Science
(dollars in thousands)

FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request
$7,475,000	$8,100,000	$8,800,400

Note:
- *FY 2023 Funding does not reflect the mandated transfer of $20 million from the Office of Nuclear Energy to the Office of Science for Nuclear Facilities Operations and Maintenance Oak Ridge National Laboratory.*

Overview
The Office of Science's (SC) mission is to deliver scientific discoveries and major scientific tools to transform our understanding of nature and advance the energy, economic, and national security of the United States (U.S.). SC is the Nation's largest Federal sponsor of basic research in the physical sciences and the lead Federal agency supporting fundamental scientific research for our Nation's energy future.

SC accomplishes its mission and advances national goals by supporting:

- *The frontiers of science*—exploring nature's mysteries from the study of fundamental subatomic particles, atoms, and molecules that are the building blocks of the materials of our universe and everything in it to the DNA, proteins, and cells that are the building blocks of life. Each of the programs in SC supports research probing the most fundamental disciplinary questions.
- *The 21st Century tools of science*—providing the nation's researchers with 28 state-of-the-art national scientific user facilities, the most advanced tools of modern science, propelling the U.S. to the forefront of science, technology development, and deployment through innovation.
- *Science for energy and the environment*—paving the knowledge foundation to spur discoveries and innovations for advancing the Department's mission in energy and environment. SC supports a wide range of funding modalities from single principal investigators to large team-based activities to engage in fundamental research on energy production, conversion, storage, transmission, and use, and on our understanding of the earth systems.

SC is an established leader of the U.S. scientific discovery and innovation enterprise. Over the decades, SC investments and accomplishments in basic research and enabling research capabilities have provided the foundations for new technologies, businesses, and industries, making significant contributions to our nation's economy, national security, and quality of life. Select scientific accomplishments enabled by the SC programs are described in the program budget narratives. Additional descriptions of recent science discoveries can be found at https://science.osti.gov/Science-Features/Science-Highlights.

Highlights and Major Changes in the FY 2024 Request
The FY 2024 Request for SC is $8,800.4 million, an increase of 8.6 percent above the FY 2023 Enacted level, to implement the Administration's objectives to advance bold, transformational leaps in U.S. Science and Technology (S&T), build a diverse workforce of the future, and ensure America remains the global S&T leader for generations to come. The FY 2024 Request supports a balanced research portfolio of basic scientific research probing some of the most fundamental questions in areas such as: high energy, nuclear, and plasma physics; materials and chemistry; biological and environmental systems; applied mathematics; next generation high-performance computing and simulation capabilities; isotope production; and basic research to advance new accelerator and energy technologies.

The Request increases investments in Administration priorities including basic research on climate change and clean energy, including additional funding for the SC Energy Earthshots and accelerating fusion development in support of the Bold Decadal Vision for Commercial Fusion Energy initiative. The SC Request establishes new Microelectronics Science Research Centers as authorized under the CHIPS and Science Act. 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 increases efforts to support underserved communities through the Reaching a New Energy Sciences Workforce (RENEW) and Funding for Accelerated, Inclusive Research (FAIR) initiatives. The request continues support for the National Quantum Information Science (QIS) Research Centers for basic research and early-stage development to accelerate the advancement of QIS through vertical integration between systems, theory, hardware, and software. Additional quantum-related R&D support

will focus on early-stage research associated with the first steps to establish a dedicated Quantum Network as well as research in quantum algorithms, applications, testbeds, and technology development of QIS isotopes of interest. The Request also supports ongoing investments in priority areas including microelectronics, biopreparedness, artificial intelligence (AI) and machine learning (ML), critical materials, exascale computing, fundamental science to transform manufacturing, accelerate innovations in emerging technologies (Accelerate), and accelerator science and technology. These initiatives position SC to address new research opportunities through more collaborative, cross-program efforts.

In FY 2024, SC requests funding for the following:

- Fusion energy sciences investments grow to over $1 billion and aligned with the recommendations of the recent Long-Range Plan developed by the Fusion Energy Sciences Advisory Committee and the Administration's Bold Decadal Vision for commercial fusion development, including through partnerships with private fusion efforts, four new Fusion Energy R&D Centers, and studies and research for a future fusion neutron source facility that is critical to the development of materials for fusion energy.
- New Microelectronics Science Research Centers will focus on a multi-disciplinary co-design innovation ecosystem in which materials, chemistries, devices, systems, architectures, algorithms, and software are developed in a closely integrated fashion.
- The SC Energy Earthshots initiative will expand to include new topics and further research that crosscuts the Energy Earthshots. Energy Earthshot Research Centers (EERCs) bring together multi-investigator, multi-disciplinary teams to address key research challenges at the interface between basic research and applied Research and Development (R&D) activities. EERCs will entail collaboration within each team awards involving academic, national laboratory, and industrial researchers and close coordination between SC and DOE energy technology offices, establishing a new era of cross-office research cooperation.
- The SC RENEW initiative expands targeted efforts to increase participation and retention of individuals from underrepresented groups in SC research activities. As part of this increase, a RENEW graduate fellowship will increase participation of students in fields aligned with SC programs. The fellowship will focus on students who received their bachelor's degree from non-R1 minority serving institutions or emerging research institutions. The goal is to advance belonging, accessibility, justice, equity, diversity, and inclusion in SC-sponsored research.
- Facility operations investments increase to ensure operations of these state-of-the-art user facilities. The 28 SC scientific user facilities 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. Researchers access these cutting-edge tools to push the frontiers of science and technology, with nearly half doing research supported by other funding agencies, from the National Science Foundation, the National Institutes of Health, and the Department of Defense and others, as well as from industry. These facilities have delivered extraordinary breakthroughs, such as accelerating 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 the 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.
- The DOE Isotope Program supports research and development in accelerator science, reactor physics, nuclear and radiochemistry, and isotope enrichment science aimed at enabling new capabilities for producing critical isotopes. Emphasis will be given to developing domestic supply chains for isotopes in which the U.S. is dependent on other countries, particularly Russia. Isotopes are foundational and enable emerging technology. It is essential for the nation's scientific and technical strength, as well as economic prosperity, that high priority isotopes needed for national security, medicine, energy, quantum computing, microelectronics, essential industrial applications, and discovery research be produced or available domestically.
- Artificial Intelligence Technology Office (AITO) will transfer to SC. AITO will continue to be the principal organizer of cross-cutting AI/ML activities including research, development, demonstration, strategy, and AI activities for the U.S. Department of Energy (DOE). AITO will continue to identify and work in collaboration with the program offices and national laboratories to address gaps in research, development, implementation, and deployment of AI investments.
- SC is committed to ensuring that students, trainees, and postdoctoral fellows are paid a fair and equitable wage sufficient to allow a reasonable standard of living. For graduate students, SC considers a reasonable living wage to be an annual income of $45,000, excluding benefits. Thus, SC plans a modest increase in research awards to support graduate student stipends at this level.

- Managed by BES, the funding requested in FY 2024 for the DOE Established Program to Stimulate Competitive Research (EPSCoR) program is distributed among the six major research programs within SC.

The Request supports SC's basic research portfolio, which includes extramural grants and contracts supporting nearly 32,000 researchers located at over 300 institutions and the 17 DOE national laboratories, spanning all fifty states and the District of Columbia. In FY 2024, SC's suite of 28 scientific user facilities will continue to provide unmatched tools and capabilities for nearly 37,000 users per year from universities, national laboratories, industry, and international partners. In additional to facility operations, the Request will support the construction of new and upgraded user facilities and the R&D necessary for future facilities to continue to provide world class research capabilities to U.S. researchers. SC also continues to update its business processes for awards management and research related activities to advance diversity, equity, and inclusion in its extramural research programs. SC allocates Working Capital Fund charges for common administrative services to the research programs and the Program Direction account.

SC supports the following FY 2024 Research Initiatives:

(dollars in thousands)

	FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request	FY 2024 Request vs FY 2023 Enacted
Office of Science				
Accelerate Innovations in Emerging Technologies	–	38,051	40,051	2,000
Accelerator Science and Technology Initiative	34,725	28,872	28,872	–
Advanced Computing	–	35,658	66,658	31,000
Artificial Intelligence and Machine Learning	129,837	165,873	167,000	1,127
Biopreparedness Research Virtual Environment (BRaVE)	21,756	59,756	63,756	4,000
Climate Resilience Centers	5,000	5,000	10,000	5,000
Critical Materials/Minerals	25,000	25,000	25,000	–
DOE Isotope Initiative	–	–	14,500	14,500
Exascale Computing	445,000	268,000	14,000	-254,000
Funding for Accelerated, Inclusive Research (FAIR)	–	35,508	49,000	13,492
Integrated Computational & Data Infrastructure	32,657	–	–	–
Fundamental Science to Transform Advanced Manufacturing	25,353	27,000	27,000	–
Microelectronics	47,701	47,701	109,701	62,000
National Virtual Climate Laboratory (NVCL)	3,000	3,000	3,000	–
Quantum Information Science	293,075	288,749	280,429	-8,320
Reaching a New Energy Sciences Workforce (RENEW)	30,000	60,000	107,000	47,000
SC Energy Earthshots	–	100,000	175,000	75,000
U.S. Fusion Program Acceleration	–	–	275,674	275,674
Urban Integrated Field Laboratories	18,079	22,000	23,000	1,000
Total, Research Initiatives	**1,111,183**	**1,210,168**	**1,479,641**	**+269,473**

Note:

- *The Integrated Computational and Data Initiative is rolled into Advanced Computing Initiative in FY 2023.*

Highlights of the FY 2024 Request by Program Office include:

- *Advanced Scientific Computing Research (ASCR)* supports research to discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to the DOE and the U.S. The ASCR Request of $1,126.0 million, is an increase of $58.0 million, or 5.4 percent, above the FY 2023 Enacted level. The Request will strengthen U.S. leadership in strategic computing with operations of the Nation's exascale computing systems, Frontier at Oak Ridge National Laboratory, and Aurora at Argonne National Laboratory. The Request includes $14.0 million for SC's contribution to DOE's Exascale Computing Initiative (ECI) to close out the Exascale Computing Project (ECP) following the deployment of the exascale computing software ecosystem and mission critical applications to address national needs in FY 2023. To ensure progress during and after ECP, the Request increases support for basic research in applied math and computer science, while transitioning research and development efforts from ECP. The Request supports new microelectronics research centers, the FAIR initiative to expand clean energy research and capabilities at MSIs, the Accelerate initiative to support fundamental research that accelerates the transition of science to technologies, and efforts to retain midcareer staff at the national laboratories. Funding increases for the SC Energy Earthshots initiative, including the establishment of additional Energy Earthshot Research Centers (EERCs) and increase support for core research that addresses the basic cross cutting research challenges of the EERCs. The Request also supports Scientific Discovery through Advanced Computing (SciDAC) partnerships with the Department's applied technology offices, NIH, and other agencies, to improve emergency response and broaden adoption of AI on leadership systems. Investments in QIS testbeds, centers, and networking are maintained. Activities implementing the Integrated Research Infrastructure, including continued planning for state-of-the-art scientific high-performance computing data resource, continue to address the unique challenges of near real-time computing needed to support the explosion of scientific data from upgrades at SC's Scientific User Facilities. The Request provides robust support for ASCR user facilities operations to ensure the availability of high-performance computing and networking to the scientific community as well as upgrades to maintain U.S. leadership in these areas. This includes upgrade planning for the National Energy Research Scientific Computing Center and the Leadership Computing Facilities. To increase participation of underrepresented groups, institutions, and regions in ASCR research, funding will support the Computational Science Graduate Fellowship, RENEW, and EPSCoR.

- *Basic Energy Sciences (BES)* supports fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels to provide foundations for new energy technologies. The BES Request of $2,692.9 million is an increase of $158.9 million, or 6.3 percent, above the FY 2023 Enacted. The Request focuses resources on the highest priorities in early-stage fundamental research, operation and maintenance of a complementary suite of scientific user facilities, and facility upgrades. New microelectronics research centers are established. In the SC Energy Earthshots Initiative, the Request increases support for research on innovations for the scientific challenges that crosscut the technological issues for individual Earthshots and for EERCs, which work toward realizing the stretch goals of the DOE Energy Earthshots. High priority areas in core research include clean energy, critical materials, manufacturing, biopreparedness, QIS, data science including AI/ML, accelerator science and technology, the Accelerate initiative, and efforts to retain midcareer staff at the national laboratories. The Request continues funding for the: Energy Frontier Research Centers, with a focus on clean energy research; multi-disciplinary National QIS Research Centers that perform basic research and early-stage development to advance QIS technologies; computational materials and chemical sciences to deliver forefront software infrastructure to the research communities; and the Batteries and Energy Storage and the Fuels from Sunlight Energy Innovation Hub programs. The Request continues support for the EPSCoR program, led by BES but funded across SC's core programs, to strengthen participation of underrepresented institutions and regions; for RENEW, targeted training opportunities to increase participation and retention of underrepresented groups in BES research areas; and for the FAIR initiative to expand BES topical research including clean energy research at underrepresented institutions. BES maintains a balanced suite of complementary tools, including supporting operations of five x-ray light sources, two neutron sources, and five nanoscale science research centers (NSRCs). At 90 percent of the optimal funding levels, the support in the FY 2024 Request will balance high priority activities required for safe and reliable user facility operations while maintaining a strong user community. The Request provides support for ongoing construction activities: Linac Coherent Light Source-II High Energy, Second Target Station, and Cryomodule Repair and Maintenance Facility; provides final funding for Advanced Light Source (ALS) Upgrade, Proton Power Upgrade and for two Major Item of Equipment projects (MIEs): the NSLS-II Experimental Tools-II project for the phased build-out of beamlines at NSLS-II and the NSRC Recapitalization

project; initiates the NSLS-II Experimental Tools-III and High Flux Isotope Reactor Pressure Vessel Replacement projects; and initiates planning for two MIEs for additional beamlines at Advanced Photon Source and ALS.

- *Biological and Environmental Research (BER)* supports transformative science and scientific user facilities to achieve a predictive understanding of complex biological, Earth, and environmental systems for clean energy and climate innovations. This fundamental research, conducted at universities, DOE national laboratories, and other research institutions across the country, focuses on pushing the envelope on research and innovation, taking advantage of the best tools and capabilities DOE has to offer. The BER Request of $931.7 million is an increase of $23.0 million, or 2.5 percent, above the FY 2023 Enacted level. The enhanced Bioenergy Research Centers (BRCs) will provide new research through individual efforts and inter-BRC shared-theme research underpinning production of clean energy and chemicals from sustainable biomass. Funding continues for the Energy Earthshot Research Centers that will remove barriers to implementing innovations from basic research into potential solutions in response to technological challenges and increased university research involving Earthshots that focus on science at the nexus of clean energy production and climate. Furthermore, enhanced biotechnology innovations will be pursued to assist development of advanced manufacturing techniques. The scope of Biopreparedness Research Virtual Environment (BRaVE) will extend to include Low Dose Radiation research. RENEW and FAIR expand with targeted efforts to broaden participation and belonging, accessibility, justice, equity, diversity, and inclusion across BER activities. EPSCoR broadens support for universities in underrepresented regions. Efforts focus on retention of midcareer staff at the national laboratories. BER will enhance its research on climate science by: expansion of both the Urban Integrated Field Laboratories (Urban IFLs) and the network of climate resilience centers, affiliated with Historically Black Colleges and Universities (HBCUs) and other Minority Serving Institutions (MSIs); and continue investments in AI approaches for improving Earth and environmental system predictability. The Request supports operations of BER's three scientific user facilities: the DOE Joint Genome Institute (JGI), the Environmental Molecular Sciences Laboratory (EMSL), and the Atmospheric Radiation Measurement Research Facility (ARM). JGI will explore new plant transformation capabilities to accelerate the ability to understand and design new beneficial functions into plants. ARM will operate at the Alabama observatory. EMSL will initiate construction of the molecular microbial phenotyping capability. The Microbial Molecular Phenotyping Capabilities project at PNNL to generate molecular phenotypic data for rapid development in high throughput genome sequencing and synthesis.

- *Fusion Energy Sciences (FES)* supports research to expand the fundamental understanding of matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. The FES Request of $1,010.5 million is an increase of $247.3 million, or 32.4 percent, above the FY 2023 Enacted level. The Request is aligned with the recommendations of the recent Long-Range Plan (LRP) developed by the Fusion Energy Sciences Advisory Committee, and the Administration's Bold Decadal Vision for commercial fusion energy development. The Request supports partnerships with the private fusion sector through the Fusion Development Milestone Program and INFUSE. The Request supports research and facility operations at the DIII-D national fusion facility at 90 percent of the optimal run time; continues to support the recovery of the National Spherical Torus Experiment-Upgrade (NSTX-U) as well as machine assembly and hardware commissioning. The Request continues to support collaborations by U.S. scientists at international facilities with unique capabilities, and research activities in AI/ML and QIS. The Request supports research activities in Materials, Fusion Nuclear Science, Advanced Manufacturing, and Enabling R&D; initiates four new integrated research centers on enabling technologies, fusion blanket/fuel cycle, advanced simulations, and structural/plasma facing materials R&D; continues to support research activities in theory and SciDAC in partnership with ASCR and data-focused activities under Advanced Computing; and continues to support research activities in both High-Energy-Density Laboratory Plasmas including LaserNetUS, and General Plasma Science including microelectronics research centers. The Request provides support for the U.S. Contributions to ITER project focusing on the design, fabrication, and delivery of in-kind hardware components, provides construction cash contributions to support the ITER Organization assembly and installation of the hardware contributions from all the ITER Members, and continues to support an ITER Research program to prepare the U.S. to take full advantage of ITER Operations. The Request provides funding for the Matter in Extreme Conditions Petawatt Laser Facility upgrade project at LCLS and supports the Material-Plasma Exposure eXperiment MIE project. The Request also continues to support research on inertial fusion energy addressing the priority research opportunities identified in the recent Basic Research Needs workshop. FES will increase its support for the RENEW and FAIR initiatives, continue to participate in the Accelerate initiative and the EPSCoR program, and focus efforts on retention of midcareer staff at the national laboratories.

- *High Energy Physics (HEP)* supports research to understand how the universe works at its most fundamental level. The HEP Request of $1,226.3 million is an increase of $60.3 million, or 5.2 percent, above the FY 2023 Enacted level, of which $75 million goes to the Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment (LBNF/DUNE) project. To support a faster completion for LBNF/DUNE, the Department has approved a new planned funding profile. To support its approved baseline, funding for the Proton Improvement Plan II project increases by $5 million. High priority areas for core research include theoretical and experimental activities in pursuit of discovery science, including hints of new physics beyond the Standard Model, such as the muon-g-2 experiment at FNAL; fostering a diverse, highly skilled workforce; graduate student traineeship programs in Accelerator Science and Engineering, HEP Instrumentation, and Computational HEP; building R&D capacity; conducting world-leading advanced technology R&D, and efforts to retain midcareer staff at the national laboratories. In partnership with SC programs, HEP promotes cross-cutting research in AL/ML, QIS, microelectronics, accelerator science and technology, and accelerating innovations in emerging technologies. Through RENEW, HEP broadens reach and increases pathways for physics and engineering students, and through FAIR, HEP invests in S&T infrastructure at MSIs. EPSCoR broadens support for universities in underrepresented regions. HEP supports the Superconducting Quantum Materials and Systems National QIS Research Center led by FNAL. Four Major Items of Equipment projects continue: Accelerator Controls Operations Research Network (ACORN), Cosmic Microwave Background Stage 4 (CMB-S4), High-Luminosity Large Hadron Collider (HL-LHC) A Toroidal LHC Apparatus (ATLAS) and Compact Muon Solenoid (CMS) Detector Upgrade Projects. HEP supports two scientific user facilities, the Fermilab Accelerator Complex and the Facility for Advanced Accelerator Experimental Tests II (FACET-II). These facilities will operate 5,200 and 3,300 hours, respectively, while addressing critical upgrades, improvements, and deferred maintenance. HEP supports laboratory-based accelerator and detector test facilities and supports the maintenance and operations of large-scale experiments and facilities that are not based at a national laboratory, such as the U.S. LHC at CERN in Geneva, Switzerland; Sanford Underground Research Facility in Lead, South Dakota; Vera C. Rubin Observatory in Chile; and the Dark Energy Spectroscopic Instrument at the Mayall telescope in Arizona.

- *Nuclear Physics (NP)* supports experimental and theoretical research to discover, explore, and understand all forms of nuclear matter. The NP Request of $811.4 million is an increase of $6.2 million, or 0.8 percent, above the FY 2023 Enacted level. The Request supports safe, efficient, and cost-effective operations of four NP scientific user facilities at nearly 90 percent optimal operations. To maintain U.S. leadership throughout this century and to extend well beyond current scientific capabilities, NP supports R&D and Preliminary Engineering Design for the Electron-Ion Collider (EIC) project. The Request also supports non-accelerator-based research using the nucleus as a laboratory to search for new physics by observing nature's fundamental symmetries and precision measurements to determine the properties of the neutron and whether the neutrino is its own anti-particle. The Request continues to support the construction of world-leading instrumentation, including a ton-scale detector for neutrinoless double beta decay to determine if the neutrino is its own antiparticle and the High Rigidity Spectrometer (HRS) to realize the full scientific potential of FRIB. NP is the primary steward of the nation's fundamental nuclear physics research portfolio, providing over 95 percent of the investment in the U.S. nuclear physics basic research. The Request supports this research portfolio through support for university and laboratory researchers to nurture critical core competencies and enable the highest priority theoretical and experimental activities to target compelling scientific opportunities at the frontier of nuclear science. The Request also supports the National Nuclear Data Center which collects, evaluates, curates, and disseminates nuclear physics data for basic nuclear research and applied nuclear technologies for global use. Efforts on QIS, in collaboration with other SC programs, for the development of quantum sensors and quantum control techniques continue, as do efforts on AI/ML which can benefit nuclear physics research and NP accelerator operations. The Request supports continued participation in the microelectronics initiative, with an emphasis on unique devices capable of surviving in cryogenic and high radiation environments; the RENEW initiative with targeted efforts ensure a future nuclear physics workforce that is creative, innovative, and capable of meeting the Nation's needs via proactive stewardship of talent with diverse ideas and backgrounds; and efforts to retain midcareer staff at the national laboratories. The Request also continues support for efforts to broaden participation in NP research: FAIR to further enhance diversity, equity, and inclusion in nuclear physics; Accelerate to research how imaging advances within nuclear physics can apply to other fields; and EPSCoR to support universities in underrepresented regions.

- *Isotope R&D and Production (IRP) or DOE Isotope Program (DOE IP)* supports national preparedness for critical isotope production and distribution to mitigate gaps and disruptions in supply chains of isotopes even during times of national crisis; a priority is to mitigate U.S. dependence on foreign supply of key isotopes. The IRP Request is $173.1 million, an

increase of $63.6 million, or 58.1 percent, above the FY 2023 Enacted level. In FY 2024, the DOE IP expects increasing demand for both radio and stable isotopes. The Russian invasion of Ukraine and subsequent impacts to isotope supply chains have highlighted the need to establish domestic supplies of critical isotopes to remove risks to the Nation's economy, national security, industrial base, and technical competitiveness. Mission readiness of isotope facilities is increased to ~92 percent and supports additional workforce to respond more efficiently as a DOE Mission Essential Function; funding supports targeted investments in infrastructure and maintenance to ensure safe and reliable operations. A core competency in stable isotope operations is strengthened to commission and prepare for operations of new capabilities. Funding supports core research teams at the production sites to improve or develop innovative approaches to isotope production and chemical separations, as well as related automation, AI/ML, and robotics. Support increases for the RENEW and FAIR initiatives providing opportunities for research, bolstered with investments in equipment and infrastructure at minority serving institutions, including attention to underserved and environmental justice regions. The Biopreparedness Research Virtual Environment (BRaVE) initiative provides increased support to tackle chemical processing of irradiated reactor targets, which has become a significant obstacle and single point failure in the program, and to provide increased isotopes for medicine and bio-medical applications. Support for microelectronics emphasizes research to establish production of isotopes needed for semiconductor manufacturing. The increase in Isotope research enables the DOE IP to proactively target fragile global isotope supply chains, investing in innovative approaches to isotope production with a focus on isotopes that are only produced in Russia. The DOE IP maintains additional efforts in the Advanced Manufacturing, Accelerate, and QIS initiatives. The FRIB Isotope Harvesting effort approaches completion, adding capabilities to extract and process rare isotopes from the beam dump of FRIB. The FY 2024 Request provides Total Estimated Cost (TEC) funding to continue the Stable Isotope Production and Research Center (SIPRC) at ORNL to restore large scale stable isotope production capacity for the Nation and remove U.S. dependency on sensitive countries. Funding supports engineering design for the ORNL Radioisotope Processing Facility (RPF) to address a lack of available radiochemical processing infrastructure to mitigate U.S. dependency on foreign supply chains of radioisotopes and meet U.S. demand for radioisotopes. Funding supports engineering design and long-lead procurements of the Clinical Alpha Radionuclide Producer (CARP) facility at BNL to address disruptions in global isotope supply chains and produce in-demand isotopes to combat cancer mortality.

- *Accelerator R&D and Production (ARDAP)* supports SC programs by working to ensure a robust pipeline of innovative accelerator technology, train an expert and diverse workforce, and reduce significant supply chain risks by reshoring critical accelerator technology. The ARDAP Request of $34.3 million, an increase of $6.8 million, or 24.9 percent, above the FY 2023 Enacted level will support cross-cutting accelerator research, operation and maintenance of a scientific user facility, and production of accelerator technologies in industry. Funded R&D will focus on transformative R&D for future generations of scientific facilities, technology transfer to industry to strengthen domestic suppliers, and encouraging community cooperation and integration by funding R&D consortia and public private partnerships. The Request supports operation of the Brookhaven National Laboratory Accelerator Test Facility for the maximum number of user hours and enables progress addressing a significant backlog of deferred maintenance, resulting in improved facility availability. Workforce development activities will address identified needs in accelerator science and engineering and foster a more diverse, inclusive workforce through continuing participation in the FAIR and RENEW initiatives. Accelerator Production will support partnerships with industry to develop the superconducting magnets, superconducting accelerators, high-intensity particle sources, radiofrequency power sources, and high-intensity laser technologies needed to build DOE's world-leading scientific facilities.

Basic and Applied R&D Coordination

Coordination between the Department's basic research and applied technology programs is a high priority within DOE and is facilitated through joint planning meetings, technical community workshops, annual contractor/awardee meetings, joint research solicitations, focused DOE program office working groups in targeted research areas, and collaborative program management of DOE's Small Business Innovation Research and Small Business Technology Transfer programs. Collaboration of research activities and facilities at the DOE national laboratories and partnership-encouraging funding mechanisms facilitate research integration within the basic and applied research communities. SC's R&D coordination also occurs at the interagency level. Specific collaborative activities are highlighted in the "Basic and Applied R&D Coordination" sections of each individual SC program budget justification narrative.

High-Risk, High-Reward Research[a]

SC incorporates high-risk, high-reward, basic research elements in all of its research portfolios; each SC research program considers a significant proportion of its supported research as high-risk, high-reward. Because advancing the frontiers of science also depends on the continued availability of state-of-the-art scientific facilities, SC constructs and operates national scientific facilities and instruments that comprise the world's most sophisticated suite of research capabilities. SC's basic research is integrated within program portfolios, projects, and individual awards; as such, it is not possible to quantitatively separate the funding contributions of particular experiments or theoretical studies that are high-risk, high-reward from other mission-driven research in a manner that is credible and auditable. SC incorporates high-risk, high-reward basic research elements in its research portfolios to drive innovation and challenge current thinking, using a variety of mechanisms to develop topics: Federal advisory committees, triennial Committees of Visitors, program and topical workshops, interagency working groups, National Academies' studies, and special SC program solicitations. Many of these topics are captured in formal reports, e.g., *Chemical Upcycling of Polymers,* Basic Energy Sciences report (2019)[b]; *Basic Research Needs for Microelectronics*, joint BES, ASCR, and HEP workshop (2018)[c]; *Basic Research Needs for Scientific Machine Learning; Core Technologies for Artificial Intelligence*, ASCR workshop (2018)[d]; *Building for Discovery: Strategic Plan for U.S. Particle Physics in the Global Context*, by the High Energy Physics Advisory Panel (2014)[e]; *From Long-distance Entanglement to Building a Nationwide Quantum Internet: Report of the DOE Quantum Internet Blueprint Workshop,* ASCR workshop report (2020)[f]; *Opportunities for Basic Research for Quantum Computing in Chemical and Materials Sciences*, Basic Energy Sciences report (2017); *Opportunities for Basic Research for Next-Generation Quantum Systems*, Basic Energy Sciences report (2017)[g]; *Basic Research Needs for Transformative Manufacturing* (2020)[h]; *Basic Research Needs Workshop on Quantum Materials for Energy Relevant Technology,* BES workshop report (2016)[i]; *Grand Challenges for Biological and Environmental Research: Progress and Future* Vision, by the BER Advisory Committee (2017)[j]; *Genome Engineering for Materials Synthesis*, BER workshop report (2018)[k]; *Plasma: at the Frontier of Scientific Discovery*, FES workshop report (2017)[l]; *Powering the Future: Fusion and Plasmas*, FES Advisory Committee Long Range Plan (2020)[m]; *FES Roundtable on QIS* (2018)[n]; *Advancing Fusion with Machine Learning,* joint FES-ASCR workshop report (2019)[o]; *Isotope Research and Production Opportunities and Priorities*, by the Nuclear Science Advisory Committee (NSAC) (2015)[p]; and *Nuclear Physics Long Range Plan*, by the Nuclear Science Advisory Committee (NSAC, 2015)[q] and *Quantum Computing and Quantum Information Sciences (QIS),* by NSAC (2019)[l]; *Office of Science User Facilities: Lessons from the COVID Era and Visions for the Future*; SC workshop report (2020)[r].

Scientific Workforce

For more than 60 years SC and its predecessors have fostered a vibrant ecosystem for the training of a highly skilled scientific and technological workforce. In addition to the undergraduate internships, graduate thesis research, and visiting faculty opportunities provided through SC's Office of Workforce Development for Teachers and Scientists, to sustain a strong workforce pipeline for DOE mission, the SC research program offices support undergraduates, graduate students, and postdoctoral researchers through sponsored research awards at universities and the DOE national laboratories nationwide. The research program offices also support targeted undergraduate and graduate-level training in areas

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[a] In compliance with the reporting requirements in the America COMPETES Act of 2007 (P.L. 110-69, section 1008)
[b] https://science.osti.gov/-/media/bes/pdf/BESat40/Polymer_Upcycling_Brochure.pdf
[c] https://science.osti.gov/-/media/bes/pdf/reports/2019/BRN_Microelectronics_rpt.pdf
[d] https://science.energy.gov/ascr/community-resources/program-documents/
[e] http://science.osti.gov/~/media/hep/hepap/pdf/May%202014/FINAL_P5_Report_Interactive_060214.pdf
[f] https://www.osti.gov/biblio/1638794/
[g] https://science.osti.gov/~/media/bes/pdf/reports/2018/Quantum_computing.pdf
[h] https://science.osti.gov/-/media/bes/pdf/reports/2020/Transformative_Mfg_Brochure.pdf?la=en&hash=95094B9257DCFD506C04787D96EEDD942EB92EEC
[i] https://science.osti.gov/~/media/bes/pdf/reports/2016/BRNQM_rpt_Final_12-09-2016.pdf
[j] https://science.osti.gov/~/media/ber/berac/pdf/Reports/BERAC-2017-Grand-Challenges-Report.pdf
[k] https://science.osti.gov/-/media/ber/pdf/community-resources/2019/GEMS_Report_2019.PDF?la=en&hash=0D7092AD5416A28207F0F95F94E00921D308A113
[l] https://science.osti.gov/~/media/fes/pdf/program-news/Frontiers_of_Plasma_Science_Final_Report.pdf
[m] https://science.osti.gov/-/media/fes/fesac/pdf/2020/202012/FESAC_Report_2020_Powering_the_Future.pdf?la=en&hash=B404B643396D74CE7EDAB3F67317E326A891C09C
[n] https://science.osti.gov/-/media/fes/pdf/workshop-reports/FES-QIS_report_final-2018-Sept14.pdf
[o] https://science.osti.gov/-/media/fes/pdf/workshop-reports/FES_ASCR_Machine_Learning_Report.pdf
[p] https://science.osti.gov/~/media/ber/pdf/community-resources/Technologies_for_Characterizing_Molecular_and_Cellular_Systems.pdf
[q] https://science.osti.gov/np/nsac/reports/
[r] https://science.osti.gov/-/media/bes/pdf/reports/2021/SC_User_Facilities_rpt_print.pdf

critically important to DOE mission (such as those associated with scientific user facilities) but not readily available in universities, such as particle accelerator and detector physics, neutron and x-ray scattering, nuclear chemistry, instrumentation, isotope R&D, and computational sciences at the leadership computing level. To help attract critical talent for stimulating fresh ideas and forward thinking, SC supports the Early Career Research Program, which funds individual research programs to identify and award outstanding rising scientists early in their careers in the disciplines supported by SC[s]. To retain highly accomplished researchers, SC initiated the Distinguished Scientist Fellows opportunity to recognize leading DOE laboratory staff and sponsoring their innovative efforts to enrich, sustain, and promote scientific and academic excellence in SC mission research and community at large through partnership between institutions of higher education and national laboratories. SC coordinates with other DOE offices and other agencies on best practices for STEM training programs and evidence-based program evaluation efforts through internal DOE working groups and active participation in all the inter-agency working groups of the National Science and Technology Council's Committee on Science, Technology, Engineering, and Mathematics Education (CoSTEM). SC also participates in the American Association for the Advancement of Science's Science & Technology Policy Fellowships program and the Presidential Management Fellows Program to bring highly qualified scientists and professionals to DOE headquarters for a maximum term of two years. The Request continues the FAIR and RENEW activities for targeted efforts to expand participation and retention of HBCUs and other MSIs, community colleges, and individuals from underrepresented groups in SC research and workforce development activities. SC administers and/or bestows several awards to recognize talented scientists and engineers that advance DOE's missions, including the Presidential Early Career Award for Scientists and Engineers (PECASE), Ernest Orlando Lawrence Award, Enrico Fermi Award, and Distinguished Scientist Fellow opportunity. The Request continues support for these honorary awards.

Cybersecurity

DOE is engaged in two categories of cyber-related activities: protecting the DOE enterprise from a range of cyber threats that can adversely impact mission capabilities, and improving cybersecurity in the electric power subsector and the oil and natural gas subsector. SC's cyber program oversees ten National Science Laboratories and three other SC offices and ensures that scientific missions are accomplished while protecting all information on associated information systems. The SC Cybersecurity program enables the mission of the Office of Science by ensuring a secure platform for scientific research and safeguarding the ability to perform that scientific research.

[s] https://science. osti.gov/early-career/

Future Year Energy Program (FYEP)

(dollars in millions)

	FY 2024 Request	FY 2025	FY 2026	FY 2027	FY 2028
Office of Science	8,800	9,002	9,209	9,420	9,637

Outyear Priorities and Assumptions

In the FY 2012 Consolidated Appropriations Act (P.L. 112-74), Congress directed DOE to include a future-years energy program (FYEP) in subsequent requests that reflects the proposed appropriations for five years. This FYEP shows outyear funding for each account for FY 2025–FY 2028. The outyear funding levels use the growth rates based on the Request level and match the outyear account totals published in the FY 2024 President's Budget for both the 050 and non-050 accounts. Actual future budget request levels will be determined as part of the annual budget process.

SC priorities in the outyears include the following:

- Increase investments in Administration priorities to advance bold, transformational leaps in U.S. S&T, build a diverse workforce of the future, and ensure America remains the global S&T leader for generations to come.
- Ensure optimal operations of all scientific user facilities.
- Continue to invest in infrastructure and utility upgrades at all national laboratories.
- Invest in ongoing and new line-item construction projects and major items of equipment to ensure the United States maintain world leading and state-of-the-art scientific user facilities.

Science
Funding by Congressional Control

(dollars in thousands)

	FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request	FY 2024 Request vs FY 2023 Enacted ($)	FY 2024 Request vs FY 2023 Enacted (%)
Advanced Scientific Computing Research					
ASCR Research	906,000	991,000	1,110,973	+119,973	+12.11%
17-SC-20 SC Exascale Computing Project (ECP)	129,000	77,000	14,000	-63,000	-81.82%
Construction					
24-SC-20 High Performance Data Facility	–	–	1,000	+1,000	–
Total, Construction	**–**	**–**	**1,000**	**+1,000**	**–**
Total, Advanced Scientific Computing Research	**1,035,000**	**1,068,000**	**1,125,973**	**+57,973**	**+5.43%**
Basic Energy Sciences					
BES Research	2,003,800	2,240,800	2,432,233	+191,433	+8.54%
Construction					
24-SC-10 HFIR Pressure Vessel Replacement (PVR), ORNL	–	–	4,000	+4,000	–
24-SC-12 NSLS-II Experimental Tools - III (NEXT-III), BNL	–	–	2,556	+2,556	–
21-SC-10 Cryomodule Repair & Maintenance Facility (CRMF), SLAC	1,000	10,000	9,000	-1,000	-10.00%
19-SC-14 Second Target Station (STS), ORNL	32,000	32,000	52,000	+20,000	+62.50%
18-SC-10 Advanced Photon Source Upgrade (APS-U), ANL	101,000	9,200	–	-9,200	-100.00%
18-SC-11 Spallation Neutron Source Proton Power Upgrade (PPU), ORNL	17,000	17,000	15,769	-1,231	-7.24%
18-SC-12 Advanced Light Source Upgrade (ALS-U), LBNL	75,100	135,000	57,300	-77,700	-57.56%
18-SC-13 Linac Coherent Light Source-II-High Energy (LCLS-II-HE), SLAC	50,000	90,000	120,000	+30,000	+33.33%
13-SC-10 Linac Coherent Light Source-II (LCLS-II), SLAC	28,100	–	–	–	–
Total, Construction	**304,200**	**293,200**	**260,625**	**-32,575**	**-11.11%**
Total, Basic Energy Sciences	**2,308,000**	**2,534,000**	**2,692,858**	**+158,858**	**+6.27%**
Biological and Environmental Research					
BER Research	815,000	908,685	921,700	+13,015	+1.43%

(dollars in thousands)

	FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request	FY 2024 Request vs FY 2023 Enacted ($)	FY 2024 Request vs FY 2023 Enacted (%)
Construction					
24-SC-31 Microbial Molecular Phenotyping Capability (M2PC), PNNL	–	–	10,000	+10,000	–
Total, Construction	**–**	**–**	**10,000**	**+10,000**	**–**
Total, Biological and Environmental Research	**815,000**	**908,685**	**931,700**	**+23,015**	**+2.53%**
Fusion Energy Sciences					
FES Research	460,000	510,222	760,496	+250,274	+49.05%
Construction					
20-SC-61 Matter in Extreme Conditions (MEC) Petawatt Upgrade, SLAC	11,000	11,000	10,000	-1,000	-9.09%
14-SC-60 U.S. Contributions to ITER	242,000	242,000	240,000	-2,000	-0.83%
Total, Construction	**253,000**	**253,000**	**250,000**	**-3,000**	**-1.19%**
Total, Fusion Energy Sciences	**713,000**	**763,222**	**1,010,496**	**+247,274**	**+32.40%**
High Energy Physics					
HEP Research	810,000	868,000	850,334	-17,666	-2.04%
Construction					
18-SC-42 Proton Improvement Plan II (PIP-II), FNAL	90,000	120,000	125,000	+5,000	+4.17%
11-SC-40 Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment	176,000	176,000	251,000	+75,000	+42.61%
11-SC-41 Muon to Electron Conversion Experiment, FNAL	2,000	2,000	–	-2,000	-100.00%
Total, Construction	**268,000**	**298,000**	**376,000**	**+78,000**	**+26.17%**
Total, High Energy Physics	**1,078,000**	**1,166,000**	**1,226,334**	**+60,334**	**+5.17%**
Nuclear Physics					
NP Operation and Maintenance	708,000	755,196	716,418	-38,778	-5.13%
Construction					
20-SC-52 Electron Ion Collider (EIC), BNL	20,000	50,000	95,000	+45,000	+90.00%
Total, Construction	**20,000**	**50,000**	**95,000**	**+45,000**	**+90.00%**
Total, Nuclear Physics	**728,000**	**805,196**	**811,418**	**+6,222**	**+0.77%**

(dollars in thousands)

	FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request	FY 2024 Request vs FY 2023 Enacted ($)	FY 2024 Request vs FY 2023 Enacted (%)
Isotope R&D and Production					
IRP Research	70,000	85,451	142,651	+57,200	+66.94%
Construction					
20-SC-51 U.S. Stable Isotope Production and Research Center (SIPRC), ORNL	12,000	24,000	20,900	-3,100	-12.92%
24-SC-92 Clinical Alpha Radionuclide Producer (CARP), BNL	–	–	1,000	+1,000	–
24-SC-91 Radioisotope Processing Facility, ORNL	–	–	8,500	+8,500	–
Total, Construction	**12,000**	**24,000**	**30,400**	**+6,400**	**+26.67%**
Total, Isotope R&D and Production	**82,000**	**109,451**	**173,051**	**+63,600**	**+58.11%**
Accelerator R&D and Production					
ARDAP Research	18,000	27,436	34,270	+6,834	+24.91%
Total, Accelerator R&D and Production	**18,000**	**27,436**	**34,270**	**+6,834**	**+24.91%**
Workforce Development for Teachers and Scientists					
WDTS	35,000	42,000	46,100	+4,100	+9.76%
Total, Workforce Development for Teachers and Scientists	**35,000**	**42,000**	**46,100**	**+4,100**	**+9.76%**
Science Laboratories Infrastructure					
PILT	4,820	4,891	5,004	+113	+2.31%
Oak Ridge Landlord	6,430	6,559	6,910	+351	+5.35%
SLI F&I	14,450	13,900	32,104	+18,204	+130.96%
SLI Laboratory Operations Apprenticeship	–	–	3,000	+3,000	–
OR Nuclear Operations	26,000	26,000	46,000	+20,000	+76.92%
Construction					
22-SC-71 Critical Infrastructure Modernization Project (CIMP) - ORNL	1,000	1,000	–	-1,000	-100.00%
22-SC-72 Thomas Jefferson Infrastructure Improvements (TJII) - TJNAF	1,000	1,000	–	-1,000	-100.00%
21-SC-71 Princeton Plasma Innovation Center (PPIC), PPPL	7,750	10,000	15,000	+5,000	+50.00%
21-SC-72 Critical Infrastructure Recovery & Renewal (CIRR), PPPL	2,000	4,000	10,000	+6,000	+150.00%

(dollars in thousands)

	FY 2022 Enacted	FY 2023 Enacted	FY 2024 Request	FY 2024 Request vs FY 2023 Enacted ($)	FY 2024 Request vs FY 2023 Enacted (%)
21-SC-73 Ames Infrastructure Modernization (AIM)	2,000	2,000	8,000	+6,000	+300.00%
20-SC-71 Critical Utilities Rehabilitation Project (CURP), BNL	26,000	26,000	–	-26,000	-100.00%
20-SC-72 Seismic and Safety Modernization (SSM), LBNL	18,000	27,500	40,000	+12,500	+45.45%
20-SC-73 CEBAF Renovation and Expansion (CEBAF), TJNAF	10,000	15,000	11,000	-4,000	-26.67%
20-SC-75 Large Scale Collaboration Center (LSCC), SLAC	21,000	21,000	–	-21,000	-100.00%
20-SC-76 Tritium System Demolition and Disposal (TSDD), PPPL	6,400	–	–	–	–
20-SC-77 Argonne Utilities Upgrade (AU2), ANL	10,000	8,000	8,007	+7	+0.09%
20-SC-78 Linear Assets Modernization Project (LAMP), LBNL	10,400	23,425	18,900	-4,525	-19.32%
20-SC-79 Critical Utilities Infrastructure Revitalization (CUIR), SLAC	8,500	25,425	35,075	+9,650	+37.95%
20-SC-80 Utilities Infrastructure Project (UIP), FNAL	10,500	20,000	45,000	+25,000	+125.00%
19-SC-71 Science User Support Center (SUSC), BNL	38,000	–	–	–	–
19-SC-73 Translational Research Capability (TRC), ORNL	21,500	–	–	–	–
19-SC-74 - BioEPIC, LBNL	35,000	45,000	38,000	-7,000	-15.56%
17-SC-71 Integrated Engineering Research Center (IERC), FNAL	10,250	–	–	–	–
Total, Construction	**239,300**	**229,350**	**228,982**	**-368**	**-0.16%**
Total, Science Laboratories Infrastructure	**291,000**	**280,700**	**322,000**	**+41,300**	**+14.71%**
Safeguards and Security					
S&S	170,000	184,099	200,000	+15,901	+8.64%
Total, Safeguards and Security	**170,000**	**184,099**	**200,000**	**+15,901**	**+8.64%**
Program Direction					
PD	202,000	211,211	226,200	+14,989	+7.10%
Total, Program Direction	**202,000**	**211,211**	**226,200**	**+14,989**	**+7.10%**
Total, Office of Science	**7,475,000**	**8,100,000**	**8,800,400**	**+700,400**	**+8.65%**

Note:

- *FY 2023 Funding does not reflect the mandated transfer of $20 million from the Office of Nuclear Energy to the Office of Science for Nuclear Facilities Operations and Maintenance Oak Ridge National Laboratory.*

SBIR/STTR funding:

- FY 2022 Enacted: SBIR $172,355,000 and STTR $24,258,000 (SC only)
- FY 2023 Enacted: SBIR $100,850,000 and STTR $14,182,000 (SC only)
- FY 2024 Request: SBIR $110,742,000 and STTR $15,580,000 (SC only)

Science
Inflation Reduction Act (IRA) Investments

The Office of Science was appropriated funds through the Inflation Reduction Act of 2022 (IRA).

(dollars in thousands)

Appropriated Funding Organization	FY 2022 IRA Supp.	Managing Organization
Advanced Scientific Computing Research		
ASCR Research	163,791	ASCR
Total, Advanced Scientific Computing Research	**163,791**	
Basic Energy Sciences		
BES Research	45,200	BES
21-SC-10 Cryomodule Repair & Maintenance Facility (CRMF), SLAC	20,000	BES
19-SC-14 Second Target Station (STS), ORNL	42,700	BES
18-SC-12 Advanced Light Source Upgrade (ALS-U), LBNL	96,600	BES
18-SC-13 Linac Coherent Light Source-II-High Energy (LCLS-II-HE), SLAC	90,000	BES
Total, Basic Energy Sciences	**294,500**	
Fusion Energy Sciences		
FES Research	14,000	FES
20-SC-61 Matter in Extreme Conditions (MEC) Petawatt Upgrade, SLAC	10,000	FES
14-SC-60 U.S. Contributions to ITER	256,000	FES
Total, Fusion Energy Sciences	**280,000**	
High Energy Physics		
HEP Research	132,633	HEP
18-SC-42 Proton Improvement Plan II (PIP-II), FNAL	10,000	HEP
11-SC-40 Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment	125,000	HEP
11-SC-41 Muon to Electron Conversion Experiment, FNAL	36,023	HEP
Total, High Energy Physics	**303,656**	
Nuclear Physics		
NP Operation and Maintenance	88,760	NP
20-SC-52 Electron Ion Collider (EIC), BNL	128,240	NP
Total, Nuclear Physics	**217,000**	
Isotope R&D and Production		
IRP Research	82,813	IRP

(dollars in thousands)

Appropriated Funding Organization	FY 2022 IRA Supp.	Managing Organization
20-SC-51 U.S. Stable Isotope Production and Research Center (SIPRC), ORNL	75,000	IRP
Total, Isotope R&D and Production	**157,813**	
Science Laboratories Infrastructure		
SLI F&I	65,890	SLI
21-SC-71 Princeton Plasma Innovation Center (PPIC), PPPL	10,000	SLI
21-SC-73 Ames Infrastructure Modernization (AIM)	17,850	SLI
20-SC-72 Seismic and Safety Modernization (SSM), LBNL	22,500	SLI
20-SC-73 CEBAF Renovation and Expansion (CEBAF), TJNAF	10,000	SLI
19-SC-74 - BioEPIC, LBNL	7,000	SLI
Total, Science Laboratories Infrastructure	**133,240**	
Total, Office of Science IRA Supp. Coordination	**1,550,000**	

- **Advanced Scientific Computing Research (ASCR) Research:** The goal of these investments is to reduce the lease-financed amounts on ASCR high performance computing systems during this period of historically high inflation. By funding larger down-payments on these systems, ASCR will save funds that otherwise would have been spent on higher interest payments. The Argonne Leadership Computing Facility received $54,100,000 to reduce future lease payments on the Aurora system by increasing the down payment on the system. The National Energy Research Scientific Computing Center (NERSC) received $52,678,000 to purchase the Perlmutter Phase 2 system outright (avoiding a high interest rate lease) and pay down the lease balance on the Perlmutter Phase I system. The Oak Ridge Leadership Computing Facility received $57,013,000 to contribute to purchase of the Frontier system outright (avoiding a high interest rate lease).

- **Basic Energy Sciences (BES) Research**: The goal of this investment is to provide funding for two major items of equipment projects. 1) NEXT-II funding enables the project to bundle many procurements scattered over 3 years into few expedited packages realizing significant savings and risks reduction. FY 2024 planned activities will continue R&D, prototyping, other supporting activities, and construction/equipment procurements. FY 2024 reflects the final year of funding for the project. 2) NSRC Recapitalization funding will reduce concerns of increasing labor, materials, and supply costs, sustain forward momentum, and reduce project risks by accelerating instrument contract awards. FY 2024 planned activities will continue design, other supporting activities, and equipment procurements. FY 2024 reflects the final year of funding for the project. The goal of this investment also provides Other Project Cost funding for two construction projects: 1) Cryomodule Repair & Maintenance Facility and 2) Linac Coherent Light Source-II-High Energy.

- **Cryomodule Repair & Maintenance Facility (CRMF):** The goal of this IRA investment is to enable the project to accelerate the procurement of the architectural and engineering design services and will expedite the design. FY 2024 planned activities will support completion of the detailed design of the facility, and technical specifications for the procurement of cryogenic systems equipment.

- **Second Target Station (STS):** The goal of this IRA investment is to help address inflation-driven concerns of increasing labor, materials, and supply costs, and sustain forward momentum and reduce project risks. FY 2024 planned activities will support continued planning, R&D, design, engineering, prototyping, and testing to advance the highest priority activities. Emphasis will be on advancing the instrument prototypes, target preliminary designs and material characterization, proton beam delivery magnets, neutron beam optics and choppers, neutron moderator, and accelerator designs and controls. A potential long lead procurement for civil construction site preparation to bring in new roads and perform site grading depends on progress of the conventional facility design and DOE review and approval of the plans and use of available funding.

- **Advanced Light Source Upgrade (ALS-U):** The goal of this IRA investment is to enable the project to significantly expedite procurements taking advantage of lower pricing and mitigate inflation uncertainties as well as schedule and technical risks, accelerating the funding profile resulting in reduced funding in the outyears. FY 2024 planned activities will continue to advance the remaining procurements for the Accumulator Ring and the Storage Ring, advance installation of the Accumulator Ring in the tunnel, start pre-staging and assembly of the Storage Ring rafts and components, as the vacuum systems, magnets and diagnostics instruments are received, in preparation for the year-long dark time during which the new Storage Ring will be installed in FY 2026. FY 2024 is the final year of funding for the project.

- **Linac Coherent Light Source-II-High Energy (LCLS-II-HE):** The goal of this IRA investment is to enable the project to expedite the design and long-lead procurements, by more than a year, significantly reducing the inflation uncertainties as well as schedule and technical risks. FY 2024 planned activities will support the production of cryomodules, continue with CD-3B procurements and begin the procurement of remaining scope including vendor supported completion of design efforts associated with the cryogenic distribution system, controls systems, and the low emittance injector beamline, and continue the R&D of the superconducting radiofrequency electron gun and initiating construction/installation contracts.

- **Fusion Energy Sciences (FES) Research:** IRA funding provides $14,000,000 to the Material Plasma Exposure eXperiment (MPEX) project which is being utilized to complete the MPEX Facility Enhancements scope, which will be completed in January 2024. At the time of the IRA funding, the MPEX Facility Enhancements represented the critical path for the project. This funding has allowed the project to proceed more quickly, reducing risk and completing critical project scope as early as possible.

- **Matter in Extreme Conditions Petawatt Upgrade (MEC-U):** IRA funding will be utilized to advance the preliminary design package in support of pursuing Critical Decision (CD)-2 (Approve Performance Baseline) currently planned for FY 2025. This funding will also allow the project team to develop a more thorough plan to proceed through CD-3 (Approve Start of Construction) and project execution.

- **U.S. Contributions to ITER:** IRA funding provides $66,000,000 for Cash Contributions to fulfill U.S. agreements to the ITER Organization from previous underfunding. The remaining $190,000,000 will continue to be used to significantly enhance the design and fabrication performance of project scope in FY 2023–2024 to include the funding activities associated with the Central Solenoid Module fabrication and shipment process and the design, fabrication, and delivery of Tokomak Cooling Water System components.

- **High Energy Physics (HEP) Research:** The goal of this investment is to advance five major items of equipment (MIEs): 1) High Luminosity Large Hadron Collider (HL-LHC) Accelerator; 2) HL-LHC A Toroidal LHC Apparatus (ATLAS) Detector; 3) HL-LHC Compact Muon Solenoid (CMS) Detector; 4) Accelerator Controls Operations Research Network (ACORN); and 5) Cosmic Microwave Background Stage 4 (CMB-S4). FY 2024 planned activities will support fabrication of the HL-LHC projects' components, since all projects are past CD-3. Funding for CMB-S4 and ACORN will support the development of their respective conceptual designs.

- **Proton Improvement Plan II:** The goal of this investment is to support and accelerate the procurement of long lead items that are part of the Accelerator Complex Infrastructure contract. All IRA funds should be expended before FY 2024.

- **Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment:** The goal of this investment is to support and accelerate the Far Site Conventional Facilities - Buildings and Site Infrastructure subproject. FY 2024 planned activities will support construction of surface building and outfitting of the underground caverns with utilities.

- **Muon to Electron Conversion Experiment:** The goal of this investment is for the majority of the remaining work for approximately two years supporting: project management; accelerator; solenoids; muon beamlines; tracker; calorimeter; cosmic ray veto; and trigger and data acquisition system. FY 2024 planned activities will support all remaining activities across the project with installation being the major activity.

- **Nuclear Physics (NP) Operation and Maintenance:** The goal of this investment is to advance four MIE projects. The MOLLER experiment at the Thomas Jefferson National Accelerator facility will measure the parity-violating asymmetry in polarized electron-electron (Møller) scattering. An anomalous amount of parity violation would signal new physics beyond our current understanding. IRA funding allows for long lead procurements to start in FY 2023 once CD-3a is achieved and sets the project for establishing its performance baseline in Q1 FY2024. Gamma-Ray Energy Tracking Array (GRETA) directly supports the NP mission by addressing the goal to understand the structure of nuclear matter, the processes of nuclear astrophysics, and the nature of the cosmos. A successful implementation of this detector will represent a major advance in gamma-ray tracking detector technology that will impact nuclear science, as well as detection techniques in homeland security and medicine. IRA funding allows for acceleration of module procurements. The High Rigidity Spectrometer (HRS) at FRIB will increase the scientific potential of state-of-the-art and community-priority devices, such as GRETA, and other ancillary detectors. The HRS will allow experiments with beams of rare isotopes at the maximum production rates for fragmentation or in-flight fission. This enhancement in experimental sensitivity provides access to critical isotopes not available otherwise. IRA funding supports conceptual design and, eventually, long lead procurement activities and establishing the project performance baseline. The Ton-Scale Neutrinoless Double Beta Decay (NLDBD) Program, implemented by deploying experiments instrumenting a large volume of a specially selected isotope to detect neutrino-less nuclear beta decays (where within a single nucleus, two neutrons decay into two protons and two electrons with no neutrinos emitted), directly supports NP's mission to explore all forms of nuclear matter. IRA funding supports the three competing technology collaborations (LEGEND, nEXO, and CUPID) to reach CD-1.

- **Electron Ion Collider**: The Electron-Ion Collider (EIC) construction project will provide unprecedented ability to x-ray the proton and discover how the mass of everyday objects is dynamically generated by the interaction of quark and gluon fields inside protons and neutrons. The EIC will maintain U.S. leadership in nuclear physics and in accelerator science and technology of colliders. IRA funding supports long lead procurements and preliminary engineering design ($128,240,000) as well as OPC research and development ($10,000,000).

- **Isotope R&D and Production (IRP) Research:** The goals of this investment include: advancement of critical infrastructure and development of production capabilities of isotopes currently not available in the U.S.; enhancement of current capabilities for optimization of isotope production and forming reserves of critical isotopes; and equipment to detritiate a legacy stockpile of contaminated heavy water for semiconductor and microelectronics manufacturing and reduce dependence on foreign supply. OPC funding for Radioisotope Production Facility (RPF) is provided at planned project profile level, optimizing schedule in the near term, and avoiding reductions in force.

- **Stable Isotope Production and Research Center (SIPRC):** Funding for SIPRC restores optimal planned funding in the near term, accelerating the completion date by about one year.

- **Science Laboratories Infrastructure (SLI) Facilities & Infrastructure:** The IRA funding provided for eleven general plant projects (GPPs) at eight laboratories. Ames National Laboratory replaced the helium recovery system and the failed HVAC system in Harley Wilhelm Hall. At Argonne National Laboratory, a waste heat recovery system from the Advanced Photon Source was installed. At Brookhaven National Laboratory, the electrical distribution system in the Physics Building (B510) was upgraded and aged portions of HVAC systems in mission critical buildings were replaced. At the Fermi National Accelerator Laboratory, improvements were made to the cooling system for the laboratory's communication system in Wilson Hall. The Pacific Northwest National Laboratory installed a high efficiency electric boiler system, new high efficiency air handlers, and new system ducting in the Life Sciences Laboratory. Princeton Plasma Physics Laboratory's fire alarm system was replaced and several other life safety improvements were made. At the Stanford Linear Accelerator Laboratory, aging cooling towers were replaced. Thomas Jefferson Accelerator Facility expanded the laydown yard.

- **Princeton Plasma Innovation Center (PPIC):** PPIC will provide a multi-purpose facility with modern, flexible, efficient, and agile research laboratories and office space to conduct research activities in support of multiple SC programs. IRA funding will be used for finalizing the design of new research building, long lead procurements, and site work.

- **Ames Infrastructure Modernization (AIM):** AIM will renovate building systems that are past their life expectancy and at greatest risk of failure in support of the SC mission. IRA funding will support detailed design and construction activities including elements of plumbing, building envelopes, and electrical.

- **Seismic and Safety Modernization (SSM):** SSM is planned to deliver approximately a 47,000 square foot new building at LBNL to address the mission need for seismically safe space for cafeteria, health services, and assembly in the event of a seismic or emergency situation. IRA funding will be used to perform abatement and demolition of existing facility (B54), installation of soil retaining walls to stabilize the site after demolition, foundations, and initial portion of vertical construction.

- **Continuous Electron Beam Accelerator Facility [CEBAF] Renovation and Expansion (CRE):** CRE will construct new space and modernize existing DOE owned space for both the CEBAF Center and the newly acquired Applied Research Center to advance the Thomas Jefferson National Accelerator Facility's (TJNAF) scientific research mission by providing the infrastructure foundation composed of technically equipped and functional workspaces that are flexible and sustainable. IRA funding will be used to support the completion of this critical construction project at TJNAF by renovating about 20 percent of the Applied Research Center.

- **Biological and Environmental Program Integration Center (BioEPIC):** BioEPIC is a 72,000 square foot laboratory and office building with planned anchor tenants from the Biosciences Area and Earth and Environmental Science Area. Integration of the planned science programs in this unique laboratory facility will leverage existing strengths and emerging technologies to allow significant progress in the understanding of how microbial communities respond to and shape environmental systems, a critical DOE mission. IRA funding will be used to accelerate the enclosure of the building to a state of being weathertight.