed networks of scientists to work on multidisciplinary research priorities. This includes enhanced low dose radiation research.
- Expanded modeling research, in particular the DOE Exascale Energy Earth System Model, to utilize advanced software and AI/ML for running on future DOE computer architectures allowing for unprecedented analyses of extreme events for energy, such as the electrical grid and urban energy systems, and other stakeholder applications.

- Continued operation of BER Scientific user facilities: the Joint Genome Institute, the Atmospheric Radiation Measurement (ARM) user facility, and the Environmental Molecular Sciences Laboratory.
  - Initiation of the Drizzle, Aerosol, and Cloud Observation Chamber project to complement ARM's field observations of cloud-aerosol interactions.
  - Continuation of the Microbial Molecular Phenotyping Capability project.
- **Fusion Energy Sciences (FES)**  
 FES supports research to understand matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. The Request is aligned with the recommendations of the recent Long-Range Plan (LRP) developed by the Fusion Energy Sciences Advisory Committee (FESAC) and the Administration's Bold Decadal Vision for commercial fusion development, and funds:
- Fusion Innovation Research Engine Centers: multi-institutional, multi-disciplinary research and development (R&D) centers to address critical S&T gaps outlined in the FESAC LRP and supporting both public and private fusion efforts.
  - Partnerships with the private sector through the Milestone program, the Innovative Network for Fusion Energy (INFUSE) program, and a pilot program to perform open research on private fusion and plasma S&T facilities.
  - DIII-D national fusion facility: Continue development of operating scenarios for advanced tokamaks devices.
  - National Spherical Torus Experiment-Upgrade: Continue collaborative research at other facilities while recovery and repair activities are ongoing and support commissioning in preparation for plasma operation.
  - U.S. Contributions to ITER project focusing on the design, fabrication, and delivery of in-kind hardware components; construction cash contributions to support the ITER Organization.
  - Two construction projects: U.S. Contributions to ITER and the Matter in Extreme Conditions Petawatt upgrade.
  - One MIE: the Material Plasma Exposure eXperiment project.
- **High Energy Physics (HEP)**  
 HEP supports research to understand how the universe works at its most fundamental level, enabling the discovery of the most elementary constituents of matter and energy, the probing of the interactions among them, and the exploration of the basic nature of space and time. The Request funds:
- AI/ML to extract signals of signature particle physics from HEP data with increasingly high volumes and complexity and to improve accelerator and detector operations in real-time and in extremely high data rate environments.
  - QIS co-development of quantum information, theory, and technology aligned with HEP science drivers and exploring new capabilities in quantum sensing and computing.
  - Microelectronics to accelerate R&D into sensor materials, detector devices, advances in front-end electronics, and integrated sensor/processor architectures.
  - Core research activities, with emphasis on the physics of the Higgs boson, neutrinos, dark matter, and dark energy; exploring the unknown; and enabling early and visible scientific results from HEP project investments.
  - Operations for the Fermilab Accelerator Complex and the Facility for Advanced Accelerator Experimental Tests II including critical upgrades, improvements, and deferred maintenance.
  - Continuing support for two construction projects: Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment and Proton Improvement Plan II; and four MIE projects: Accelerator Controls Operations Research Network, Cosmic Microwave Background Stage 4, and the High Luminosity Large Hadron Collider ATLAS and CMS Detector Upgrade Projects.
- **Nuclear Physics (NP)**  
 NP supports experimental and theoretical research to discover, explore, and understand all forms of nuclear matter. The Request funds:
- High priority world-class nuclear physics research and core competencies in quantum chromodynamics, nuclei and nuclear structure and astrophysics, and fundamental symmetries at universities and laboratories.
  - Operations of all NP user facilities at nearly 90 percent optimal funding including: the Relativistic Heavy Ion Collider; the 12 GeV Continuous Electron Beam Accelerator Facility; the Argonne Tandem Linac Accelerator System; and the newly constructed Facility for Rare Isotope Beams.
  - Support for QIS research efforts to enable precision NP measurements, development of quantum sensors based on atomic-nuclear interactions, and development of quantum computing algorithms.

- Expanded support for AI/ML research aimed at the automated optimization of accelerator availability and performance, as well as software enabling data-analytics-driven discovery.
  - Continued support for the Electron-Ion Collider construction project, the High Resolution Spectrometer to study fast neutron beams at FRIB and the Ton-scale Neutrinoless Double Beta Decay MIE to determine whether the neutrino is its own antiparticle.
- **Isotope R&D and Production (DOE IP)**  
DOE IP supports fundamental research in nuclear and radiochemistry, chemical separations, accelerator and reactor physics, and isotope enrichment to produce priority radioactive and stable isotopes in short supply that no domestic entity has the capability to meet market demand; a priority is to reduce U.S. dependence on foreign isotope supply chains. The Request funds:
- Core research activities to develop innovative isotope production, chemical processing, and enrichment technologies, including domestic supply chains of isotopes required to support Administration Priorities on fighting cancer, fusion energy, microelectronics, Quantum Information Science (QIS), and biopreparedness.
  - Mission readiness of facilities to produce isotopes in short supply or otherwise not available increases to approximately 85 percent, relative to FY 2023.
  - Modernization and refurbishment activities to increase safe, robust, and reliable operations across production sites to better tackle growing gaps in isotope supply chains.
  - The University Isotope Network to produce research and “boutique” radioisotopes. The FRIB Isotope Harvesting effort completes transition to routine operations.
  - Initial operations of the Stable Isotope Production Facility MIE as the first domestic large scale gas centrifuge cascade to produce Xe-129 for polarized lung imaging.
  - Continued support for three construction projects: Stable Isotope Production and Research Center, Radioisotope Processing Facility, and Clinical Alpha Radionuclide Producer.
- **Accelerator R&D and Production (ARDAP)**  
ARDAP supports cross-cutting basic R&D in accelerator S&T, access to unique SC accelerator R&D infrastructure, workforce development, and public-private partnerships to advance new technologies for use in SC’s scientific facilities and in commercial products. The Request funds:
- Research, development, and deployment of accelerator technology and the implementation of the first consortium-based approach to accelerator R&D, and workforce development.
  - Public-private partnerships to develop technologies that include advanced superconducting wire and cable, superconducting accelerators, and advanced radiofrequency power sources for accelerators.
  - Operation of the Accelerator Test Facility.
- **Workforce Development for Teachers and Scientists (WDTS)**  
WDTS invests in sustaining a skilled and diverse talent pool in science, technology, engineering, and mathematics (STEM) to support DOE missions. The Request funds:
- Sustained support for the core STEM workforce training programs to develop a highly skilled future S&T workforce.
  - Strategic investment in building innovative pathways for continuous and connected engagement toward a workforce development ecosystem.
  - Support for critical infrastructure to operationalize the workforce development mission based on evidence-based management practices.
  - Intentional outreach and engagement for broadening participation through targeted outreach to individuals and institutions/schools from emerging research and underserved communities.

- **Science Laboratories Infrastructure (SLI)**  
SLI supports scientific and technological innovation at the SC laboratories by sustaining and modernizing general purpose infrastructure and fostering safe, efficient, reliable, resilient, and environmentally responsible operations. The Request funds eight ongoing construction projects, a Laboratory Operations Apprentice Program, at least eight General Plant Projects, and Payment in Lieu of Taxes.
- **Safeguards and Security (S&S)**  
S&S maintains security measures to protect personnel and assets in an environment of open scientific research. The Request funds implementation of the Department’s credentialing directive and sustained efforts for S&S elements.
- **Program Direction (PD)**  
PD supports the Federal workforce that plans, develops, and oversees SC investments in world-leading basic research and scientific user facilities, and provides critical oversight to 10 of DOE’s national laboratories. The Request funds Salaries, Benefits, Travel, Support Services, Other Related Expenses, and the Working Capital Fund.