Science
(dollars in thousands)

FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted
$8,100,000	$8,100,000	$8,583,000	+$483,000

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.*

Proposed Appropriation Language
For Department of Energy expenses including the purchase, construction, and acquisition of plant and capital equipment, and other expenses necessary for science activities in carrying out the purposes of the Department of Energy Organization Act (42 U.S.C. 7101 et seq.), including the acquisition or condemnation of any real property or any facility or for plant or facility acquisition, construction, or expansion, and purchase of not more than [35] *35* passenger motor vehicles [including one ambulance for replacement only], [$8,100,000,000] *$8,583,000,000*, to remain available until expended: *Provided*, That of such amount, [$211,211,000] *$246,000,000* shall be available until September 30, [2025] *2026*, for program direction.

Explanation of Change
Proposed appropriation language updates reflect the funding and replacement of passenger motor vehicle levels.

Public Law Authorization
Science:
- Public Law 95-91, "Department of Energy Organization Act", 1977
- Public Law 102-486, "Energy Policy Act of 1992"
- Public Law 108-153, "21st Century Nanotechnology Research and Development Act 2003"
- Public Law 108-423, "Department of Energy High-End Computing Revitalization Act of 2004"
- Public Law 109-58, "Energy Policy Act of 2005"
- Public Law 110-69, "America COMPETES Act of 2007"
- Public Law 111-358, "America COMPETES Reauthorization Act of 2010"
- Public Law 115-246, "American Super Computing Leadership Act of 2017"
- Public Law 115-246, "Department of Energy Research and Innovation Act", 2018
- Public Law 115-368, "National Quantum Initiative Act", 2018
- Public Law 117-167, "CHIPS and Science Act", 2022
- Public Law 117-169, "Inflation Reduction Act of 2022"

Isotope R&D and Production:
- Public Law 101-101, "1990 Energy and Water Development Appropriations Act", establishing the Isotope Production and Distribution Program Fund
- Public Law 103-316, "1995 Energy and Water Development Appropriations Act", amending the Isotope Production and Distribution Program Fund to provide flexibility in pricing without regard to full-cost recovery

Workforce Development for Teachers and Scientists:
- Public Law 101-510, "DOE Science Education Enhancement Act of 1991"
- Public Law 103-382, "The Albert Einstein Distinguished Educator Fellowship Act of 1994"

Mission
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.).

Overview
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 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.

SC accomplishes its mission and advances national goals by supporting:

- *Science for energy, economic and national security*—building a foundation of scientific and technical knowledge to spur discoveries and innovations for advancing the Department's mission. 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.
- *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.

The FY 2025 Request for SC is $8,583.0 million, an increase of 6.0 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 and inclusive workforce of the future, and ensure America remains the global S&T leader for generations to come. The FY 2025 Request supports a balanced portfolio of basic scientific research probing some of the most fundamental questions in areas such as: fusion energy and plasma physics, nuclear energy, high energy; materials science and chemistry; biological and environmental systems; applied mathematics; next generation high-performance computing and simulation capabilities; artificial intelligence and machine learning; isotope production; and basic research to advance new accelerator and energy technologies.

The Request increases investments in Administration priorities including basic research on Artificial Intelligence (AI) and Machine Learning (ML), climate change and clean energy, including additional funding for the SC Energy Earthshots, and efforts to support underserved communities through the Reaching a New Energy Sciences Workforce (RENEW) and Funding for Accelerated, Inclusive Research (FAIR) initiatives. The SC Request supports ongoing investments in fusion development in support of the Long Range Plan (LRP) and Bold Decadal Vision for Commercial Fusion Energy. 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. The Request continues investments in microelectronics and isotope production and research. These initiatives position SC to advance and address new research opportunities through collaborative, cross-program efforts.

FY 2023 Key Accomplishments
Advanced Scientific Computing Research
Delivering a Capable Exascale Computing Ecosystem for the Nation
- The Exascale Computing Project (ECP) met all of the project's key performance parameters in 2023 and successfully completed, documented, and closed out the project in FY 2024, under budget and ahead of schedule. The project

enabled the launch of exascale systems that use less than 20MW and created a modern, interoperable, and portable software ecosystem that addresses the needs of simulations, big data, and AI with numerous awards including 13 R&D 100 awards, 7 Gordon Bell finalists and prizes, and dozens of industry recognitions. ECP investments de-risked the jump to accelerated High Performance Computing (HPC) for a wide range of use cases in science and engineering. As a result, scores of companies, universities, and government labs from across the Nation have stood up compatible hardware and installed ECP software and applications - with many more leveraging ECP technologies through cloud service providers.

Industry Partners Leverage ECP to Launch Exascale Innovation Era

- One of the hallmarks of ECP has been collaboration with industry partners who have helped promote exascale computing and the successful integration of software technologies, applications, and hardware to deliver a fully capable exascale ecosystem. For example, GE Research is using Frontier for virtual testing of innovative new open fan jet engine designs to achieve greater fuel efficiency and advance towards their goal of reducing CO2 emissions by 20 percent over today's most efficient engines.

Interagency Partners Leverage Exascale and AI to Improve Cancer Outcomes

- ECP included a unique partnership with the National Cancer Institute as part of the Cancer Moonshot. A focus on this effort was to develop CANDLE (CANcer Distributed Learning Environment), an AI-based computer code that brings together DOE capabilities and cancer research to accelerate discovery of new cancer therapies and improve outcomes. The CANDLE framework was recognized with a 2023 R&D 100 Award and has also been used to research potential treatments for SARS-CoV-2 and to assess the performance of DOE's exascale computing systems.

Democratizing Quantum Control

- The quantum systems that hold great promise for scientific computing and networking are delicate, requiring sophisticated and often costly control electronics to achieve state-of the-art performance. The Quantum Instrumentation Control Kit (QICK) board aims to change that. QICK board combines a commercial off-the-shelf programmable logic board with open-source software that can be adapted to any type of quantum experiment. Dozens of research groups are now using QICK board to advance research ranging from development of novel silicon-based qubits to qubit-based sensors for dark matter detection.

Basic Energy Sciences

Maintaining World-leadership in Scientific User Facilities

- Two major facility upgrade projects to maintain world-leading capabilities, Linac Coherent Light Source-II (LCLS-II) and Advanced Photon Source (APS)-Upgrade, attained significant milestones. Completed early in FY 2024, LCLS-II upgraded the world's first hard x-ray Free Electron Laser to deliver a million x-ray pulses per second with beams that are on average 10,000 times brighter than before the upgrade. This world record performance provides even greater fidelity on the structure and dynamics of quantum materials, catalysts, and biological systems, among others. The upgraded APS will be the Nation's first "4th generation" storage ring-based x-ray light source and offer users more coherent x-ray beams that are up to 500 times brighter, enabling completely new studies of complex systems (e.g., batteries, solar cells, biological systems) in real time and under real-world conditions. Notably, in April 2023 the APS stopped operations to install the upgraded storage ring with restart of operations planned about a year later.

Closing the loop on Photosystem II

- Light-driven oxidation of water to oxygen during natural photosynthesis is one of the most fundamental processes for life on Earth. For decades, researchers have studied this reaction for insights that could drive development of artificial photosynthetic systems for production of clean fuels and products. Now, the chemical structures during the final steps of light-driven conversion of water to oxygen have finally been characterized at room temperature using x-ray lasers, including LCLS. The results—the culmination of decades of research from hundreds of scientists—set the stage for more rapid development of artificial photosynthesis, a promising clean energy technology.

Rapidly and reproducibly disinfecting water with a nanostructured powder and sunlight

- Powder-based disinfection systems offer advantages for water sanitization but to date have been limited by low efficiency. Researchers demonstrated rapid (less than 1 minute) and nearly complete disinfection of water containing E. coli using a suspended nanostructured powder. The powder can be removed with a simple magnet and reused in a

new contaminated water sample. This approach is easy to implement, has small-scale (e.g., personal use) to large-scale (e.g., wastewater treatment) applications, and may enable efficient removal of diverse water-borne pathogens.

10 years of cutting-edge research in energy storage

- Meeting the Nation's ambitious net-zero carbon emissions goals requires a generational leap in battery technology. Since 2013, the Argonne National Laboratory-led Joint Center for Energy Storage Research (JCESR), the Batteries and Energy Storage Energy Innovation Hub, has conducted ground-breaking research for beyond Li-ion batteries. After 10 years, JCESR concluded its efforts with over 1,000 journal papers, nearly 100 inventions, 34 patents, 3 startups, and, importantly, training for more than 330 students and postdocs who now have careers in academia, industry, and at DOE national laboratories. JCESR's pioneering work in data and AI/ML approaches for battery research are also now widely available to the research and industrial community as part of the Materials Project at Lawrence Berkeley National Laboratory (LBNL). Collectively, JCESR's accomplishments have accelerated the pace of progress in energy storage research.

Improving the synthesis and stability of promising solar cell materials under real world conditions.

- Solar cells based on mixed-halide perovskites offer dual benefits of greater efficiency and lower cost relative to existing technology but currently lack adequate stability to make them viable commercial products. Researchers from a BES-supported Energy Frontier Research Center developed a new method for making mixed halide-perovskite solar cell materials that enables better control of crystallization rate, yielding higher quality materials with dramatically improved stability and performance under real world conditions. This new synthetic approach overcomes a major limitation to performance and offers a new pathway to perovskite solar cells as a competitive commercial technology.

Biological and Environmental Research

Notable accomplishments in Biological Systems Science include:

- Discovery of lignin degradation with no oxygen needed highlights a breakthrough for bioprocessing of plant biomass and biomanufacturing. Lignin is a major component of plant biomass and is notoriously resistant to breakdown thereby hindering efficient use of plant biomass as biofuel/bioproduct feedstock. Recent results conclusively show that fungi can degrade lignin anaerobically (i.e., with no oxygen), a process previously thought not to be possible and very likely due to novel chemistry. The findings demonstrate a new path towards efficient breakdown of lignin as a prelude to producing more valuable energy related products from this famously recalcitrant material.
- A modification of the CRISPR-CAS system for precise genome editing has been developed for modifying individual members within a soil microbial community. The work has relevance for altering cellular metabolism during bioprocessing of plant biomass for bioenergy or bioproduct production. Species-specific, phage-based methods were developed to deliver CRISPR-CAS based genome editing machinery to specifically targeted microbes within a mixed microbial community, demonstrating the ability to modify microorganisms selectively for enhanced biotechnologies, including carbon management. The use of a phage-based system allows delivery of the CRISPR-CAS components only to those microorganisms susceptible to phage infection thereby allowing the researchers to target specific cells within mixed culture for editing.

Notable accomplishments in Earth and Environmental Systems Sciences include:

- Building more accurate and sophisticated climate models on faster computers is critical for addressing energy challenges involving extreme events e.g., grid resilience. DOE's Energy Exascale Earth System (E3SM) climate model is the first to run on an exascale computer, placing the U.S. as the global leader in high resolution prediction science. BER scientists developed a 3 km resolution climate prediction capability using the Frontier computer that allows for unprecedented scientific analyses for stakeholder applications. The team that developed the high-resolution atmospheric component of the climate model recently won the first-ever Association for Computing Machinery (ACM) Gordon Bell Prize for Climate Modelling at the International Conference for High Performance Computing, Networking, Storage and Analysis (SC23).
- Understanding and modeling changes in precipitation associated with urbanization and irrigation has a direct impact on the dynamics and vulnerabilities of water and energy systems due to climate extremes. Effects of large-scale urbanization were shown to suppress regional precipitation, while irrigation enhances most precipitation types. DOE's newly established Urban Integrated Field Laboratories will incorporate improved rainfall predictions that are needed to better describe impacts of climate and urban change on water and energy infrastructures while also fostering more equitable resource planning across diverse communities.

Fusion Energy Sciences

DIII-D National Fusion Facility Completes Highest-Powered Negative Triangularity Experiments.

- Researchers evaluated the performance and characteristics of negative triangularity-shaped plasmas in DIII-D in a 16-day experimental thrust that produced the highest-powered experiments of this kind worldwide. The cross-section of a plasma configured in a "negative triangularity" appears mirrored, resembling a backwards "D," as opposed to the more common configuration where the shape of the plasma takes the same "D" shape as the vacuum vessel. Plasmas in this configuration are less likely to impact the inner walls of the tokamak, potentially offering significant benefits for the design of future fusion power plants.

Exploring Reinforcement Learning to Control Nuclear Fusion Reactions.

- Using reinforcement learning methods, researchers developed a numerical model based on 15,000 plasma discharges from the DIII-D National Fusion Facility. The model predicts the evolution of DIII-D plasmas subject to controllable plasma parameters. The reinforcement learning method examined historic and real-time data to vary and control the plasma rotation velocity in search of optimal plasma stability. The method was successfully used to train a real-time controller for DIII-D's heating and momentum injection systems. This successful project is one of the first attempts to control a tokamak using reinforcement learning and shows promise that these methods could be used to also control other aspects of the plasma state.

Fusion temperatures in a small package.

- The researchers at PPPL, ORNL, and the private fusion company Tokamak Energy Ltd in the United Kingdom (UK) achieved a record 100-million-degree ion temperature (many times hotter than the core of our sun) in a device with a plasma volume equivalent to the cargo space of a crossover SUV through a first-of-the-kind international Collaborative Research and Development Agreement (CRADA). Overall, this work confirms that spherical tokamaks can achieve one of three conditions necessary for commercial fusion energy production in a smaller, and potentially more economical, device than other fusion configurations.

High Energy Physics

Most precise measurements of the muon magnetic anomaly from the g-2 experiment

- In August 2023, the Muon g-2 collaboration revealed its second result for the measurement of a quantity known as g-2, which bolsters the first result published by the collaboration in 2021. The new result is based on data taken in 2019 and 2020 and improves the precision by more than a factor of 2 compared to the first result. Since it is so precise, this measurement is particularly sensitive to the influence of new particles or forces beyond what is included in the Standard Model of particle physics; therefore, a factor of 2 improvement can exclude a large range of possible models of new physics or point the way to exactly where the next discovery lies. This leads to a total uncertainty of the experimental average for the muon magnetic anomaly of 190 parts-per-billion (ppb). This is the world's most precise measurement ever made at a particle accelerator.

Advances in dark energy studies were made in spectroscopic and imaging next-generation experiments.

- The Dark Energy Spectroscopic Instrument (DESI) experiment released its detection of baryon acoustic oscillation (BAO) signal in 2023 using the first two months of data. The measurement represents an early validation they are on target to achieve a high-significance BAO detection at sub-percent precision using the map of 40 million galaxies and their redshifts from the completed five-year survey. This will allow an exquisite determination of the effects of dark energy on the expansion history of the universe over the past 11 billion years.

Nuclear Physics

Shape-shifting nuclei illuminate nature's whimsy

- Using the new Facility for Rare Isotope Beams, researchers have made more than 210 rare-isotope beams for forty-six experiments involving 177 students, across 180 institutions in 50 countries. One exciting example is a high energy quantum state of sodium 32 (32Na) that exists for a full 24 millionths of a second, compared to nearly all high energy quantum states that decay instantaneously. Its existence could be explained by three different nuclear theories, one of which suggests it changes shape spontaneously from that of a squashed basketball to an American football. Discovering which theory comes closest is the subject of intense research to create new knowledge that will advance goals for non-proliferation, nuclear medicine, space exploration, and the discovery of new physics beyond our current understanding.

New tools to discover nature's recipe for quark-gluon soup

Scientists have proven the quark-gluon plasma from the early universe can be produced by smashing atoms at velocities near the speed of light, exhibiting spectacular phenomena. For example, a thin slice of this plasma just a femtometer (0.000000000000001 meter) thick can stop a quark or gluon from punching through it, even when these particles have giga-electron-volts of energy. How that happens is a question that scientists are ready to answer with completion and commissioning of the super Pioneering High Energy Nuclear Interaction eXperiment (sPHENIX) detector at the Relativistic Heavy Ion Collider (RHIC). New diagnostics have also been developed to determine the precise temperature of this spectacular environment within the nucleus by observing the sequential dissolution of a well-known set of particle states formed from different combinations of quarks. The stage is now set to tell how the quark-gluon soup gets made when the temperature gets to be 12 billion Kelvin as it was in the very early universe.

Mystery of mysteries: the nature of the neutrino

- We know the neutrino mass is small, but we do not know how small. The fact it has a mass at all is currently not explained by established physics theory. These unknowns, as well as whether the neutrino is its own anti-particle, may account for why there is more matter than ani-matter in the universe. To answer these unknowns, an ongoing international campaign to search for a rare decay called neutrinoless double beta decay— the decay of a nucleus in which two neutrons transform themselves into two protons, two electrons, but no neutrinos. Such a decay can only happen if the neutrino is indeed its own anti-particle. Recently, the Majorana Demonstrator experiment carried out at the Sanford Underground Research Facility (SURF) in South Dakota demonstrated that up to a limit of 8.3×10^{25} years, no such decay would be observed, setting a new limit for the follow-up global campaign which aims to improve the sensitivity to this decay by 1000 times.

Isotope R&D and Production

Newly Refurbished Hot Cells Produce Record Batch Size of Rare Cancer Therapeutic

- The recently renovated All-Purpose (AP) Hot Cells at Brookhaven National Laboratory (BNL) enabled a record-breaking achievement of the DOE IP Tri-Lab Ac-225 Research Effort for the provision of isotopes for innovative cancer research, producing the largest Ac-225 batch to date: 112 mCi of Ac-225 was produced of this rare isotope. Ac-225 shows stunning success in treating metastasized cancers but is in short supply. The Tri-Lab collaboration established reliable, routine Ac-225 production, demonstrating that the process is scalable, but had been constrained at the 50 mCi level due to insufficient radiochemical processing capacity at the target irradiation sites (BNL and Los Alamos National Laboratory [LANL]). The renovation of the AP Hot Cells was completed in 2023, and the BNL Medical Isotope Research and Production Program (MIRP) successfully and reliably produced monthly batches of Ac-225 since operations were authorized. With the AP Hot Cells, DOE can provide additional supply of Ac-225 to support clinical trials.

The DOE Isotope Program (DOE IP) Welcomes the University of Wisconsin-Madison and Texas A&M to the University Isotope Network (UIN)

- The University of Wisconsin-Madison (UWM) Cyclotron Research Group joined the DOE IP UIN for the production of research and "boutique" isotopes. Supported by DOE IP funding, the UWM Cyclotron Research Group developed three new production lines of medical isotopes used in medical imaging and cancer therapy (Manganese-52g, Bromine-77, and Yttrium-86) and are now in routine production and available through National Isotope Development Center (NIDC). The UWM Cyclotron Research group brings expertise in developing targets for isotope production using low energy

cyclotrons and will serve as the target resource for the other cyclotrons sites with the UIN. Texas A&M Cyclotron Institute has developed Astatine-211 (At-211) production which is now available for routine regional distribution through NIDC. There are now six universities in the UIN.

Accelerator R&D and Production

- In FY 2023, the ARDAP program supported compact cryocooled superconducting accelerator R&D that will pave the way for industrial applications. Such accelerators have been shown to effectively destroy a wide variety of pollutants such as volatile organic compounds[a] and the "forever chemicals" called PFAS[bc] found in many U.S. drinking water sources and in the blood of 97 percent of Americans.[d]

- In 2023, the BNL Accelerator Test Facility (ATF) provided more than 2,000 hours of beamtime to users who performed experiments that elucidated the origin of the remnant magnetic field in our galaxy,[e] demonstrated new techniques using ionic liquids to generate surgically-useful laser light,[f] and that is helping National Aeronautics and Space Administration (NASA) quantify the effects of solar radiation on space-borne electronics.[g]

Workforce Development for Teachers and Scientists

- DOE National Laboratory Based Activities - WDTS's four workforce training programs prepare U.S. students for science, technology, engineering, and mathematics (STEM) careers by providing hands-on research experiences and inclusive mentorship at 17 DOE national laboratories. A total of 1,280 undergraduate students from 2-/4-year colleges and universities, 131 graduate students, and 85 faculty from institutions historically underrepresented in research were supported. Among all the participants, approximately 34.1 percent were women, about a quarter came from 150 Minority Serving Institutions (MSIs), including 21 Historically Black Colleges and Universities (HBCUs), 1 Tribal College and University (TCU), and 101 Hispanic Serving Institution. More than 98 percent reported positive impacts to their educational and career goals, more than 92 percent would consider a career at DOE national laboratories.

- Reaching a New Energy Sciences Workforce (RENEW) - In FY 2023, WDTS established the first cohort of five WDTS RENEW Pathway Summer Schools for high school and early undergraduate students at 6 DOE national laboratories. In collaboration with SC research programs and Oak Ridge Institute for Science and Education, WDTS successfully led the first year of the SC portfolio level evaluation and assessment of the RENEW initiative. The preliminary assessment shows that the RENEW activities effectively reached diverse participants and institutions, especially those from historically underrepresented groups and communities in SC portfolio.

- National Science Bowl®(NSB) – In FY 2023, more than 2,700 middle school students (from 504 schools) and 5,200 high school students (from 941 schools) participated in 108 regional competitions, representing forty-nine U.S. States, the District of Columbia, and Puerto Rico. The NSB®continues to inspire young students nationwide to strive for high levels of academic success and follow their passions in STEM.

- Intentional Outreach and Engagement for Broadening Participation – In FY 2023, through multiple venues, WDTS actively engaged HBCUs, TCUs, MSIs, and community colleges for raising awareness, reducing barriers, and recruiting students and faculty from all walks of life, especially from underserved communities. WDTS successfully expanded model outreach practices, including mini-semester, student STEM ambassadors, and MSI faculty workshop, to more laboratories.

[a] https://www.sciencedirect.com/science/article/abs/pii/S0969806X1730511X
[b] https://www.jlab.org/partnerships/blastpfas
[c] https://phys.org/news/2024-02-electron-eradicate-chemicals.html
[d] https://www.mdpi.com/1660-4601/12/6/6098
[e] https://www.bnl.gov/atf/docs/mapping-the-self-generated-magnetic-fields-due-to-thermal-weibel-instability.pdf
[f] https://journals.aps.org/prapplied/abstract/10.1103/PhysRevApplied.19.014052
[g] https://www.bnl.gov/atf/experiments/references/ae130.pdf

Science Laboratories Infrastructure

Line-Item Construction Projects

- Since FY 2006, the SLI program has invested nearly $1.2 billion to successfully complete 19 mission-enabling line-item construction projects that provided state-of-the-art science user support facilities, renovated and repurposed aged facilities, upgraded inadequate core infrastructure and systems, and removed excess (obsolete?) facilities. These investments began following an FY 2006 SC decision to modernize infrastructure across the SC-stewarded laboratory complex. With these investments, the SLI program constructed approximately 1.8 million gsf of new and modernized existing space. As a result, an estimated 3,050 laboratory users and researchers now occupy newly constructed and/or modernized buildings that better support scientific and technological innovation in a collaborative environment. SLI has been honored with 14 DOE Secretary's Achievement Awards for its contributions to the SC mission.

General Plant Projects (GPP) upgrades across SC Laboratories

- From FY 2016 through FY 2023, SLI has disbursed nearly $280 million in 49 laboratory core infrastructure improvement projects including $150 million in electrical and utility improvements, $57 million in building renovations, $44 million in safety and environmental projects, $20 million in sustainability/resilience and $8 million in other site improvement projects. Examples of FY 2023 SLI GPP investments in core infrastructure include the replacement of an emergency generator in the Waste Handling Facility at LBNL and conversion of the fossil fuel furnace serving the AUD-PSL buildings at PNNL to a hot water system using geothermal heat pumps.

Future Year Energy Program (FYEP)

(dollars in thousands)

	FY 2025 Request	FY 2026	FY 2027	FY 2028	FY 2029
Office of Science	8,583,000	8,780,409	8,982,358	9,188,953	9,400,298

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 2026–FY 2029. The outyear funding levels use the growth rates based on the Request level and match the outyear account totals published in the FY 2025 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 an inclusive and diverse workforce of the future, and ensure America remains the global S&T leader for generations to come.
- Ensure continued 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 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted ($)	FY 2025 Request vs FY 2023 Enacted (%)
Advanced Scientific Computing Research					
ASCR Research	991,000	1,033,108	1,136,682	+145,682	+14.70%
17-SC-20 SC Exascale Computing Project (ECP)	77,000	–	–	-77,000	-100.00%
Construction					
24-SC-20 High Performance Data Facility	–	–	16,000	+16,000	–
Total, Construction	**–**	**–**	**16,000**	**+16,000**	**–**
Total, Advanced Scientific Computing Research	**1,068,000**	**1,033,108**	**1,152,682**	**+84,682**	**+7.93%**
Basic Energy Sciences					
BES Research	2,240,800	2,249,563	2,398,785	+157,985	+7.05%
Construction					
24-SC-10 HFIR Pressure Vessel Replacement (PVR), ORNL	–	–	6,000	+6,000	–
24-SC-12 NSLS-II Experimental Tools - III (NEXT-III), BNL	–	–	5,500	+5,500	–
21-SC-10 Cryomodule Repair & Maintenance Facility (CRMF), SLAC	10,000	9,000	20,000	+10,000	+100.00%
19-SC-14 Second Target Station (STS), ORNL	32,000	52,000	52,000	+20,000	+62.50%
18-SC-10 Advanced Photon Source Upgrade (APS-U), ANL	9,200	–	–	-9,200	-100.00%
18-SC-11 Spallation Neutron Source Proton Power Upgrade (PPU), ORNL	17,000	15,769	–	-17,000	-100.00%
18-SC-12 Advanced Light Source Upgrade (ALS-U), LBNL	135,000	57,300	–	-135,000	-100.00%
18-SC-13 Linac Coherent Light Source-II-High Energy (LCLS-II-HE), SLAC	90,000	120,000	100,000	+10,000	+11.11%
Total, Construction	**293,200**	**254,069**	**183,500**	**-109,700**	**-37.41%**
Total, Basic Energy Sciences	**2,534,000**	**2,503,632**	**2,582,285**	**+48,285**	**+1.91%**

(dollars in thousands)

	FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted ($)	FY 2025 Request vs FY 2023 Enacted (%)
Biological and Environmental Research					
BER Research	908,685	835,644	926,225	+17,540	+1.93%
Construction					
24-SC-31 Microbial Molecular Phenotyping Capability (M2PC), PNNL	–	–	19,000	+19,000	–
Total, Construction	**–**	**–**	**19,000**	**+19,000**	**–**
Total, Biological and Environmental Research	**908,685**	**835,644**	**945,225**	**+36,540**	**+4.02%**
Fusion Energy Sciences					
FES Research	510,222	554,668	609,496	+99,274	+19.46%
Construction					
20-SC-61 Matter in Extreme Conditions (MEC) Petawatt Upgrade, SLAC	11,000	10,000	10,000	-1,000	-9.09%
14-SC-60 U.S. Contributions to ITER	242,000	240,000	225,000	-17,000	-7.02%
Total, Construction	**253,000**	**250,000**	**235,000**	**-18,000**	**-7.11%**
Total, Fusion Energy Sciences	**763,222**	**804,668**	**844,496**	**+81,274**	**+10.65%**
High Energy Physics					
HEP Research	868,000	820,301	825,768	-42,232	-4.87%
Construction					
18-SC-42 Proton Improvement Plan II (PIP-II), FNAL	120,000	125,000	125,000	+5,000	+4.17%
11-SC-40 Long Baseline Neutrino Facility/Deep Underground Neutrino Experiment	176,000	251,000	280,000	+104,000	+59.09%
11-SC-41 Muon to Electron Conversion Experiment, FNAL	2,000	–	–	-2,000	-100.00%
Total, Construction	**298,000**	**376,000**	**405,000**	**+107,000**	**+35.91%**
Total, High Energy Physics	**1,166,000**	**1,196,301**	**1,230,768**	**+64,768**	**+5.55%**
Nuclear Physics					
NP Operation and Maintenance	755,196	676,203	723,091	-32,105	-4.25%

(dollars in thousands)

	FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted ($)	FY 2025 Request vs FY 2023 Enacted (%)
Construction					
20-SC-52 Electron Ion Collider (EIC), BNL	50,000	95,000	110,000	+60,000	+120.00%
Total, Construction	**50,000**	**95,000**	**110,000**	**+60,000**	**+120.00%**
Total, Nuclear Physics	**805,196**	**771,203**	**833,091**	**+27,895**	**+3.46%**
Isotope R&D and Production					
IRP Research	85,451	132,651	135,000	+49,549	+57.99%
Construction					
20-SC-51 U.S. Stable Isotope Production and Research Center (SIPRC), ORNL	24,000	20,900	45,900	+21,900	+91.25%
24-SC-92 Clinical Alpha Radionuclide Producer (CARP), BNL	–	–	1,000	+1,000	–
24-SC-91 Radioisotope Processing Facility, ORNL	–	–	2,000	+2,000	–
Total, Construction	**24,000**	**20,900**	**48,900**	**+24,900**	**+103.75%**
Total, Isotope R&D and Production	**109,451**	**153,551**	**183,900**	**+74,449**	**+68.02%**
Accelerator R&D and Production					
ARDAP Research	27,436	29,175	31,273	+3,837	+13.99%
Total, Accelerator R&D and Production	**27,436**	**29,175**	**31,273**	**+3,837**	**+13.99%**
Workforce Development for Teachers and Scientists					
WDTS	42,000	42,100	43,100	+1,100	+2.62%
Total, Workforce Development for Teachers and Scientists	**42,000**	**42,100**	**43,100**	**+1,100**	**+2.62%**
Science Laboratories Infrastructure					
PILT	4,891	5,004	5,119	+228	+4.66%
Oak Ridge Landlord	6,559	6,910	7,032	+473	+7.21%
SLI F&I	13,900	32,104	50,029	+36,129	+259.92%
SLI Laboratory Operations Apprenticeship	–	–	5,000	+5,000	–
OR Nuclear Operations	26,000	46,000	46,000	+20,000	+76.92%

(dollars in thousands)

	FY 2023 Enacted	FY 2024 Annualized CR	FY 2025 Request	FY 2025 Request vs FY 2023 Enacted ($)	FY 2025 Request vs FY 2023 Enacted (%)
Construction					
22-SC-71 Critical Infrastructure Modernization Project (CIMP) - ORNL	1,000	–	–	-1,000	-100.00%
22-SC-72 Thomas Jefferson Infrastructure Improvements (TJII) - TJNAF	1,000	–	–	-1,000	-100.00%
21-SC-71 Princeton Plasma Innovation Center (PPIC), PPPL	10,000	10,000	35,000	+25,000	+250.00%
21-SC-72 Critical Infrastructure Recovery & Renewal (CIRR), PPPL	4,000	10,000	20,000	+16,000	+400.00%
21-SC-73 Ames Infrastructure Modernization (AIM)	2,000	8,000	–	-2,000	-100.00%
20-SC-71 Critical Utilities Rehabilitation Project (CURP), BNL	26,000	–	–	-26,000	-100.00%
20-SC-72 Seismic and Safety Modernization (SSM), LBNL	27,500	35,000	18,000	-9,500	-34.55%
20-SC-73 CEBAF Renovation and Expansion (CEBAF), TJNAF	15,000	11,000	11,000	-4,000	-26.67%
20-SC-75 Large Scale Collaboration Center (LSCC), SLAC	21,000	–	–	-21,000	-100.00%
20-SC-77 Argonne Utilities Upgrade (AU2), ANL	8,000	8,000	3,000	-5,000	-62.50%
20-SC-78 Linear Assets Modernization Project (LAMP), LBNL	23,425	18,900	30,000	+6,575	+28.07%
20-SC-79 Critical Utilities Infrastructure Revitalization (CUIR), SLAC	25,425	30,000	20,000	-5,425	-21.34%
20-SC-80 Utilities Infrastructure Project (UIP), FNAL	20,000	35,000	45,000	+25,000	+125.00%
19-SC-74 - BioEPIC, LBNL	45,000	38,000	–	-45,000	-100.00%
Total, Construction	**229,350**	**203,900**	**182,000**	**-47,350**	**-20.65%**
Total, Science Laboratories Infrastructure	**280,700**	**293,918**	**295,180**	**+14,480**	**+5.16%**
Safeguards and Security					
S&S	184,099	200,000	195,000	+10,901	+5.92%
Total, Safeguards and Security	**184,099**	**200,000**	**195,000**	**+10,901**	**+5.92%**
Program Direction					
PD	211,211	236,700	246,000	+34,789	+16.47%
Total, Program Direction	**211,211**	**236,700**	**246,000**	**+34,789**	**+16.47%**
Total, Office of Science	**8,100,000**	**8,100,000**	**8,583,000**	**+483,000**	**+5.96%**

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 2023 Enacted: SBIR $100,850,000 and STTR $14,182,000 (SC only)
- FY 2024 Annualized CR: SBIR $95,418,000 and STTR $13,424,000 (SC only)
- FY 2025 Request: SBIR $101,886,000 and STTR $14,329,000 (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.