Science Laboratories Infrastructure

Overview

The Science Laboratories Infrastructure (SLI) program mission is to support scientific and technological innovation at the Office of Science (SC) laboratories by funding and sustaining general purpose infrastructure and fostering safe, efficient, reliable, and environmentally responsible operations. The main priorities of the SLI program are improving SC's existing physical assets (including major utility systems) and funding new cutting-edge facilities that enable emerging science opportunities. The SLI program, consisting of Line-Item Construction Projects and General Plant Projects (GPP), also funds Payments in Lieu of Taxes (PILT) to local communities around the Argonne, Brookhaven, and Oak Ridge National Laboratories as well as Nuclear Operations at Oak Ridge National Laboratory (ORNL) and landlord responsibilities across the Oak Ridge Reservation.

SC manages an infrastructure portfolio worth nearly $22 billion, which is composed of 13 sites with nearly 23 million gross square feet (gsf) in 1,570 government owned buildings. SC assets at the 10 national laboratories include major research and user facilities, laboratory and office buildings, support facilities, and a vast network of utilities that form the backbone of each site. SC provides significant stewardship of research facilities, the renovation and replacement of general-purpose infrastructure, including buildings and support infrastructure. However, approximately half of the buildings are rated substandard or inadequate to meet mission needs. In addition, nearly two-thirds of support infrastructure, including utility systems, is rated as substandard or inadequate. This resulted in unplanned outages, costly repairs, elevated safety risks and inefficiencies. In collaboration with SC programs and the laboratories, the SLI program works to address identified deficiencies to reduce the impacts on the mission.

SC laboratories conduct rigorous and consistent analyses of the condition, utilization, mission readiness, and resilience of the facilities and infrastructure which are most critical to mission accomplishment. SC and the laboratories use these assessments to develop comprehensive Campus Strategies in the annual laboratory planning process. To support the core capabilities and achieve the scientific vision, each laboratory's Campus Strategy identifies activities and infrastructure investments such as Line-Item (LI) Construction and General Plant Projects (GPPs). SC leadership uses these Campus Strategies to determine the facilities and infrastructure needs and priorities, which, combined with complex-wide infrastructure analyses, form the basis of SLI budget requests.

To sustain and enhance its general-purpose infrastructure, SC invested over $613.7 million in maintenance, repair, and construction in FY 2021. These investments came from a variety of funding sources including Federal appropriations for line-item and general plant projects and laboratory overhead funding of Institutional GPP (IGPP) projects as well as maintenance and repair. The SLI investments in line-item construction and science-supporting general infrastructure are key elements of this overall investment strategy.

Highlights of the FY 2023 Request

The SLI program Request continues to focus on improving infrastructure across the SC national laboratory complex. The FY 2023 Request does not include any new line-item construction projects.

The Request also supports eleven ongoing construction projects:

1. Princeton Plasma Innovation Center at Princeton Plasma Physics Laboratory (PPPL);
2. Critical Utilities Rehabilitation Project at Brookhaven National Laboratory (BNL);
3. Seismic and Safety Modernization project at Lawrence Berkeley National Laboratory (LBNL);
4. Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion project at Thomas Jefferson National Accelerator Facility (TJNAF);
5. Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC);
6. Critical Infrastructure Recovery & Renewal at Princeton Plasma Physics Laboratory (PPPL);
7. Argonne Utilities Upgrade project at Argonne National Laboratory (ANL);
8. Linear Assets Modernization Project at LBNL;
9. Critical Utilities Infrastructure Revitalization project at SLAC;
10. Utilities Infrastructure Project at Fermi National Accelerator Laboratory (FNAL), and:
11. Biological and Environmental Program Integration Center (BioEPIC) at LBNL.

These ongoing projects will upgrade and improve utility systems and facilities and provide new laboratory space with the necessary performance capabilities to enhance SC's mission.

The FY 2023 Request also includes funding for general purpose infrastructure projects that will address emerging, high priority core infrastructure and utility needs across SC laboratories and facilities. Infrastructure needs and priorities for all laboratories are evaluated annually by SLI. Projects are evaluated on mission readiness, cost savings (including energy and water), environment safety and health issues, sustainability (including net zero initiatives), resilience, and reliability.

Science Laboratories Infrastructure
Funding

(dollars in thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Science Laboratories Infrastructure				
Payment In Lieu of Taxes (PILT)	4,650	4,820	4,891	+241
OR Landlord	5,860	6,430	6,559	+699
Facilities and Infrastructure	29,790	17,200	15,200	-14,590
Oak Ridge Nuclear Operations	26,000	20,000	20,000	-6,000
Subtotal, Science Laboratories Infrastructure	**66,300**	**48,450**	**46,650**	**-19,650**

(dollars in thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Construction				
21-SC-71, Princeton Plasma Innovation Center (PPIC), PPPL	150	900	10,000	+9,850
21-SC-72, Critical Infrastructure Recovery & Renewal (CIRR), PPPL	150	2,000	4,000	+3,850
21-SC-73, Ames Infrastructure Modernization (AIM)	150	–	–	-150
20-SC-71, Critical Utilities Rehabilitation Project (CURP), BNL	20,000	26,000	13,000	-7,000
20-SC-72, Seismic and Safety Modernization (SSM), LBNL	5,000	27,500	27,500	+22,500
20-SC-73, CEBAF Renovation and Expansion (CEBAF), TJNAF	2,000	10,000	2,000	–
20-SC-74, Craft Resources Support Facility (CRSF), ORNL	25,000	–	–	-25,000
20-SC-75, Large Scale Collaboration Center (LSCC), SLAC	11,000	12,000	30,000	+19,000
20-SC-76, Tritium System Demolition and Disposal (TSDD), PPPL	13,000	6,400	–	-13,000
20-SC-77, Argonne Utilities Upgrade (AU2), ANL	500	500	8,000	+7,500
20-SC-78, Linear Assets Modernization Project (LAMP), LBNL	500	500	23,425	+22,925
20-SC-79, Critical Utilities Infrastructure Revitalization (CUIR), SLAC	500	500	25,425	+24,925
20-SC-80, Utilities Infrastructure Project (UIP), FNAL	500	500	20,000	+19,500
19-SC-71, Science User Support Center (SUSC), BNL	20,000	38,000	–	-20,000
19-SC-73, Translational Research Capability (TRC), ORNL	22,000	21,500	–	-22,000
19-SC-74, BioEPIC, LBNL	20,000	35,000	45,000	+25,000
18-SC-71, Energy Sciences Capability (ESC), PNNL	23,000	–	–	-23,000
17-SC-71, Integrated Engineering Research Center (IERC), FNAL	10,250	10,250	–	-10,250
Subtotal, Construction	**173,700**	**191,550**	**208,350**	**+34,650**
Total, Science Laboratories Infrastructure	**240,000**	**240,000**	**255,000**	**+15,000**

Science Laboratories Infrastructure
Explanation of Major Changes

(dollars in thousands)

	FY 2023 Request vs FY 2021 Enacted
Infrastructure Support The Request provides funding for general plant projects to address emerging high-priority infrastructure needs across the SC complex; and continues to support Payment in Lieu of Taxes (PILT), nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation.	**-19,650**
Construction Funding supports eleven ongoing line-item projects at ANL, BNL, FNAL, LBNL, PPPL, SLAC, and TJNAF.	**+34,650**
Total, Science Laboratories Infrastructure	**+15,000**

Program Accomplishments

Since FY 2006, the SLI program has invested nearly $1.8 billion in general purpose infrastructure across the SC-stewarded laboratory complex. These investments have provided state-of-the-art science user support facilities, renovated, and repurposed aged facilities, upgraded inadequate core infrastructure and systems, and removed excess.

Line-Item Construction Projects.

Since FY 2006, the SLI program has successfully completed 16 line-item projects while garnering thirteen DOE Secretary's Achievement Awards. These investments occurred following an FY 2006 SC decision to initiate a major effort to modernize infrastructure across the SC-stewarded laboratory complex. With these investments, the SLI program constructed more than 1,207,000 gsf of new space and modernized more than 452,000 gsf of existing space. As a result, an estimated 2,900 laboratory users and researchers now occupy newly constructed and/or modernized buildings that better support scientific and technological innovation in a collaborative environment.

Core General Plant Project upgrades across SC Laboratories.

Since FY 2016, SLI has funded nearly $203,000,000 in 36 laboratory core infrastructure improvement projects (GPP projects with TEC less than $20,000,000) including $133,000,000 in electrical and utility improvements, $35,340,000 in building renovations, $28,800,000 in safety and environmental projects and $5,730,000 in sustainability. Examples of recent SLI investments in core infrastructure include building heating, ventilation, and air conditioning (HVAC) upgrades at BNL, access control upgrades at Ames and Fermi and steam to hydronics conversion at PNNL. SLI also funded electrical substation and building HVAC system improvements at LBNL, cooling tower water reuse at TJNAF and facility improvement including fire protection at the Office of Scientific and Technical Information.

Building 350 Legacy Project at Argonne National Laboratory (ANL).

As of the end of FY 2020, this SLI-funded project removed all 20,253 nuclear material items from the former New Brunswick Laboratory building. The project also cleaned up approximately 20,481 square feet of the building's 28,598 total square feet that is within this project's scope for cleanout, a part of which is currently being used for programmatic work. The project continues to remove the remaining nuclear materials and clean-up space so the building can eventually be renovated and repurposed as a radiological facility by ANL, with project completion scheduled for FY 2022.

Science Laboratories Infrastructure
Infrastructure Support

Description

This subprogram supports investments that focus on laboratory core infrastructure and operations. Continuing investments in core infrastructure (e.g., utility systems, site-wide services, and general-purpose facilities) ensure that facilities and utilities are either upgraded or replaced as they approach end-of-life. Upgraded facilities have improved reliability, resilience, efficiency, and performance. This subprogram also supports nuclear operations at the Oak Ridge National Laboratory (ORNL), funds stewardship-type needs (e.g., roads and grounds maintenance) across the Oak Ridge Reservation, and funds Payments In Lieu of Taxes (PILT) to local communities around the Argonne National Laboratory (ANL), Brookhaven National Laboratory (BNL), and ORNL. Stewardship-type needs (e.g., roads and grounds maintenance) across the Oak Ridge Reservation are also included.

Facilities and Infrastructure

This activity supports minor construction investments (general plant projects of less than $20,000,000) that address urgent and emerging core infrastructure needs. SC laboratories conduct rigorous condition assessments of their core infrastructure, which determine the need for investments in these basic systems that form the backbone of their campuses. The Science Laboratories Infrastructure program maintains an active list of critical core infrastructure investment needs. Projects are evaluated on mission readiness, cost savings (including energy and water), environment safety and health issues, sustainability (including net zero initiatives), resilience, and reliability. Priorities are evaluated continuously, and the highest priority projects are selected for funding upon entry into the corresponding execution year.

Oak Ridge Nuclear Operations

To support critical DOE nuclear operations, this Request includes funding to operate ORNL's non-reactor nuclear facilities (i.e., Buildings 7920, 7930, 3525, 3047, and 3025E). These facilities support a variety of users including SC Programs, the National Nuclear Security Administration, the Office of Nuclear Energy, and other federal agencies. This funding supports maintenance and repair of hot cells and supporting systems and ensuring compliance with safety standards and procedures.

OR Landlord

This funding supports landlord responsibilities, including infrastructure for the 24,000-acre Oak Ridge Reservation and DOE facilities in the city of Oak Ridge, Tennessee. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.

Payment In Lieu of Taxes (PILT)

Funding within this activity supports SC stewardship responsibilities for PILT. The Department is authorized to provide discretionary payments to state and local government authorities for real property that is not subject to taxation because it is owned by the United States Federal Government and operated by the Department. Under this authorization, PILT is provided to communities around ANL, BNL, and ORNL to compensate for lost tax revenues for land removed from local tax rolls. PILT payments are negotiated between the Department and local governments based on land values and tax rates.

Science Laboratories Infrastructure
Infrastructure Support

Activities and Explanation of Changes

(dollars in thousands)

FY 2021 Enacted		FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted
Infrastructure Support	**$66,300**	**$46,650**	**-$19,650**
Facilities and Infrastructure	$29,790	$15,200	-$14,590
Funding supports the highest priority core infrastructure needs across the SC complex.		The Request will continue to support the highest priority core infrastructure needs across the SC complex.	Funding will support critical core infrastructure needs.
Oak Ridge Nuclear Operations	$26,000	$20,000	-$6,000
Funding supports critical nuclear operations and will provide funding to manage ORNL's nuclear facilities.		The Request will continue to support critical nuclear operations and will provide funding to manage ORNL's nuclear facilities.	Funding will support the most critical nuclear operations and facilities at ORNL.
OR Landlord	$5,860	$6,559	+$699
Funding continues support of landlord responsibilities across the Oak Ridge Reservation. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.		The Request will continue to support of landlord responsibilities across the Oak Ridge Reservation. Activities include maintenance of roads, grounds, and other infrastructure; and support and improvement of environmental protection, safety, and health.	Funding will support OR landlord requirements.
Payment In Lieu of Taxes (PILT)	$4,650	$4,891	+$241
Funding supports PILT payments to communities around ANL, BNL, and ORNL.		The Request will provide funding for PILT payments to communities around ANL, BNL, and ORNL.	Funding will support anticipated PILT requirements.

Science Laboratories Infrastructure
Construction

Description

The Science Laboratories Infrastructure (SLI) program funds line-item projects to maintain and enhance the general-purpose infrastructure at SC laboratories. SLI's infrastructure modernization construction projects are focused on the accomplishment of long-term science goals and strategies at each SC laboratory. The main objectives of the SLI program are improvement of SC's physical assets and funding of new cutting-edge facilities to enable emerging science opportunities. Modernizing infrastructure, some more than 50 years old, supporting the SC national laboratories, will ensure the critical needs of the future science initiatives and world class user facilities are met for decades to come, while minimizing unwanted disruptions through resilience and reliability, ensuring safety and maintainability.

The FY 2023 Request includes funding for eleven ongoing line-item construction projects:

1. Princeton Plasma Innovation Center at PPPL;
2. Critical Infrastructure Recovery & Renewal at PPPL;
3. Critical Utilities Rehabilitation Project at BNL;
4. Seismic and Safety Modernization at LBNL;
5. CEBAF Renovation and Expansion at TJNAF;
6. Large Scale Collaboration Center at SLAC;
7. Argonne Utilities Upgrade at ANL;
8. Linear Assets Modernization Project at LBNL;
9. Critical Utilities Infrastructure Revitalization at SLAC;
10. Utilities Infrastructure Project at FNAL; and
11. Biological and Environmental Program Integration Center at LBNL.

No new line-item construction projects are included within this request.

21-SC-71, Princeton Plasma Innovation Center, PPPL

The Princeton Plasma Innovation Center (PPIC) will provide a multi-purpose facility to PPPL, with space for offices, medium bay research labs for diagnostics and fabrication, remote participation and collaboration, and research support to meet the SC mission and fulfill the research needs of the Fusion Energy Sciences (FES), Advanced Scientific Computing Research (ASCR), and Basic Energy Sciences (BES) programs.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on January 22, 2021. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the second quarter of FY 2024. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is $78,300,000 to $96,300,000 and the preliminary Total Project Cost (TPC) range is $80,500,000 to $98,500,000. These cost ranges encompass the most feasible preliminary alternative at this time.

21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL

The Critical Infrastructure Recovery & Renewal (CIRR) project at PPPL will revitalize critical infrastructure that supports the PPPL campus. Upgrades that may be completed as part of the CIRR project include: the electrical distribution system; standby power; chilled water generation and distribution; distribution networks for steam, compressed air, sanitary waste, and condenser, storm, canal, and potable water; HVAC systems; and communication systems.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on February 23, 2021. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the third quarter of FY 2024. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is $80,100,000 to $96,000,000. The preliminary Total Project Cost (TPC) range for this project is $81,800,000 to $97,700,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

20-SC-71, Critical Utilities Rehabilitation Project, BNL

The Critical Utilities Rehabilitation Project at BNL will revitalize and upgrade highest risk major utility systems to meet the needs of SC facilities supporting Nuclear Physics (NP), BES, High Energy Physics (HEP), Biological and Environmental Research (BER), and ASCR program missions.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1/3A, Approve Alternative Selection and Cost Range and Approve Long-Lead Procurements and Start of Early Construction Activities, was approved on February 6, 2020. The preliminary estimate for CD-2/3, Approve Performance Baseline and approve Start of Construction, is anticipated in the third quarter of FY 2022. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is $70,000,000 to $92,000,000. The preliminary TPC range for this project is $71,000,000 to $93,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is $92,000,000 and the preliminary TPC point estimate for this project is $93,000,000.

20-SC-72, Seismic and Safety Modernization, LBNL

The Seismic and Safety Modernization project will address seismic safety issues and emergency response capabilities at LBNL. Specifically, facilities with large congregation areas, facilities that are necessary for emergency response personnel, and facilities necessary to maintain continuity of operations will be improved. The facilities that are the primary focus of this project are the Cafeteria, Health Services, and Fire House sleeping quarters.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on September 4, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the first quarter of FY 2023. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $76,300,000 to $95,400,000 and the preliminary TPC range of $78,500,000 to $97,600,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is $95,400,000 and the preliminary TPC point estimate for this project is $97,600,000.

20-SC-73, CEBAF Renovation and Expansion, TJNAF

The CEBAF Renovation and Expansion project will renovate existing space and provide new research, administrative, and support service space enabling TJNAF to better support SC missions. The CEBAF center at TJNAF is currently overcrowded and has inadequate utility systems that are experiencing frequent failures. This project will renovate 123,000 to 250,000 gross square feet (gsf) of existing space in the CEBAF center and the Applied Research Center (ARC), upgrade high risk utility systems, and provide 82,000 to 150,000 gsf of additional space for visitors, users, research, education, and support.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range which was approved on March 18, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the fourth quarter of FY 2022. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $47,000,000 to $96,000,000 and a preliminary TPC range of $50,000,000 to $99,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

20-SC-75, Large Scale Collaboration Center, SLAC

The Large Scale Collaboration Center project will construct a multi-office building of approximately 38,000 to 45,000 gsf to consolidate and provide space for 100-150 occupants in a common building, provide synergies among all major SC-sponsored programs at SLAC, and provide a centralized office and collaboration space for cross-functional teams with the necessary performance capabilities to grow the science research programs. With the growth in SC mission activities at SLAC —from the Linac Coherent Light Source (LCLS), LCLS-II, LCLS-II-HE projects to Facility for Advanced Accelerator Experimental Tests (FACET)-II and the Matter in Extreme Conditions project—the laboratory currently lacks office spaces for scientists and staff as current spaces are fully occupied or oversubscribed, and therefore do not support the needs for joint collaborations for exploring challenges and developing solutions using large-scale data sets. Adjacent space that allows needed collaboration in computational science, machine learning, artificial intelligence, exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling is also not currently available.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on November 18, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the third quarter of FY 2022. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. This project has a preliminary TEC range of $56,000,000 to $90,400,000 and a preliminary TPC range of $58,000,000 to $92,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TEC point estimate for this project is $64,000,000 and the preliminary TPC point estimate for this project is $66,000,000.

20-SC-77, Argonne Utilities Upgrade, ANL

The Argonne Utilities Upgrade project at ANL will revitalize and selectively upgrade ANL's existing major utility systems to increase the reliability, capability, and safety of ANL's infrastructure to meet the DOE's mission. The project will focus on systems such as steam, water, sanitary sewer, chilled water, and electrical systems.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on July 1, 2021. The preliminary estimate for CD-2, Approve Baseline, is anticipated in the third quarter of FY 2024 This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is $172,000,000 to $290,300,000. The preliminary Total Project Cost (TPC) range for this project is $173,000,000 to $291,300,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

20-SC-78, Linear Assets Modernization Project, LBNL

The Linear Assets Modernization Project at LBNL will upgrade high priority utility systems to increase the reliability, capability, and safety of LBNL's infrastructure to meet the DOE's mission. The project will upgrade utility systems including, but not limited to, domestic water, natural gas, storm drain, sanitary sewer, electrical, and communications.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, was approved on May 17, 2019. The project's CD-1, Approve Alternative Selection and Cost Range, is anticipated in the second quarter of FY 2022. This project is pre-CD-2, therefore schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is $164,000,000 to $376,000,000. The preliminary Total Project Cost (TPC) range for this project is $170,000,000 to $382,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC

The primary objective of CUIR is to close infrastructure gaps to support multi-program science missions as technologies, instruments, experimental parameters, sensitivities, and complexity associated with evolving science demand increases required reliability, resiliency, and service levels in electrical, mechanical, and civil systems site wide. The CUIR project will address the critical campus-wide utility and infrastructure issues by replacing, repairing, and modernizing the highest risk water/fire protection, sanitary sewer, storm drain, electrical, and cooling water system deficiencies. Subject matter experts responsible for stewardship of the systems have identified these needs through condition assessments, inspections, and recommendations.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on January 21, 2022. The preliminary estimate for CD-3A, Approve Long Lead Procurements, is anticipated in the second quarter of FY 2023. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary Total Estimated Cost (TEC) range for this project is $160,000,000 to $306,000,000. The preliminary Total Project Cost (TPC) range for this project is $164,500,000 to $310,500,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

20-SC-80, Utilities Infrastructure Project, FNAL

The Utilities Infrastructure Project at FNAL will modernize the highest risk major utility systems across the FNAL campus. Specifically, this project will evaluate the current condition of the industrial cooling water system, potable water distribution system, sanitary sewer and storm collection systems, natural gas distribution system, electrical distribution system, and the Central Utility Building. Selected portions of the systems will be modernized to assure safe, reliable, and

efficient service to mission critical facilities. In addition, upgrades to obsolete, end-of-life components will increase capacity, reliability, and personnel safety for critical utilities.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, was approved on February 23, 2022. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the second quarter of FY 2024. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The current preliminary Total Estimated Cost (TEC) range for this project is $248,000,000 to $403,000,000 and the preliminary Total Project Cost (TPC) range of $252,000,000 to $407,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time.

19-SC-74, BioEPIC, LBNL

The BioEPIC project will construct a new, state-of-the-art facility with laboratory space to support high performance research by the BER, ASCR and BES programs. LBNL has grown from a pioneering particle and nuclear physics laboratory into a multidisciplinary research facility with broad capabilities in physical, chemical, computational, biological, and environmental systems research in support of the DOE mission. Much of the biological sciences program at LBNL is located offsite and away from the main laboratory and other parts are dispersed across several locations on the LBNL campus. This arrangement has posed a challenge to research and operational capabilities limiting scientific progress and the kind of collaborative science that is required for understanding, predicting, and harnessing the Earth's microbiome for energy and environmental benefits.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, CD-2/3, Approve Performance Baseline and Approve Start of Construction, was approved on September 13, 2021. The preliminary estimate for CD-4, Approve Start of Operations, is anticipated in the fourth quarter of FY 2027. The TEC point estimate for this project is $165,000,000 and the TPC point estimate for this project is $167,200,000.

Activities and Explanation of Changes

(dollars in thousands)

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted
Construction $173,700	**$208,350**	**+$34,650**
21-SC-71, Princeton Plasma Innovation Center, PPPL $150	$10,000	+$9,850
Funding initiates Project Engineering and Design (PED) activities.	The Request will support ongoing PED activities and initiate construction activities.	Funding will support the continuation of PED activities for this project and initiate construction activities.
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL $150	$4,000	+$3,850
Funding initiates PED activities.	The Request will support ongoing PED activities and initiate construction and associated activities.	Funding will support the continuation of PED activities for this project and enable the initiation of construction and associated activities.
21-SC-73, Ames Infrastructure Modernization $150	$ —	-$150
Funding initiates PED activities.	No funding is requested for this project in FY 2023.	No funding is requested for this project in FY 2023.

(dollars in thousands)

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted
20-SC-71, Critical Utilities Rehabilitation Project, BNL $20,000	$13,000	-$7,000
Funding supports construction activities.	The Request will support ongoing construction activities.	Funding will support ongoing construction activities for this project.
20-SC-72, Seismic and Safety Modernization, LBNL $5,000	$27,500	+$22,500
Funding initiates construction activities.	The Request will support construction and associated activities.	Funding will support ongoing construction and associated activities for this project.
20-SC-73, CEBAF Renovation and Expansion, TJNAF $2,000	$2,000	$ —
Funding supports ongoing PED activities.	The Request will support ongoing PED and construction activities.	Funding will support ongoing PED and construction activities for this project.
20-SC-74, Craft Resources Support Facility, ORNL $25,000	$ —	-$25,000
Funding supports the completion of construction activities.	Final funding for this project was received in FY 2021.	FY 2021 provided final funding for this project.
20-SC-75, Large Scale Collaboration Center, SLAC $11,000	$30,000	+$19,000
Funding supports ongoing construction activities.	The Request will support ongoing construction activities.	Funding will support ongoing construction for this project.
20-SC-76, Tritium System Demolition and Disposal, PPPL $13,000	$ —	-$13,000
Funding supports ongoing construction activities.	Final funding for the project is requested in FY 2022.	Final funding for this project is requested in FY 2022.
20-SC-77, Argonne Utilities Upgrade, ANL $500	$8,000	+$7,500
Funding supports ongoing PED activities.	The Request will support ongoing PED activities.	Funding will support ongoing PED activities for this project.

(dollars in thousands)

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted
20-SC-78, Linear Assets Modernization Project, LBNL $500	$23,425	+$22,925
Funding supports ongoing PED activities.	The Request will support ongoing PED activities and early construction activities.	Funding will support ongoing PED activities and the early construction activities for this project.
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC $500	$25,425	+$24,925
Funding supports ongoing PED activities.	The Request will support ongoing PED activities and initiate early construction activities.	Funding will support ongoing PED activities and the initiation of early construction activities for this project.
20-SC-80, Utilities Infrastructure Project, FNAL $500	$20,000	+$19,500
Funding supports ongoing PED activities.	The Request will support ongoing PED activities and initiate early construction activities.	Funding will support ongoing PED activities and the initiation of early construction activities for this project.
19-SC-71, Science User Support Center, BNL $20,000	$ —	-$20,000
Funding supports construction activities.	Final funding for this project is requested in FY 2022.	Final funding for this project is requested in FY 2022.
19-SC-73, Translational Research Capability, ORNL $22,000	$ —	-$22,000
Funding supports construction activities.	Final funding for this project is requested in FY 2022.	Final funding for this project is requested in FY 2022.
19-SC-74, BioEPIC, LBNL $20,000	$45,000	+$25,000
Funding supports construction activities.	The Request will support ongoing construction activities.	Funding will support ongoing construction activities for this project.

(dollars in thousands)

FY 2021 Enacted	FY 2023 Request	Explanation of Changes FY 2023 Request vs FY 2021 Enacted
18-SC-71, Energy Sciences Capability, PNNL $23,000	$ —	-$23,000
Funding supports the completion of construction activities.	Final funding for this project was received in FY 2021.	FY 2021 provided final funding for this project.
17-SC-71, Integrated Engineering Research Center, FNAL $10,250	$ —	-$10,250
Funding supports construction activities.	Final funding for this project is requested in FY 2022.	Final funding for this project is requested in FY 2022.

Science Laboratories Infrastructure
Capital Summary

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Capital Operating Expenses						
Minor Construction Activities						
General Plant Projects	N/A	N/A	29,590	17,000	15,000	-14,590
Total, Capital Operating Expenses	**N/A**	**N/A**	**29,590**	**17,000**	**15,000**	**-14,590**

Science Laboratories Infrastructure
Minor Construction Activities

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
General Plant Projects (GPP)						
GPPs (greater than or equal to $5M and less than $20M)						
Welcome and Access Center at FNAL	12,500	–	1,000	11,500	–	-1,000
Mission Critical Buildings Upgrade HVAC Systems at BNL	8,700	–	8,700	–	–	-8,700
Site-wide HVAC System Improvements at LBNL	15,000	–	15,000	–	–	-15,000
Steam to Hydronics Conversion Project at PNNL	7,000	–	–	1,600	5,400	+5,400
Emergency Generator Upgrades, Phase 1 at LBNL	5,500	–	–	–	5,500	+5,500
Total GPPs (greater than or equal to $5M and less than $20M)	N/A	N/A	24,700	13,100	10,900	-13,800
Total GPPs less than $5M	N/A	N/A	4,890	3,900	4,100	-790
Total, General Plant Projects (GPP)	**N/A**	**N/A**	**29,590**	**17,000**	**15,000**	**-14,590**
Total, Minor Construction Activities	**N/A**	**N/A**	**29,590**	**17,000**	**15,000**	**-14,590**

Note:

- *GPP activities less than $5M include design and construction for additions and/or improvements to land, buildings, replacements or addition to roads, and general area improvements. AIP activities less than $5M include minor construction at an existing accelerator facility.*

Science Laboratories Infrastructure
Institutional General Plant Projects (IGPP)

(dollars in thousands)

	Total	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Institutional General Plant Projects (IGPP)					
IGPPs (greater than or equal to $5M and less than $20M)					
Quantum Lab Renovations at ANL	6,000	6,000	—	—	-6,000
Bldg. 222 Lab Renovations at ANL	6,000	6,000	—	—	-6,000
Electrical Modernization Program at ANL	8,500	8,500	—	—	-8,500
Sitewide Fixed Generator installations and upgrades at LBNL	10,000	10,000	—	—	-10,000
Grizzly Substation Transformers Installation at LBNL	17,500	17,500	—	—	-17,500
Consolidate Power Operations at ORNL	5,000	5,000	—	—	-5,000
ESH Lab and Training Space at ORNL	10,100	10,100	—	—	-10,100
4501 Ventilation Safety Improvements at ORNL	5,000	5,000	—	—	-5,000
6007/6008 Shop and Change house mods at ORNL	8,000	8,000	—	—	-8,000
4500N Modifications at ORNL	9,600	9,600	—	—	-9,600
Remodel Life Sciences Laboratory 2 (LSL2) Labs 404-424 at PNNL	6,200	6,200	—	—	-6,200
B/396, User Housing at BNL	19,500	—	19,500	—	—
Autonomous Discovery Lab Renovations at ANL	10,000	—	10,000	—	—
Low Vibration EMF Capability at ORNL	9,600	—	9,600	—	—
4500N Wing 1 Buildout at ORNL	9,000	—	9,000	—	—
Space Renovation Program - Bldg. 368	8,000	—	8,000	—	—
Multiprogram Office Bldg. #2 at ORNL	8,000	—	8,000	—	—
Campus Parking Areas at ORNL	5,000	—	5,000	—	—
Infrastructure Major Upgrades/Improvements at SLAC	8,000	—	8,000	—	—
Former B7 Tensile Structure Installation at LBNL	7,000	—	7,000	—	—
7625 Cooling Tower Replacement at ORNL	7,000	—	7,000	—	—

(dollars in thousands)

	Total	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Space Renovation Programs - Bldg 368 at ANL	8,000	—	—	8,000	+8,000
B71 MEP Modernization at LBNL	13,000	—	—	13,000	+13,000
EGCR campus utilities at ORNL	9,000	—	—	9,000	+9,000
7667 LLW site improvements at ORNL	7,000	—	—	7,000	+7,000
Advanced Secure Communications New Build at PNNL	19,000	—	—	19,000	+19,000
300 Area Utilities Improvements at PNNL	11,000	—	—	11,000	+11,000
General Purpose Lab New Build at PNNL	13,000	—	—	13,000	+13,000
Richland North Office Building New Build at PNNL	13,000	—	—	13,000	+13,000
PNNL Richland Central Infrastructure at PNNL	6,000	—	—	6,000	+6,000
Total IGPPs (greater than or equal to $5M and less than $20M)	282,000	91,900	91,100	99,000	+7,100
Total IGPPs less than $5M	93,942	37,780	27,285	28,877	-8,903
Total, Institutional General Plant Projects (IGPP)	**381,942**	**129,680**	**118,385**	**133,877**	**+4,197**
Total, Minor Construction Activities	**463,032**	**159,270**	**135,385**	**168,377**	**+9,107**

Note:

- *Institutional General Plant Projects (IGPPs) are indirect funded minor construction activities that are general institutional in nature and address general purpose, site-wide needs.*

Science Laboratories Infrastructure
Construction Projects Summary

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
22-SC-71, Critical Infrastructure Modernization Project, ORNL						
Total Estimated Cost (TEC)	403,329	–	–	1,000	–	–
Other Project Cost (OPC)	4,000	500	750	750	–	-750
Total Project Cost (TPC)	**407,329**	**500**	**750**	**1,750**	**–**	**-750**
22-SC-72, Thomas Jefferson Infrastructure Improvements, TJNAF						
Total Estimated Cost (TEC)	92,000	–	–	1,000	–	–
Other Project Cost (OPC)	1,000	–	1,000	–	–	-1,000
Total Project Cost (TPC)	**93,000**	**–**	**1,000**	**1,000**	**–**	**-1,000**
21-SC-71, Princeton Plasma Innovation Center, PPPL						
Total Estimated Cost (TEC)	96,300	–	150	900	10,000	+9,850
Other Project Cost (OPC)	1,840	1,410	90	–	–	-90
Total Project Cost (TPC)	**98,140**	**1,410**	**240**	**900**	**10,000**	**+9,760**
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL						
Total Estimated Cost (TEC)	87,300	–	150	2,000	4,000	+3,850
Other Project Cost (OPC)	1,700	1,052	300	–	–	-300
Total Project Cost (TPC)	**89,000**	**1,052**	**450**	**2,000**	**4,000**	**+3,550**
21-SC-73, Ames Infrastructure Modernization						
Total Estimated Cost (TEC)	26,000	–	150	2,000	–	-150
Other Project Cost (OPC)	1,075	75	200	225	–	-200
Total Project Cost (TPC)	**27,075**	**75**	**350**	**2,225**	**–**	**-350**

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
20-SC-71, Critical Utilities Rehabilitation Project, BNL						
Total Estimated Cost (TEC)	92,000	20,000	20,000	26,000	13,000	-7,000
Other Project Cost (OPC)	1,000	410	590	–	–	-590
Total Project Cost (TPC)	**93,000**	**20,410**	**20,590**	**26,000**	**13,000**	**-7,590**
20-SC-72, Seismic Safety and Infrastructure Upgrades, LBNL						
Total Estimated Cost (TEC)	95,400	10,000	5,000	27,500	27,500	+22,500
Other Project Cost (OPC)	2,200	1,070	–	–	–	–
Total Project Cost (TPC)	**97,600**	**11,070**	**5,000**	**27,500**	**27,500**	**+22,500**
20-SC-73, CEBAF Renovation and Expansion, TJNAF						
Total Estimated Cost (TEC)	87,000	2,000	2,000	10,000	2,000	–
Other Project Cost (OPC)	3,000	1,467	–	–	600	+600
Total Project Cost (TPC)	**90,000**	**3,467**	**2,000**	**10,000**	**2,600**	**+600**
20-SC-74, Craft Resources Support Facility, ORNL						
Total Estimated Cost (TEC)	40,000	15,000	25,000	–	–	-25,000
Other Project Cost (OPC)	1,000	850	–	–	–	–
Total Project Cost (TPC)	**41,000**	**15,850**	**25,000**	**–**	**–**	**-25,000**
20-SC-75, Large Scale Collaboration Center, SLAC						
Total Estimated Cost (TEC)	64,000	11,000	11,000	12,000	30,000	+19,000
Other Project Cost (OPC)	2,000	504	–	–	400	+400
Total Project Cost (TPC)	**66,000**	**11,504**	**11,000**	**12,000**	**30,400**	**+19,400**

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
20-SC-76, Tritium System Demolition and Disposal, PPPL						
Total Estimated Cost (TEC)	32,400	13,000	13,000	6,400	–	-13,000
Other Project Cost (OPC)	1,000	900	100	–	–	-100
Total Project Cost (TPC)	**33,400**	**13,900**	**13,100**	**6,400**	**–**	**-13,100**
20-SC-77, Argonne Utilities Upgrade, ANL						
Total Estimated Cost (TEC)	215,000	500	500	500	8,000	+7,500
Other Project Cost (OPC)	1,000	700	300	–	–	-300
Total Project Cost (TPC)	**216,000**	**1,200**	**800**	**500**	**8,000**	**+7,200**
20-SC-78, Linear Assets Modernization Project, LBNL						
Total Estimated Cost (TEC)	236,000	500	500	500	23,425	+22,925
Other Project Cost (OPC)	4,980	673	1,230	500	–	-1,230
Total Project Cost (TPC)	**240,980**	**1,173**	**1,730**	**1,000**	**23,425**	**+21,695**
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC						
Total Estimated Cost (TEC)	204,000	500	500	500	25,425	+24,925
Other Project Cost (OPC)	3,928	323	1,000	–	–	-1,000
Total Project Cost (TPC)	**207,928**	**823**	**1,500**	**500**	**25,425**	**+23,925**
20-SC-80, Utilities Infrastructure Project, FNAL						
Total Estimated Cost (TEC)	310,000	500	500	500	20,000	+19,500
Other Project Cost (OPC)	4,930	1,500	1,530	500	–	-1,530
Total Project Cost (TPC)	**314,930**	**2,000**	**2,030**	**1,000**	**20,000**	**+17,970**
19-SC-71, Science User Support Center at BNL						
Total Estimated Cost (TEC)	85,000	27,000	20,000	38,000	–	-20,000
Other Project Cost (OPC)	1,200	1,200	–	–	–	–
Total Project Cost (TPC)	**86,200**	**28,200**	**20,000**	**38,000**	**–**	**-20,000**

(dollars in thousands)

	Total	Prior Years	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
19-SC-72, Electrical Capacity and Distribution Capability, ANL						
Total Estimated Cost (TEC)	60,000	60,000	–	–	–	–
Other Project Cost (OPC)	1,000	1,000	–	–	–	–
Total Project Cost (TPC)	**61,000**	**61,000**	**–**	**–**	**–**	**–**
19-SC-73, Translational Research Capacity, ORNL						
Total Estimated Cost (TEC)	93,500	50,000	22,000	21,500	–	-22,000
Other Project Cost (OPC)	1,500	1,400	–	–	–	–
Total Project Cost (TPC)	**95,000**	**51,400**	**22,000**	**21,500**	**–**	**-22,000**
19-SC-74, BioEPIC Building						
Total Estimated Cost (TEC)	165,000	20,000	20,000	35,000	45,000	+25,000
Other Project Cost (OPC)	2,200	1,536	–	–	–	–
Total Project Cost (TPC)	**167,200**	**21,536**	**20,000**	**35,000**	**45,000**	**+25,000**
18-SC-71, Energy Sciences Capability, PNNL						
Total Estimated Cost (TEC)	90,000	67,000	23,000	–	–	-23,000
Other Project Cost (OPC)	3,000	1,362	–	1,638	–	–
Total Project Cost (TPC)	**93,000**	**68,362**	**23,000**	**1,638**	**–**	**-23,000**
17-SC-71, Integrated Engineering Research Center at FNAL						
Total Estimated Cost (TEC)	85,000	64,500	10,250	10,250	–	-10,250
Other Project Cost (OPC)	1,000	950	–	50	–	–
Total Project Cost (TPC)	**86,000**	**65,450**	**10,250**	**10,300**	**–**	**-10,250**
Total, Construction						
Total Estimated Cost (TEC)	**N/A**	**N/A**	**173,700**	**195,550**	**208,350**	**+34,650**
Other Project Cost (OPC)	**N/A**	**N/A**	**7,090**	**3,663**	**1,000**	**-6,090**
Total Project Cost (TPC)	**N/A**	**N/A**	**180,790**	**199,213**	**209,350**	**+28,560**

Science Laboratories Infrastructure
Funding Summary

(dollars in thousands)

	FY 2021 Enacted	FY 2022 Annualized CR	FY 2023 Request	FY 2023 Request vs FY 2021 Enacted
Projects				
Line Item Construction (LIC)	173,700	191,550	208,350	+34,650
Total, Projects	**173,700**	**191,550**	**208,350**	**+34,650**
Other	66,300	48,450	46,650	-19,650
Total, Science Laboratories Infrastructure	**240,000**	**240,000**	**255,000**	**+15,000**

21-SC-71, Princeton Plasma Innovation Center, PPPL
Princeton Plasma Physics Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Princeton Plasma Innovation Center (PPIC) project is $10,000,000 of Total Estimated Cost (TEC) funding. The TEC range for this project is $78,300,000 to $96,300,000. The preliminary Total Project Cost (TPC) range for this project is $80,500,000 to $98,500,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $98,500,000.

This project will provide a multi-purpose facility with modern, flexible, efficient, and agile research laboratories and office space to conduct plasma research activities in support of multiple SC programs.

Significant Changes

This project was initiated in FY 2021. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on January 22, 2021. FY 2023 funds will support Project Engineering and Design (PED) activities, long lead procurement, site preparation activities, and construction activities after the appropriate CD approvals.

A Federal Project Director has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	9/9/19	N/A	4Q FY 2020	2Q FY 2022	N/A	2Q FY 2023	N/A	4Q FY 2029
FY 2022	9/9/19	8/25/20	1/22/21	4Q FY 2023	1Q FY 2024	2Q FY 2024	N/A	4Q FY 2028
FY 2023	9/9/19	8/25/20	1/22/21	2Q FY 2024	2Q FY 2024	2Q FY 2024	N/A	1Q FY 2029

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	N/A	2Q FY 2022
FY 2022	4Q FY 2023	4Q FY 2023
FY 2023	2Q FY 2024	4Q FY 2023

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	9,000	100,000	109,000	2,500	2,500	111,500
FY 2022	8,900	87,400	96,300	2,200	2,200	98,500
FY 2023	8,900	87,400	96,300	2,200	2,200	98,500

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The Princeton Plasma Innovation Center (PPIC) is envisioned as a 77,000 to 107,000 gross square feet (gsf) multi-story office and laboratory building at Princeton Plasma Physics Laboratory (PPPL) to serve as a single new multi-use facility that will house space for offices, medium bay research labs for diagnostics and fabrication, remote experiment participation and collaboration, and research support.

Justification

To advance the plasma science and fusion frontier in support of the DOE mission, PPPL requires new or enhanced facilities and infrastructure to foster innovation to make fusion energy a practical reality and further U.S. economic competitiveness. The primary SC program relevant to the PPIC project is Fusion Energy Sciences (FES), and the primary Core Capability is Plasma and Fusion Energy Sciences. The missions of SC's Advanced Scientific Computing Research and Basic Energy Sciences programs are also relevant to the mission need for the PPIC with second order effect to Large Scale User Facilities/Advanced Instrumentation and Systems Engineering and Integration.

PPPL plays a key role in assisting FES achieve its strategic goals. The PPPL vision is "enabling a world powered by safe, clean, and plentiful fusion energy while leading discoveries in plasma science and technology." To support this vision, PPPL carries out experiments and computer simulations of the behavior of plasma, which is hot electrically charged gas. Plasmas with sufficient temperature generate fusion reactions. Therefore, PPPL's aim is to be a leading center for future fusion concepts. The understanding of plasma and its related technologies also has a broad impact on many other scientific fields and applications that are central to U.S. economic health and competitiveness. This impact extends to astrophysics and space sciences, plasma-material interactions, plasma processing, particle acceleration, and high energy density plasmas. Many industries, such as the microelectronics industry, utilize plasmas to synthesize and shape the materials in their products. These industries are increasingly seeking collaboration with PPPL to improve their understanding of existing plasma processes and to develop new modeling and measurement techniques potentially leading to new processes and applications. PPPL, in collaboration with Princeton University, is strengthening its efforts to develop innovations for the next generation microelectronics to advance economic competitiveness, national security, and future energy applications.

However, the current condition, capabilities, and configuration of PPPL infrastructure do not adequately support current or planned scientific efforts. In particular, the lack of adequate laboratory infrastructure, modern collaboration space, and modern office infrastructure are not optimal to support PPPL research. PPPL would benefit from office and laboratories capabilities that can effectively accomplish the advancement of the FES mission.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multi-Story Building	77,000 gsf	107,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2021	150	150	–
FY 2022	900	900	–
FY 2023	7,850	7,850	6,000
Outyears	–	–	2,900
Total, Design (TEC)	**8,900**	**8,900**	**8,900**
Construction (TEC)			
FY 2023	2,150	2,150	–
Outyears	85,250	85,250	87,400
Total, Construction (TEC)	**87,400**	**87,400**	**87,400**
Total Estimated Cost (TEC)			
FY 2021	150	150	–
FY 2022	900	900	–
FY 2023	10,000	10,000	6,000
Outyears	85,250	85,250	90,300
Total, TEC	**96,300**	**96,300**	**96,300**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	10	10	10
FY 2020	1,400	1,400	1,400
FY 2021	450	450	450
Outyears	340	340	340
Total, OPC	**2,200**	**2,200**	**2,200**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	10	10	10
FY 2020	1,400	1,400	1,400
FY 2021	600	600	450
FY 2022	900	900	–
FY 2023	10,000	10,000	6,000
Outyears	85,590	85,590	90,640
Total, TPC	**98,500**	**98,500**	**98,500**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	7,900	7,900	**N/A**
Design - Contingency	1,000	1,000	**N/A**
Total, Design (TEC)	**8,900**	**8,900**	**N/A**
Construction	72,000	72,000	**N/A**
Construction - Contingency	15,400	15,400	**N/A**
Total, Construction (TEC)	**87,400**	**87,400**	**N/A**
Total, TEC	**96,300**	**96,300**	**N/A**
Contingency, TEC	*16,400*	*16,400*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	300	300	**N/A**
Conceptual Design	1,700	1,700	**N/A**
OPC - Contingency	200	200	**N/A**
Total, Except D&D (OPC)	**2,200**	**2,200**	**N/A**
Total, OPC	**2,200**	**2,200**	**N/A**
Contingency, OPC	*200*	*200*	***N/A***
Total, TPC	**98,500**	**98,500**	**N/A**
Total, Contingency (TEC+OPC)	***16,600***	***16,600***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	—	2,000	—	—	107,000	109,000
	OPC	2,300	—	—	—	200	2,500
	TPC	2,300	2,000	—	—	107,200	111,500
FY 2022	TEC	—	150	7,750	—	88,400	96,300
	OPC	1,410	90	—	—	700	2,200
	TPC	1,410	240	7,750	—	89,100	98,500
FY 2023	TEC	—	150	900	10,000	85,250	96,300
	OPC	1,410	450	—	—	340	2,200
	TPC	1,410	600	900	10,000	85,590	98,500

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2029
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2079

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs[ggg]	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	1,336	1,336	46,774	46,774
Utilities	198	198	6,936	6,936
Maintenance and Repair	1,518	1,518	53,154	53,154
Total, Operations and Maintenance	3,052	3,052	106,864	106,864

[ggg] Life-Cycle costs will be performed as part of CD-1.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Princeton Plasma Physics Laboratory	77,000-107,000
Area of D&D in this project at Princeton Plasma Physics Laboratory	None
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[hhh]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	13,400

8. Acquisition Approach

The PPPL Management and Operating (M&O) Contractor, Princeton University, is performing the acquisition for this project, overseen by the Princeton Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. It will evaluate various acquisition and project delivery methods prior to achieving CD-1 and potential benefits of using single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. The M&O Contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

[hhh] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL
Princeton Plasma Physics Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Critical Infrastructure Recovery & Renewal (CIRR) project is $4,000,000 of Total Estimated Cost (TEC) funding. The preliminary TEC range for this project is $80,100,000 to $96,000,000. The preliminary Total Project Cost (TPC) range for this project is $81,800,000 to $97,700,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $89,000,000.

Princeton Plasma Physics Laboratory's (PPPL's) increasingly unreliable, non-redundant, utility infrastructure is negatively impacting laboratory operations. Scientific productivity is dependent on a capable, available, flexible, maintainable, reliable, and resilient support infrastructure. This project will provide critical infrastructure needed to operate the laboratory missions safely and efficiently. These systems will be modern and energy efficient, reducing the operating cost and improving the resilience of the facilities.

Significant Changes

This project was a new start in the FY 2021 Request. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on February 23, 2021. FY 2023 funds will continue Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level was assigned to this project at CD-1 approval.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	9/16/19	N/A	2Q FY 2020	4Q FY 2022	4Q FY 2023	4Q FY 2023	N/A	4Q FY 2029
FY 2022	9/16/19	2Q FY 2021	2/23/21	3Q FY 2024	1Q FY 2024	3Q FY 2024	N/A	4Q FY 2029
FY 2023	9/16/19	2/23/21	2/23/21	3Q FY 2024	2Q FY 2024	3Q FY 2024	N/A	4Q FY 2028

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2022	1Q FY 2023
FY 2022	3Q FY 2024	3Q FY 2023
FY 2023	3Q FY 2024	3Q FY 2023

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	8,000	72,400	80,400	1,500	1,500	81,900
FY 2022	9,800	77,300	87,100	1,900	1,900	89,000
FY 2023	9,950	77,350	87,300	1,700	1,700	89,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The CIRR project at PPPL will revitalize critical infrastructure that supports the PPPL campus to ensure reliability and resilience. Upgrades that may be completed as part of the CIRR project include: the electrical distribution system; standby power; chilled water generation and distribution; distribution networks for steam, compressed air, sanitary waste, and condenser, storm, canal, and potable water; HVAC systems; and communication systems. The scientific activities that require reliable and resilient utilities include: NSTX-U; LTX-β; and FLARE.

Justification

PPPL is a significant element of the DOE capability in plasma science and directly supports the DOE mission to make fusion energy a practical reality and further U.S. economic competitiveness. To maintain system operability, it is essential to have reliable infrastructure in place. The current systems are at capacity, unreliable, and inefficient. Portions of the current system are part of the original infrastructure built in 1958. To maintain current missions and enable future ones, the infrastructure must be upgraded with modern, efficient, and reliable systems.

CIRR will deliver significantly more modern and resilient general-purpose infrastructure. The combination of data collection and artificial intelligent monitoring systems will be able to adjust to trends, predict maintenance requirements, and react to extreme weather events, such as automatically transfer power to minimize impacts to mission critical scientific operations. Additionally, modern utility systems will be more efficient and sustainable. For example, replacing the obsolete hot deck/cold deck HVAC system will not only result in repair savings, but will generate significant energy savings as well. Every element of this project will be designed to consider the best available and most efficient technology.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The Key Performance Parameters (KPPs) are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
▪ Chilled Water Generation	▪ Improve configuration and efficiency of the Central Chilled Water Plant to ensure distribution of 1,200 tons of cooling capacity to the site.	▪ N/A
▪ Communications Distribution Network	▪ Improve data infrastructure cabling and components by replacing existing copper cable with 2,000 linear feet of cat 6 cable. ▪ Provide 2,500 linear feet of 48 strand network fiber cable connected to the PU Computer Center. ▪ Provide 15,000 linear feet of 24 strand fiber optic cable to support site wide communication.	▪ Threshold plus upgrade additional communication system components to improve security, reliability, and flexibility.
▪ Electrical Distribution & Standby Power	▪ Create redundancy and improve mission readiness of the primary electrical distribution system in the 138 kV Yard. ▪ Provide site-wide capacity of standby generation at 3,500 KW. ▪ Upgrade 8 Substations for priority buildings and facilities.	▪ Increase site-wide capacity of standby generation up to 4,350 KW. ▪ Upgrade up to 10 substations for additional buildings/facilities to improve flexibility for maintenance and operations.
▪ HVAC Systems	▪ Upgrade 8 HVAC system equipment for priority buildings on C-Site and D-Site.	▪ Upgrade up to 14 HVAC system equipment for additional buildings to meet sustainability goals and improve maintenance and operations.
▪ Underground Distribution Network	▪ Replace all failed critical underground piping, valves, and components for campus utilities. ▪ Replace 1,700 linear feet of electrical feeders (26kv) for improved reliability. ▪ Upgrade 9,500 sqft. of Storm Retention Basin liner.	▪ Threshold plus upgrade additional underground system components to improve maintenance and reliability.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2021	150	150	–
FY 2022	2,000	2,000	1,000
FY 2023	4,000	4,000	4,000
Outyears	3,800	3,800	4,950
Total, Design (TEC)	**9,950**	**9,950**	**9,950**
Construction (TEC)			
Outyears	77,350	77,350	77,350
Total, Construction (TEC)	**77,350**	**77,350**	**77,350**
Total Estimated Cost (TEC)			
FY 2021	150	150	–
FY 2022	2,000	2,000	1,000
FY 2023	4,000	4,000	4,000
Outyears	81,150	81,150	82,300
Total, TEC	**87,300**	**87,300**	**87,300**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	6	6	6
FY 2020	1,046	1,046	1,046
FY 2021	300	300	300
Outyears	348	348	348
Total, OPC	**1,700**	**1,700**	**1,700**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	6	6	6
FY 2020	1,046	1,046	1,046
FY 2021	450	450	300
FY 2022	2,000	2,000	1,000
FY 2023	4,000	4,000	4,000
Outyears	81,498	81,498	82,648
Total, TPC	**89,000**	**89,000**	**89,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	7,600	7,600	**N/A**
Design - Contingency	2,350	2,200	**N/A**
Total, Design (TEC)	**9,950**	**9,800**	**N/A**
Construction	59,500	59,400	**N/A**
Construction - Contingency	17,850	17,900	**N/A**
Total, Construction (TEC)	**77,350**	**77,300**	**N/A**
Total, TEC	**87,300**	**87,100**	**N/A**
Contingency, TEC	*20,200*	*20,100*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	200	200	**N/A**
Conceptual Design	1,300	1,500	**N/A**
OPC - Contingency	200	200	**N/A**
Total, Except D&D (OPC)	**1,700**	**1,900**	**N/A**
Total, OPC	**1,700**	**1,900**	**N/A**
Contingency, OPC	*200*	*200*	***N/A***
Total, TPC	**89,000**	**89,000**	**N/A**
Total, Contingency (TEC+OPC)	***20,400***	***20,300***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	—	2,000	—	—	78,400	80,400
	OPC	1,300	—	—	—	200	1,500
	TPC	1,300	2,000	—	—	78,600	81,900
FY 2022	TEC	—	150	2,000	—	84,950	87,100
	OPC	1,052	300	—	—	548	1,900
	TPC	1,052	450	2,000	—	85,498	89,000
FY 2023	TEC	—	150	2,000	4,000	81,150	87,300
	OPC	1,052	300	—	—	348	1,700
	TPC	1,052	450	2,000	4,000	81,498	89,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2028
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs[iii]	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	1,100	1,100	55,000	55,000
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	1,000	1,000	50,000	50,000
Total, Operations and Maintenance	2,100	2,100	105,000	105,000

[iii] Life-Cycle costs will be performed as part of CD-1.

7. D&D Information

This project replaces critical infrastructure components; no new construction area is anticipated to be constructed in this project and it will not replace existing facilities.

	Square Feet
New area being constructed by this project at Princeton Plasma Physics Laboratory	None
Area of D&D in this project at Princeton Plasma Physics Laboratory	None
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[jjj]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The PPPL Management and Operating (M&O) Contractor, Princeton University, will perform the acquisition for this project, overseen by the Princeton Site Office. The M&O Contractor will be responsible for awarding and managing all subcontracts related to the project. It will evaluate various acquisition and project delivery methods prior to achieving CD-1 and potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. The M&O Contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

[jjj] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-71, Critical Utilities Rehabilitation Project, BNL
Brookhaven National Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Critical Utilities Rehabilitation Project (CURP) is $13,000,000 of Total Estimated Cost (TEC) funding. The preliminary TEC range for this project is $70,000,000 to $92,000,000. The preliminary Total Project Cost (TPC) range for this project is $71,000,000 to $93,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $93,000,000.

This project will upgrade failing utility infrastructure that is still in use from BNL's origins as World War II Army Camp Upton. Utility systems including steam, water, sanitary sewer, chilled water, and electrical systems will be revitalized and upgraded to meet the needs of supporting SC facilities and the Nuclear Physics (NP), Basic Energy Sciences (BES), High Energy Physics (HEP), Biological and Environmental Research (BER), and Advanced Scientific Computing Research (ASCR) programs. The project will address the most critical vulnerabilities and assure reliable and stable utility services to mission critical facilities. By replacing failure-prone and inefficient equipment the utility systems will be revitalized and made more efficient.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1/3A, Approve Alternate Selection and Cost Range/Approve Long Lead Procurements, which was approved on February 6, 2020. The project is constructing long lead procurements in accordance with the approved CD-3A scope. FY 2023 funds will support construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than $50,000,000 and equal to or less than $100,000,000) was assigned to this project at CD-1.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2020	7/20/18	4Q FY 2019	4Q FY 2019	4Q FY 2020	4Q FY 2021	4Q FY 2021	N/A	4Q FY 2026
FY 2021	7/20/18	4Q FY 2019	2Q FY 2020	2Q FY 2021	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2024
FY 2022	7/20/18	8/16/19	2/6/20	2Q FY 2022	4Q FY 2023	2Q FY 2022	N/A	4Q FY 2025
FY 2023	7/20/18	8/16/19	2/6/20	3Q FY 2022	4Q FY 2023	3Q FY 2022	N/A	4Q FY 2025

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2020	4Q FY 2020	N/A
FY 2021	4Q FY 2020	2Q FY 2020
FY 2022	2Q FY 2022	2/6/20
FY 2023	2Q FY 2022	2/6/20

CD-3A – Approve Long-Lead Procurements, Original Scope

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2020	8,500	76,500	85,000	800	800	85,800
FY 2021	7,100	84,900	92,000	800	800	92,800
FY 2022	10,400	81,600	92,000	1,000	1,000	93,000
FY 2023	10,400	81,600	92,000	1,000	1,000	93,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

CURP's scope is to revitalize and upgrade the highest risk major utility systems across the BNL campus by replacing piping in areas prone to water main breaks and provide other water system improvements to improve system operations and reliability. The project will also replace select sections of the sanitary utility systems with failing pumps, controllers, and/or manholes, and provide several required modifications to the central chilled water system in order to support growth of process loads and assure reliability. CURP will replace deteriorated and leaking steam systems along Cornell Avenue to assure safe, reliable, and efficient steam service to mission critical facilities on the north side of the campus. Also, older feeder cables and inadequate breakers will be replaced to increase capacity, reliability, and personnel safety.

Justification

BNL is a multi-program DOE national laboratory with recognized impact on national science needs. BNL provides scientific leadership in NP, photon sciences, energy science for BES, and data-driven discovery for ASCR, with leading programs in selected areas of HEP, BER, accelerator science and technology, and national security and non-proliferation. BNL utilizes world-class facilities and core expertise to: advance energy and environment-related basic research and apply them to 21st century problems of critical importance to the Nation; and advance fundamental research in nuclear and particle physics to gain a deeper understanding of matter, energy, space, and time.

Although there has been substantial investment in recent years to modernize and construct new research facilities at BNL, much of BNL's utility infrastructure serving these facilities is over 50 years old and some is over 70 years old, dating to BNL's origin as a U.S. Army base during World Wars I and II. Efficient, maintainable, and reliable utilities are critical to the success and mission capability of BNL's research facilities. Currently, a significant portion of BNL's utility infrastructure is beyond useful life and suffering from failures, decreased reliability, lack of redundancy, and limitations in capacity. For example, a June 2021 failure of a condensate pipe in the steam system will require approximately $3.2 million of repairs as part of the

CURP project. As such, there is an urgent need to revitalize and selectively upgrade BNL's existing major utility systems to assure reliable service, meet capacity requirements, and enable readiness of facilities critical to the research mission.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
▪ Rehabilitate and selectively upgrade BNL's existing major utility systems including steam, water, sanitary sewer, chilled water, and electrical systems	**Chilled Water**	
	▪ Replace one 1250 ton Centrifugal Chiller, refrigerant alarm, and chemical injection system at the Central Chilled Water Facility (CCWF)	▪ Install new Reduced Pressure Zone's and chemical injection systems on various cooling towers
		▪ Replace additional Chillers
	Steam	
	▪ Replace 1 Manhole	▪ Replace manholes, steam, and condensate piping, valves, and equipment within 18 manholes
	▪ Replace 3,000 LF steam/condensate	▪ Replace up to approximately 10 miles steam and/or condensate piping site wide
	▪ Replace obsolete control systems, install economizer on boiler and build 200SF extension on B610	▪ Upgrade B610 Building Envelope
		▪ Replace generators and associated switchgear.
		▪ Replace Boiler 1A & stack in B610
	Potable Water	
	▪ Rebuild Wellhouse # 12 & Granular Activated Carbon System (CD-3A)	▪ Replace up to approximately 35 miles of water mains, valves, hydrants, and service lines site wide
	▪ Replace and demolish 300,000-gallon water tank (CD-3A)	▪ Repair/revitalize 1 million Gallon water tank
	▪ Replace/add 5 isolation valves	▪ Replace/add up to 40 isolation valves
	Electrical	
	▪ Install new 13.8KV feeder B603 to B600 to serve as an alternate to B600 & NSLS II	▪ Replace 69KV Oil Circuit Breaker
	▪ Refurbish 30 magnablast breakers in substation 603	▪ Install new 13.8KV feeder from substation 603 to Renaissance Road
		▪ Install new 13.SKV feeder from Renaissance to Technology Drive

Performance Measure	Threshold	Objective
	Sanitary Sewer	
	▪ Replace 4 lift stations site wide	▪ Replace up to 40 lift stations site wide
	▪ Re-line 200LF of sewer lines & refurbish 1 manhole	▪ Re-line up to approximately 35 miles of sewer lines & replace 40 manholes
		▪ Install storage facility chemical dosing system at B575
		▪ Recoat aeration and aerobic digester tanks
		▪ Demolish primary clarifier tank

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	10,000	10,000	–
FY 2021	400	400	740
FY 2022	–	–	7,190
FY 2023	–	–	2,470
Total, Design (TEC)	**10,400**	**10,400**	**10,400**
Construction (TEC)			
FY 2020	10,000	10,000	89
FY 2021	19,600	19,600	200
FY 2022	26,000	26,000	13,000
FY 2023	13,000	13,000	26,000
Outyears	13,000	13,000	42,311
Total, Construction (TEC)	**81,600**	**81,600**	**81,600**
Total Estimated Cost (TEC)			
FY 2020	20,000	20,000	89
FY 2021	20,000	20,000	940
FY 2022	26,000	26,000	20,190
FY 2023	13,000	13,000	28,470
Outyears	13,000	13,000	42,311
Total, TEC	**92,000**	**92,000**	**92,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2020	410	410	410
FY 2021	590	590	590
Total, OPC	**1,000**	**1,000**	**1,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2020	20,410	20,410	499
FY 2021	20,590	20,590	1,530
FY 2022	26,000	26,000	20,190
FY 2023	13,000	13,000	28,470
Outyears	13,000	13,000	42,311
Total, TPC	**93,000**	**93,000**	**93,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	8,320	8,320	**N/A**
Design - Contingency	2,080	2,080	**N/A**
Total, Design (TEC)	**10,400**	**10,400**	**N/A**
Construction	65,280	65,280	**N/A**
Construction - Contingency	16,320	16,320	**N/A**
Total, Construction (TEC)	**81,600**	**81,600**	**N/A**
Total, TEC	**92,000**	**92,000**	**N/A**
Contingency, TEC	*18,400*	*18,400*	***N/A***
Other Project Cost (OPC)			
Conceptual Design	1,000	1,000	**N/A**
Total, Except D&D (OPC)	**1,000**	**1,000**	**N/A**
Total, OPC	**1,000**	**1,000**	**N/A**
Contingency, OPC	***N/A***	*N/A*	***N/A***
Total, TPC	**93,000**	**93,000**	**N/A**
Total, Contingency (TEC+OPC)	***18,400***	***18,400***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	12,000	—	—	—	73,000	85,000
	OPC	800	—	—	—	—	800
	TPC	12,800	—	—	—	73,000	85,800
FY 2021	TEC	20,000	15,000	—	—	57,000	92,000
	OPC	800	—	—	—	—	800
	TPC	20,800	15,000	—	—	57,000	92,800
FY 2022	TEC	20,000	20,000	26,000	—	26,000	92,000
	OPC	410	590	—	—	—	1,000
	TPC	20,410	20,590	26,000	—	26,000	93,000
FY 2023	TEC	20,000	20,000	26,000	13,000	13,000	92,000
	OPC	410	590	—	—	—	1,000
	TPC	20,410	20,590	26,000	13,000	13,000	93,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2025
Expected Useful Life	Varies by System
Expected Future Start of D&D of this capital asset	4Q FY 2025

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	N/A	N/A	N/A
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	N/A	N/A	N/A	N/A
Total, Operations and Maintenance	N/A	N/A	N/A	N/A

7. D&D Information

This project replaces critical infrastructure components and minimal, if any, support buildings will be constructed. The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Brookhaven National Laboratory	None
Area of D&D in this project at Brookhaven National Laboratory	None
Area at Brookhaven National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[kkk]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The BNL Management and Operating (M&O) Contractor, Brookhaven Science Associates, will perform the acquisition for this project, overseen by the Brookhaven Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project and will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-2. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build, construction manager/general contractor methods, and design-build. The M&O contractor will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. The M&O contractor's annual performance and evaluation measurement plan will include project performance metrics on which it will be evaluated.

[kkk] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-72, Seismic and Safety Modernization, LBNL
Lawrence Berkeley National Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Seismic and Safety Modernization (SSM) project is $27,500,000 of Total Estimated Cost (TEC) funding. The TEC range for this project is $76,300,000 to $95,400,000. The preliminary Total Project Cost (TPC) range for this project is $78,500,000 to $97,600,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $97,600,000.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on September 4, 2019. FY 2023 funds will support construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than $50,000,000 and equal to or less than $100,000,000) has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2020	9/6/18	4Q FY 2019	4Q FY 2019	4Q FY 2021	4Q FY 2022	4Q FY 2022	N/A	4Q FY 2027
FY 2021	9/6/18	6/17/19	9/4/19	3Q FY 2021	1Q FY 2022	2Q FY 2022	N/A	2Q FY 2027
FY 2022	9/6/18	6/17/19	9/4/19	1Q FY 2022	1Q FY 2022	1Q FY 2023	N/A	4Q FY 2026
FY 2023	9/6/18	6/17/19	9/4/19	1Q FY 2023	1Q FY 2023	1Q FY 2023	N/A	1Q FY 2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2020	4Q FY 2021	N/A
FY 2021	3Q FY 2021	3Q FY 2021
FY 2022	1Q FY 2022	1Q FY 2022
FY 2023	1Q FY 2023	1Q FY 2023

CD-3A – Approve Long-Lead Procurement and Site Preparation Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2020	10,000	85,400	95,400	2,200	2,200	97,600
FY 2021	10,000	85,400	95,400	2,200	2,200	97,600
FY 2022	9,000	86,400	95,400	2,200	2,200	97,600
FY 2023	9,000	86,400	95,400	2,200	2,200	97,600

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The SSM project will construct a new facility on the existing cafeteria site to house the cafeteria, health services and operational support services (human resources, conferencing, and other potential groups) to meet the requirements of Risk Category III of the California Building Code (CBC). In addition, the second floor of the B48 (Fire House) will be seismically upgraded to meet Risk Category IV of the CBC.

Justification

Lawrence Berkeley National Laboratory (LBNL) executes 22 of the Office of Science's (SC'S) 24 core capabilities and the mission of multiple SC program offices, with specifically strong presences of the Advanced Scientific Computing Research (ASCR), Biological and Environment Research (BER), Basic Energy Sciences (BES), and High Energy Physics (HEP) programs. LBNL is located on a 202-acre site in the hills above the University of California, Berkeley campus employs approximately 3,400 full time employees; and is home to five SC national user facilities: the Advanced Light Source, the Energy Sciences Network, the Joint Genome Institute, the Molecular Foundry, and the National Energy Research Scientific Computing Center. In FY 2016, over 11,000 researchers used these facilities, representing roughly one third of the total for all SC user facilities. In pursuing the SC mission, LBNL leverages collaborative science to bring together teams of individuals with different fields of expertise to work together on common solutions to the SC mission. However, these research activities must be executed with a unique caution since LBNL is located less than one mile from the Hayward Fault and less than 25 miles from the San Andreas Fault, which would both pose a life safety risk to employees, visitors, and guests during a significant seismic event.

The U.S. Geological Survey's newest earthquake forecast, the third Uniform California Earthquake Rupture Forecast, states a 98 percent probability of a 6.0 magnitude or higher earthquake in the San Francisco Bay Area before 2043. Recent engineering evaluations from a San Francisco Bay Area structural engineering firm have identified significant and extensive seismic safety hazards in critical LBNL support buildings, including the Cafeteria, Health Services, and Fire House. Structural deficiencies identified in these buildings will likely cause significant structural damage with life safety hazards during a magnitude 6.0+ earthquake on the Hayward Fault or a magnitude 8.3 earthquake on the San Andreas Fault and will impede LBNL's ability to resume operations.

The SSM project will address seismic safety issues and emergency response capabilities, specifically related to facilities with large congregation areas as well as improve facilities and transportation capabilities that are necessary for emergency response personnel and maintaining continuity of operations. The facilities that are the primary focus of this project are the Cafeteria, Health Services, and Fire House sleeping quarters. Demolition of the cafeteria is anticipated to allow for construction of a new, more sustainable, and operationally resilient facility. Additional supporting functions such as utilities or site modifications may be included in the project if they are deemed necessary.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
New Facility to include a Cafeteria, Health Services & Operational Support Services	▪ 35,000 gross square feet (gsf) ▪ Meet requirements of Risk Category III of the CBC	▪ 60,000 gsf ▪ Meet requirements of Risk Category III of the CBC
Seismic Upgrade of B48 (Fire House)	▪ Meet requirements of Risk Category IV of CBC	N/A

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	9,000	9,000	3,000
FY 2021	–	–	5,000
FY 2022	–	–	1,000
Total, Design (TEC)	**9,000**	**9,000**	**9,000**
Construction (TEC)			
FY 2020	1,000	1,000	–
FY 2021	5,000	5,000	–
FY 2022	27,500	27,500	5,000
FY 2023	27,500	27,500	35,000
Outyears	25,400	25,400	46,400
Total, Construction (TEC)	**86,400**	**86,400**	**86,400**
Total Estimated Cost (TEC)			
FY 2020	10,000	10,000	3,000
FY 2021	5,000	5,000	5,000
FY 2022	27,500	27,500	6,000
FY 2023	27,500	27,500	35,000
Outyears	25,400	25,400	46,400
Total, TEC	**95,400**	**95,400**	**95,400**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	1,050	1,050	1,050
FY 2020	20	20	20
Outyears	1,130	1,130	1,130
Total, OPC	**2,200**	**2,200**	**2,200**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	1,050	1,050	1,050
FY 2020	10,020	10,020	3,020
FY 2021	5,000	5,000	5,000
FY 2022	27,500	27,500	6,000
FY 2023	27,500	27,500	35,000
Outyears	26,530	26,530	47,530
Total, TPC	**97,600**	**97,600**	**97,600**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	8,300	8,300	**N/A**
Design - Contingency	700	700	**N/A**
Total, Design (TEC)	**9,000**	**9,000**	**N/A**
Construction	71,400	71,400	**N/A**
Construction - Contingency	15,000	15,000	**N/A**
Total, Construction (TEC)	**86,400**	**86,400**	**N/A**
Total, TEC	**95,400**	**95,400**	**N/A**
Contingency, TEC	*15,700*	*15,700*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	200	200	**N/A**
Conceptual Design	1,800	1,800	**N/A**
OPC - Contingency	200	200	**N/A**
Total, Except D&D (OPC)	**2,200**	**2,200**	**N/A**
Total, OPC	**2,200**	**2,200**	**N/A**
Contingency, OPC	*200*	*200*	***N/A***
Total, TPC	**97,600**	**97,600**	**N/A**
Total, Contingency (TEC+OPC)	***15,900***	***15,900***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	5,000	—	—	—	90,400	95,400
	OPC	1,500	—	—	—	700	2,200
	TPC	6,500	—	—	—	91,100	97,600
FY 2021	TEC	10,000	10,000	—	—	75,400	95,400
	OPC	1,600	—	—	—	600	2,200
	TPC	11,600	10,000	—	—	76,000	97,600
FY 2022	TEC	10,000	5,000	27,500	—	52,900	95,400
	OPC	1,070	—	—	—	1,130	2,200
	TPC	11,070	5,000	27,500	—	54,030	97,600
FY 2023	TEC	10,000	5,000	27,500	27,500	25,400	95,400
	OPC	1,070	—	—	—	1,130	2,200
	TPC	11,070	5,000	27,500	27,500	26,530	97,600

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2027
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2077

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	N/A	N/A	N/A
Utilities	53	53	2,658	2,658
Maintenance and Repair	318	318	15,882	15,882
Total, Operations and Maintenance	371	371	18,540	18,540

7. D&D Information

The new area being constructed in this project is replacing existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory.....	35,000 - 60,000
Area of D&D in this project at Lawrence Berkeley National Laboratory.....	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[III]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	15,000 - 60,000

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California, is performing the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor evaluated various acquisition approaches and project delivery methods prior to achieving CD-1 and selected a Construction Manager/General Contractor approach as the best method to deliver the project. The M&O contractor is also responsible for awarding and administering all subcontracts related to this project. Its annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

[III] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-73, CEBAF Renovation and Expansion, TJNAF
Thomas Jefferson National Accelerator Facility
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion (CRE) project is $2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is $47,000,000 to $96,000,000. The preliminary Total Project Cost (TPC) range for this project is $50,000,000 to $99,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $90,000,000.

The CEBAF center at Thomas Jefferson National Accelerator Facility (TJNAF) is currently overcrowded and has inadequate utility systems that are experiencing frequent failures. This project will renovate 131,000 to 250,000 gross square feet (gsf) of existing space in the CEBAF center and the Applied Research Center (ARC), upgrade high risk utility systems, and provide 82,000 to 150,000 gsf of additional space for visitors, users, research, education, and support.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on March 18, 2019. FY 2023 funds will support Project Engineering and Design (PED) activities, and construction and associated activities.

A Federal Project Director with the appropriate certification (Level II: TPC greater than $50,000,000 and equal to or less than $100,000,000) has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2020	7/20/18	4Q FY 2019	4Q FY 2019	4Q FY 2020	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2026
FY 2021	7/20/18	4Q FY 2019	1Q FY 2020	4Q FY 2020	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2026
FY 2022	7/20/18	4Q FY 2019	3/18/19	1Q FY 2022	3Q FY 2022	4Q FY 2022	N/A	4Q FY 2029
FY 2023	7/20/18	10/16/19	3/18/19	4Q FY 2022	3Q FY 2022	4Q FY 2023	N/A	4Q FY 2029

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2020	4Q FY 2020	4Q FY 2020	4Q FY 2021
FY 2021	4Q FY 2020	4Q FY 2020	4Q FY 2021
FY 2022	1Q FY 2022	1Q FY 2022	N/A
FY 2023	4Q FY 2022	4Q FY 2022	N/A

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities
CD-3B – Approve Start of Remaining Construction Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2020	4,200	61,800	66,000	435	435	66,435
FY 2021	5,000	82,000	87,000	2,300	2,300	89,300
FY 2022	8,000	79,000	87,000	3,000	3,000	90,000
FY 2023	5,000	82,000	87,000	3,000	3,000	90,000

Notes:
- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The scope of the CRE project will include renovating 131,000 to 250,000 gsf of existing space and providing 82,000 to 150,000 gsf of additional office and laboratory space (including acquisition of the ARC) for 120 to 200 research, education, and support staff. The renovation will include reconfiguration to provide more functional, flexible, and efficient spaces that meet current code standards. CRE will replace the mechanical systems in the existing CEBAF Center, which have exceeded their service life and experienced multiple failures. The renovated building will be energy sustainable and will meet high performance building standards, including energy conservation, green building principles, and sustainable design. Also, the project will design the building to meet Federal legislative objectives. Upon completion, SC will relocate administrative and support staff from the Service Support Center (SSC) (leased space) into the ARC, and TJNAF will dedicate the CEBAF Center to scientific staff to more efficiently address functional workspace needs for TJNAF staff and users.

Justification

With nearly 1,600 users, TJNAF supports one of the largest nuclear physics user communities in the world. The expanded scientific scope associated with the 12 GeV upgrade (e.g., double the energy with simultaneous delivery to four experimental halls) is creating more and larger collaborations, requiring more technical workshops, and resulting in more visitors to the Laboratory. The Laboratory expects staff and user population to increase 2 percent per year for the next 10 years and will soon exceed available space, which is already near capacity. Further, TJNAF is actively pursuing several large inter-entity transfer projects such as the cryomodules and cryogenics plants for Linac Coherent Light Source (LCLS)-I, LCLS-II-High Energy, Facility for Rare Isotope Beams (FRIB), and the Utilities Upgrade Project (UUP) that will require additional staffing. TJNAF will continue to play a key role in the design and development of emerging SC initiative(s).

Currently, TJNAF is lacking technically equipped and functional space to accommodate advanced scientific research and major missions on the immediate horizon. The existing CEBAF Center is well beyond full capacity. The current occupant

density of this building is 110 gsf per occupant which is significantly below the DOE standard of 180 gsf per occupant. In addition, utility systems at the CEBAF center are inadequate, failing, and inefficient for the existing usage.

TJNAF also continues to advance a strategic campus plan designed to deliver more attractive, mission-focused, and functional workspaces by consolidating the Laboratory workforce scattered over several leased buildings in a single center that provides more effective and efficient operations. This includes appropriately consolidating workers currently housed in the ARC and SSC leased spaces. This would allow for leases to be discontinued and reduce the cost to sustain existing buildings and infrastructure and more efficiently address functional workspace needs for TJNAF staff and users. This project will upgrade mechanical systems and provide 82,000 to 150,000 gsf of additional space for visitors, users, research, education, and support especially for projects such as 12 GeV and the newly planned EIC at BNL. The CRE project infrastructure and buildings will support climate resilience by being designed to account for projected changes in temperature and precipitation through building energy efficiency, precipitation retention, buried electrical distribution and enhanced monitoring of assets to reduce the risk of failure as climate conditions change.

TJNAF must be prepared to accommodate planned staff and user growth which means additional office space must be programmed soon. The Laboratory is pursuing Major Items of Equipment (MIEs), several large inter-entity transfer projects for other national laboratories, and a pivotal technical role in a proposed Electron Ion Collider.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
CEBAF Center Renovation	66,000 gsf	128,000 gsf
CEBAF Center Expansion	22,000 gsf	57,000 gsf
ARC Renovation	65,000 gsf	122,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	2,000	2,000	39
FY 2021	2,000	2,000	3,233
FY 2023	1,000	1,000	1,728
Total, Design (TEC)	**5,000**	**5,000**	**5,000**
Construction (TEC)			
FY 2022	10,000	10,000	4,000
FY 2023	1,000	1,000	4,000
Outyears	71,000	71,000	74,000
Total, Construction (TEC)	**82,000**	**82,000**	**82,000**
Total Estimated Cost (TEC)			
FY 2020	2,000	2,000	39
FY 2021	2,000	2,000	3,233
FY 2022	10,000	10,000	4,000
FY 2023	2,000	2,000	5,728
Outyears	71,000	71,000	74,000
Total, TEC	**87,000**	**87,000**	**87,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	878	878	878
FY 2020	589	589	589
FY 2023	600	600	600
Outyears	933	933	933
Total, OPC	**3,000**	**3,000**	**3,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	878	878	878
FY 2020	2,589	2,589	628
FY 2021	2,000	2,000	3,233
FY 2022	10,000	10,000	4,000
FY 2023	2,600	2,600	6,328
Outyears	71,933	71,933	74,933
Total, TPC	**90,000**	**90,000**	**90,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	3,500	6,500	**N/A**
Design - Contingency	1,500	1,500	**N/A**
Total, Design (TEC)	**5,000**	**8,000**	**N/A**
Construction	65,000	62,000	**N/A**
Construction - Contingency	17,000	17,000	**N/A**
Total, Construction (TEC)	**82,000**	**79,000**	**N/A**
Total, TEC	**87,000**	**87,000**	**N/A**
Contingency, TEC	*18,500*	*18,500*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	2,400	2,400	**N/A**
Conceptual Design	400	400	**N/A**
OPC - Contingency	200	200	**N/A**
Total, Except D&D (OPC)	**3,000**	**3,000**	**N/A**
Total, OPC	**3,000**	**3,000**	**N/A**
Contingency, OPC	*200*	*200*	***N/A***
Total, TPC	**90,000**	**90,000**	**N/A**
Total, Contingency (TEC+OPC)	***18,700***	***18,700***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	2,000	—	—	—	64,000	66,000
	OPC	20	—	—	—	415	435
	TPC	2,020	—	—	—	64,415	66,435
FY 2021	TEC	2,000	2,000	—	—	83,000	87,000
	OPC	1,700	—	—	—	600	2,300
	TPC	3,700	2,000	—	—	83,600	89,300
FY 2022	TEC	2,000	2,000	10,000	—	73,000	87,000
	OPC	1,467	—	—	—	1,533	3,000
	TPC	3,467	2,000	10,000	—	74,533	90,000
FY 2023	TEC	2,000	2,000	10,000	2,000	71,000	87,000
	OPC	1,467	—	—	600	933	3,000
	TPC	3,467	2,000	10,000	2,600	71,933	90,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2029
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2079

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	288	288	14,400	14,400
Utilities	432	432	21,600	21,600
Maintenance and Repair	1,008	1,008	50,400	50,400
Total, Operations and Maintenance	1,728	1,728	86,400	86,400

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Thomas Jefferson National Accelerator Facility.....	82,000 - 150,000
Area of D&D in this project at Thomas Jefferson National Accelerator Facility.....	None
Area at Thomas Jefferson National Accelerator Facility to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[mmm]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The TJNAF Management and Operating (M&O) contractor, Jefferson Science Associates, will perform the acquisition for this project, overseen by the Thomas Jefferson Site Office. The M&O contractor will consider various acquisition approaches and project delivery methods prior to achieving CD-1 and will be responsible for awarding and administering all subcontracts related to this project. Its annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

[mmm] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-75, Large Scale Collaboration Center, SLAC
SLAC National Accelerator Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Large Scale Collaboration Center (LSCC) is $30,000,000 of Total Estimated Cost (TEC) funding. The preliminary TEC range for this project is $56,000,000 to $90,400,000. The preliminary Total Project Cost (TPC) range for this project is $58,000,000 to $92,400,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $66,000,000.

This project will construct a new facility allowing for collocation of cross-functional teams in a common building, providing synergies between all major SC-sponsored programs.

Significant Changes

This project was initiated in FY 2020. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on November 18, 2019. The project performed an analysis of Alternatives and determined the preferred alternative is to construct a new building, which the SLI program approved. FY 2023 funds will support long-lead procurements and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than $50,000,000 and equal to or less than $100,000,000) has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2020	7/20/18	4Q FY 2019	4Q FY 2019	4Q FY 2020	4Q FY 2020	4Q FY 2020	N/A	4Q FY 2026
FY 2021	7/20/18	4Q FY 2019	11/18/19	3Q FY 2022	1Q FY 2023	3Q FY 2022	3Q FY 2023	4Q FY 2027
FY 2022	7/20/18	8/15/19	11/18/19	3Q FY 2022	1Q FY 2024	3Q FY 2022	3Q FY 2023	4Q FY 2027
FY 2023	7/20/18	8/15/19	11/18/19	3Q FY 2022	1Q FY 2023	3Q FY 2022	3Q FY 2023	4Q FY 2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A	CD-3B
FY 2020	TBD	N/A	–
FY 2021	TBD	1Q FY 2020	1Q FY 2023
FY 2022	3Q FY 2022	N/A	N/A
FY 2023	3Q FY 2022	N/A	N/A

CD-3A – Approve Long-Lead Procurements and Start of Early Construction
CD-3B – Approve Remaining Construction Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2020	6,000	54,000	60,000	1,000	1,000	61,000
FY 2021	9,000	55,000	64,000	2,000	2,000	66,000
FY 2022	11,000	53,000	64,000	2,000	2,000	66,000
FY 2023	11,000	53,000	64,000	2,000	2,000	66,000

Notes:
- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope
The LSCC project will construct a multi-office building of approximately 34,000 to 45,000 gross square feet (gsf) to consolidate and provide space for 100-150 occupants in a common building. The LSCC will provide synergies among all major SC-sponsored programs at SLAC and provide a centralized office and collaboration space for cross-functional teams with the necessary performance capabilities to grow the science research programs.

Justification
Advances in scientific exploration require the coordinated development of an extensive range of sophisticated imaging tools and extremely large amounts of data sets and images for current and future user facilities and research programs, including the Linac Coherent Light Source (LCLS), the LCLS-II and LCLS-II-HE, the Stanford Synchrotron Radiation Laboratory (SSRL), Cryo-Electron Microscopy (EM), ATLAS at the Large Hadron Collider (LHC), the Large Synoptic Survey Telescope (LSST), the Deep Underground Neutrino Experiment (DUNE), and the Facility for Advanced Accelerator Experimental Tests (FACET)-II.

Existing buildings provide sufficient laboratory and experimental space. Current office spaces near experimental areas, however, are fully occupied or oversubscribed, and projected staff and user increases exceed availability of adequate space. Office spaces in current buildings are not properly configured and do not address the pressing need to accommodate teams that are developing critical algorithms and data analysis techniques alongside staff scientists or visiting researchers and users.

With growing numbers of scientific staff and users dealing with increased rates of data generation on the order of terabytes per second streaming from detectors, it is essential to reduce data volumes while preserving the science content of the data. This can be accomplished by collaborating with expertise in data science and massive-scale data analytics. The real-

time computing for data reduction and, most importantly, for feedback defines the scale of the computing infrastructure required onsite and offsite. This real-time feedback, done during experiment operation and between shifts, is instrumental for the user to optimize the experiment and receive datasets as complete as possible before leaving the facility. Cross-functional teams that understand accelerator and instrument operations also need to collaborate to address the common and expanding need for substantial computation support.

Furthermore, the High Energy Density program is also working closely with SLAC's LCLS directorate and the U.S. scientific community to advance the Matter in Extreme Conditions (MEC) project, which will result in much improved optical and x-ray laser capabilities that will enable novel experiments to push the scientific frontier. Scientists at the MEC project will perform these activities in collaboration with LCLS and academic partners and users ahead of full-scale experiments at LCLS.

SLAC currently lacks office spaces for scientists and staff to jointly explore challenges and develop solutions using large-scale data sets. Adjacent office spaces that enable researchers to benefit from collaboration with subject matter experts in computational science, artificial intelligence/machine learning (AI/ML), exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling are also not currently available.

To address these capability gaps, SLAC proposes to construct a new LSCC which will enable the lab to improve the ability to co-locate cross-functional teams that understand accelerator and instrument operations, provide synergies between all major SC-sponsored programs at SLAC, engage a broad spectrum of researchers in a common building to explore materials science, chemical science, cosmology, computational support, AI/ML, exascale applications, and quantum information science (QIS); engage in private partnerships; and provide a centralized office and collaboration space with the necessary performance capabilities to grow the photon science research program.

LSCC is a modern, energy efficient, sustainable, and collaborative facility for data analytics which supports scientific research and development for energy savings, battery energy storage, charging infrastructure, electrical power grids, and artificial photo-catalysts to convert sunlight to fuel. LSCC will also use AI/ML in the building management system to provide energy savings in utility usage. LSCC is being analyzed to be SLAC's first campus net-zero and carbon-zero building. LSCC will also provide collaborative work, research, and meeting space for Energy@Stanford & SLAC conference, held annually at Stanford and SLAC.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Multi-Story Office Building	34,000 gsf	45,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	11,000	11,000	314
FY 2021	–	–	1,931
FY 2022	–	–	8,755
Total, Design (TEC)	**11,000**	**11,000**	**11,000**
Construction (TEC)			
FY 2021	11,000	11,000	–
FY 2022	12,000	12,000	13,000
FY 2023	30,000	30,000	40,000
Total, Construction (TEC)	**53,000**	**53,000**	**53,000**
Total Estimated Cost (TEC)			
FY 2020	11,000	11,000	314
FY 2021	11,000	11,000	1,931
FY 2022	12,000	12,000	21,755
FY 2023	30,000	30,000	40,000
Total, TEC	**64,000**	**64,000**	**64,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	500	500	500
FY 2020	4	4	4
FY 2023	400	400	400
Outyears	1,096	1,096	1,096
Total, OPC	**2,000**	**2,000**	**2,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	500	500	500
FY 2020	11,004	11,004	318
FY 2021	11,000	11,000	1,931
FY 2022	12,000	12,000	21,755
FY 2023	30,400	30,400	40,400
Outyears	1,096	1,096	1,096
Total, TPC	**66,000**	**66,000**	**66,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	8,800	8,800	**N/A**
Design - Contingency	2,200	2,200	**N/A**
Total, Design (TEC)	**11,000**	**11,000**	**N/A**
Construction	42,400	42,400	**N/A**
Construction - Contingency	10,600	10,600	**N/A**
Total, Construction (TEC)	**53,000**	**53,000**	**N/A**
Total, TEC	**64,000**	**64,000**	**N/A**
Contingency, TEC	*12,800*	*12,800*	***N/A***
Other Project Cost (OPC)			
Conceptual Design	2,000	2,000	**N/A**
Total, Except D&D (OPC)	**2,000**	**2,000**	**N/A**
Total, OPC	**2,000**	**2,000**	**N/A**
Contingency, OPC	***N/A***	*N/A*	***N/A***
Total, TPC	**66,000**	**66,000**	**N/A**
Total, Contingency (TEC+OPC)	***12,800***	***12,800***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	3,000	—	—	—	57,000	60,000
	OPC	700	—	—	—	300	1,000
	TPC	3,700	—	—	—	57,300	61,000
FY 2021	TEC	11,000	8,000	—	—	45,000	64,000
	OPC	700	1,300	—	—	—	2,000
	TPC	11,700	9,300	—	—	45,000	66,000
FY 2022	TEC	11,000	11,000	12,000	—	30,000	64,000
	OPC	504	—	—	—	1,496	2,000
	TPC	11,504	11,000	12,000	—	31,496	66,000
FY 2023	TEC	11,000	11,000	12,000	30,000	—	64,000
	OPC	504	—	—	400	1,096	2,000
	TPC	11,504	11,000	12,000	30,400	1,096	66,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2077

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	81	81	4,050	4,050
Utilities	154	154	7,700	7,700
Maintenance and Repair	170	170	8,500	8,500
Total, Operations and Maintenance	405	405	20,250	20,250

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at SLAC National Laboratory	34,000-45,000
Area of D&D in this project at SLAC National Laboratory	8,260
Area at SLAC National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[nnn]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The SLAC Management and Operating (M&O) contractor, Stanford University, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. Various acquisition alternatives were considered for this project, such as traditional design-bid-build, design-build, and construction manager/general contractor. After considering these alternatives in relation to the schedule, size, and risk, the design-build approach was selected. The M&O contractor's annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.

[nnn] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-77, Argonne Utilities Upgrade, ANL
Argonne National Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Argonne Utilities Upgrade (AU2) project is $8,000,000 of Total Estimated Cost (TEC) funding. The preliminary TEC range for this project is $172,000,000 to $290,300,000. The preliminary Total Project Cost (TPC) range for this project is $173,000,000 to $291,300,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $216,000,000.

AU2 is proposed to revitalize and selectively upgrade Argonne National Laboratory's (ANL's) existing major utility systems including steam, water, sanitary sewer, chilled water, and electrical systems.

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on May 17, 2019. FY 2023 funds will support Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification level has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	5/17/19	4Q FY 2020	4Q FY 2020	4Q FY 2021	4Q FY 2021	4Q FY 2022	N/A	4Q FY 2026
FY 2022	5/17/19	11/30/20	3Q FY 2021	4Q FY 2023	2Q FY 2024	4Q FY 2024	N/A	4Q FY 2033
FY 2023	5/17/19	10/30/20	7/1/21	3Q FY 2024	4Q FY 2025	4Q FY 2025	N/A	4Q FY 2033

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021	1Q FY 2021
FY 2022	2Q FY 2024	N/A
FY 2023	3Q FY 2024	N/A

CD-3A – Approve Long-Lead Procurements and Start of Early Construction

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	37,500	177,500	215,000	1,000	1,000	216,000
FY 2022	37,500	177,500	215,000	1,000	1,000	216,000
FY 2023	37,500	177,500	215,000	1,000	1,000	216,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The preliminary scope of the AU2 project includes upgrading failing 1940's-era utilities across the ANL campus. These utilities include steam, water, sanitary sewer, chilled water, and electrical systems.

Justification

An efficient, maintainable, and reliable infrastructure is critical to the success and mission capability of ANL's research facilities. As such, there is an urgent mission need to revitalize and selectively upgrade ANL's existing major utility systems including steam, water, sanitary sewer, chilled water and electrical systems. For example, steam is a critical infrastructure for Argonne facilities; improving the resilience of this plant would prevent catastrophic freezing damage to buildings, utilities, and major pieces of scientific equipment. Additionally, the Advanced Photon Source (APS) is dependent on the steam utility for holding extremely tight temperature and humidity ranges required for beam line operations and stability requirements.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
▪ Utility Plants (Chilled Water, Steam & Condensate)	▪ Construct new combined 6,300-ton chilled water plant with N+1 reliability and boiler house with peak demand of 250,000 lbs./hour of 200 psi saturated steam with N+1 reliability	▪ Equipment & controls upgrades at the 371, 450, and 528 chilled water plants ▪ Repair five domestic water tanks ▪ Potential capacity upgrades, new equipment, equipment replacements, and various other utility system reliability projects to increase reliability of laboratory internal utilities

Performance Measure	Threshold	Objective
▪ Utility Piping (Chilled Water, Steam & Condensate, Sewer, Domestic, Lab, & Canal Water)	▪ Repair, replace or construct new distribution piping for 7,500 linear feet of utility piping and support structures (e.g., vaults, pipe supports, valves, culverts, etc.)	▪ Repair, replace or construct new distribution piping for up to 15,000 linear feet of utility piping and support structures (e.g., vaults, pipe supports, valves, culverts, etc.) ▪ Install between 50 and 250 new smart meters

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	500	500	500
FY 2023	8,000	8,000	8,000
Outyears	28,000	28,000	28,500
Total, Design (TEC)	**37,500**	**37,500**	**37,500**
Construction (TEC)			
Outyears	177,500	177,500	177,500
Total, Construction (TEC)	**177,500**	**177,500**	**177,500**
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	500	500	500
FY 2023	8,000	8,000	8,000
Outyears	205,500	205,500	206,000
Total, TEC	**215,000**	**215,000**	**215,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	100	100	100
FY 2020	600	600	600
FY 2021	300	300	300
Total, OPC	**1,000**	**1,000**	**1,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	100	100	100
FY 2020	1,100	1,100	600
FY 2021	800	800	800
FY 2022	500	500	500
FY 2023	8,000	8,000	8,000
Outyears	205,500	205,500	206,000
Total, TPC	**216,000**	**216,000**	**216,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	30,000	30,000	**N/A**
Design - Contingency	7,500	7,500	**N/A**
Total, Design (TEC)	**37,500**	**37,500**	**N/A**
Construction	142,000	142,000	**N/A**
Construction - Contingency	35,500	35,500	**N/A**
Total, Construction (TEC)	**177,500**	**177,500**	**N/A**
Total, TEC	**215,000**	**215,000**	**N/A**
Contingency, TEC	*43,000*	*43,000*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	1,000	1,000	**N/A**
Total, Except D&D (OPC)	**1,000**	**1,000**	**N/A**
Total, OPC	**1,000**	**1,000**	**N/A**
Contingency, OPC	***N/A***	*N/A*	***N/A***
Total, TPC	**216,000**	**216,000**	**N/A**
Total, Contingency (TEC+OPC)	***43,000***	***43,000***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	500	2,000	—	—	212,500	215,000
	OPC	700	300	—	—	—	1,000
	TPC	1,200	2,300	—	—	212,500	216,000
FY 2022	TEC	500	500	10,000	—	204,000	215,000
	OPC	700	300	—	—	—	1,000
	TPC	1,200	800	10,000	—	204,000	216,000
FY 2023	TEC	500	500	500	8,000	205,500	215,000
	OPC	700	300	—	—	—	1,000
	TPC	1,200	800	500	8,000	205,500	216,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	N/A
Expected Useful Life	N/A
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs[ooo]	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	N/A	N/A	N/A
Utilities	N/A	N/A	N/A	N/A
Maintenance and Repair	N/A	N/A	N/A	N/A
Total, Operations and Maintenance	N/A	N/A	N/A	N/A

[ooo] Life-Cycle costs will be performed as part of CD-1.

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Argonne National Laboratory	None
Area of D&D in this project at Argonne National Laboratory	None
Area at Argonne National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[ppp]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The ANL Management and Operating (M&O) Contractor, UChicago Argonne, LLC, will perform the acquisition for this project, overseen by the Argonne Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. The M&O contractor will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build and design-build. The M&O contractor will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for ANL, on which it will be evaluated.

[ppp] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with the decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-78, Linear Assets Modernization Project, LBNL
Lawrence Berkeley National Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Linear Assets Modernization Project (LAMP) is $23,425,000 of Total Estimated Cost (TEC) funding. The preliminary TEC range for this project is $164,000,000 to $376,000,000. The preliminary Total Project Cost (TPC) range for this project is $170,000,000 to $382,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $242,000,000.

LAMP will upgrade high priority utility systems to increase the reliability, capability, resilience, and safety of LBNL's infrastructure to meet DOE's mission. The project will upgrade utility systems, including, but not limited to, domestic water, natural gas, storm drain, sanitary sewer, electrical, and communication.

Significant Changes

This project was initiated in the FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, which was approved on May 17, 2019. FY 2023 funds will support Project Engineering and Design (PED) activities and will initiate long-lead procurement activities after the appropriate CD approval. CD-1, Approve Alternative Selection and Cost Range" was scheduled for March 17, 2022, but needed to be rescheduled due to Project Management Executive availability.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	5/17/19	4Q FY 2020	4Q FY 2020	4Q FY 2021	3Q FY 2022	4Q FY 2022	N/A	4Q FY 2032
FY 2022	5/17/19	1Q FY 2022	1Q FY 2022	1Q FY 2023	4Q FY 2022	1Q FY 2023	N/A	4Q FY 2033
FY 2023	5/17/19	11/1/21	2Q FY 2022	4Q FY 2025	2Q FY 2024	4Q FY 2025	N/A	1Q FY 2035

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021	1Q FY 2021
FY 2022	1Q FY 2023	3Q FY 2022
FY 2023	4Q FY 2025	3Q FY 2025

CD-3A – Approve Long-Lead Procurements and Start of Early Construction

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	48,000	188,000	236,000	3,700	3,700	239,700
FY 2022	23,500	212,500	236,000	4,000	4,000	240,000
FY 2023	50,000	186,000	236,000	6,000	6,000	242,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

LAMP will upgrade the highest priority utility systems to increase the reliability, capability, and safety of LBNL's infrastructure to meet the DOE's mission. The utility systems include, but are not limited to, domestic water, natural gas, storm drain, sanitary sewer, electrical, and communication.

The project will first address higher priority/higher risk areas and will aim to resolve the most critical systems while focusing infrastructure investment considering operational risk and efficiencies, redundancy, utility bundling, and preparation for strategic growth including expanding the primary switching substation at Grizzly Peak to power the National Energy Research Scientific Computing Center (NERSC) to full capacity. LAMP will implement a multi-system-based, common geographical approach in the repair and improvement of LBNL's utility assets, considering potential synergies with nearby sustainment and improvement projects, particularly where utility reconfigurations may necessitate or otherwise provide opportunities for enhancement.

Justification

Established in 1931, LBNL is the oldest DOE national laboratory. SC utilizes the capabilities of LBNL to execute 23 of the 24 core capabilities and the mission of multiple SC program offices, including a strong presence of Advanced Scientific Computing Research, Biological and Environmental Research, Basic Energy Sciences, and High Energy Physics, many of which support all dimensions of climate research initiatives. The mission need of this project is to support the SC mission and multiple scientific programs by increasing the reliability, capability, and safety of LBNL's utility infrastructure while significantly reducing deferred maintenance. Utility infrastructure represents almost half of LBNL's large, deferred maintenance backlog and represents a significant capability gap in LBNL's ability to provide reliable and safe services to meet DOE's mission needs. Direct investment is necessary to enable transformational infrastructure improvements to accelerate deferred maintenance reduction, restore operational reliability, increase resiliency, and enhance support for scientific advancements. Moreover, existing infrastructure is insufficient to support the future vision of planned facility modernization and growth. Without a modern utility infrastructure backbone, future growth of the science mission at LBNL may not be able to be fully accommodated.

Although LBNL has begun measures to strengthen the laboratory's resilience to unplanned outages due to natural hazards such as earthquake, wildfire, and extreme weather, the mission need of this project remains, which is to support the SC mission and multiple scientific programs by modernizing distributed utilities to increase reliability, resilience, and capacity to meet growing demands. The first sub-project of the LAMP project will enable an optimized NERSC-10 upgrade which will play a central role in breakthrough science in the climate arena.

LAMP will deliver significantly more modern and resilient general-purpose infrastructure. The combination of data collection and artificial intelligent monitoring systems will enable the systems to adjust to trends, predict maintenance requirements, and react to extreme weather events, such as automatically transferring power to minimize impacts to mission critical scientific operations. Additionally, modern utility systems will be more efficient and sustainable. For example, the underground utility corridors will not only be upgraded to the best available technology but will be designed to be maintainable and monitored using artificial intelligence to enable predictive maintenance.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The project is currently pre-CD-1 so KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Storm Drainage System, Hydrauger/ Slope Stability	Install 1,000 Linear Feet of hydraugers.	Install up to 2,500 Linear Feet of hydraugers. (Lawrence Corridor)
		Install up to 3,000 Linear Feet of hydraugers. (East Canyon/McMillan Corridor)
Sanitary Sewer	Install 150 Linear Feet of pipe.	Install up to 2,500 Linear Feet of pipe. (Lawrence Corridor)
		Install up to 3,500 Linear Feet of pipe. (McMillan Corridor)
		Install up to 1,000 Linear Feet of pipe along the electrical distribution loop corridors. (McMillan Corridor)
High Pressure City Water	Install 1,500 Linear Feet of pipe.	Install up to 3,500 Linear Feet of pipe. (East Canyon Corridor)
		Install up to 2,000 Linear Feet of pipe along the electrical distribution loop corridors. (McMillan Corridor)

Performance Measure	Threshold	Objective
Communications & Data	Install 2,600 Linear Feet of ductbank.	Install up to 4,000 Linear Feet of ductbank with manholes and cables. (Lawrence Corridor)
		Install up to 2,500 Linear Feet of ductbank with manholes and cables. (East Canyon Corridor)
		Install up to 1,500 Linear Feet of ductbank with manholes and cables along the electrical distribution loop corridors. (East Canyon Corridor)
		Install up to 1,500 Linear Feet of ductbank with manholes and cables. (McMillan Corridor)
		Install up to 5,000 Linear Feet of ductbank with manholes and cables along the electrical distribution loop corridors. (McMillan Corridor)
Electrical Distribution/Grizzly Substation	Expand the Grizzly Substation to 70 MW capacity.	Expand the Grizzly Substation up to 150 MW capacity with two redundant lines with SCADA for new equipment.
		Provide a new SCADA Control Building.
		Provide two remote SCADA Control Rooms.
		Provide SCADA remote control and monitoring of existing and new circuit breakers.
		Install up to 400 Linear Feet of electrical feeders segregating lines 1 and 2 for SW-A1.
		Install SCADA for existing 115kV equipment.
	Install 1,500 Linear Feet of electrical feeders segregating lines 1 and 2. (Lawrence Corridor)	Install up to 3,500 Linear Feet of electrical feeders segregating lines 1 and 2.
		Feed B59 (NERSC) with up to 80 MW of electrical power with 3,500 Linear Feet of redundant and segregated lines.
		Install up to 2,000 Linear Feet of electrical feeders and Pad Mounted Switches for electrical distribution loops, segregating lines 1 and 2.
		Provide SCADA remote control and monitoring of existing and new circuit breakers.
	Install 1,200 Linear Feet of electrical feeders segregating lines 1 and 2. (East Canyon/McMillan Corridor) (Con't)	Install up to 2,600 Linear Feet of electrical feeders segregating lines 1 and 2. (East Canyon Corridor)
		Install up to 5,700 Linear Feet of electrical feeders and Pad Mounted Switches for electrical distribution loops, segregating lines 1 and 2. (East Canyon Corridor)
		Provide SCADA remote control and monitoring of existing and new circuit breakers. (East Canyon Corridor)

Performance Measure	Threshold	Objective
Electrical Distribution/Grizzly Substation (Con't)	Install 1,200 Linear Feet of electrical feeders segregating lines 1 and 2. (East Canyon/McMillan Corridor) (Con't)	Install up to 2,200 Linear Feet of electrical feeders segregating lines 1 and 2. (McMillan Corridor)
		Install up to 6,300 Linear Feet of electrical feeders and Pad Mounted Switches for electrical distribution loops, segregating lines 1 and 2. (McMillan Corridor)
		Provide SCADA remote control and monitoring of existing and new circuit breakers. (McMillan Corridor)
Natural Gas	Install 200 Linear Feet of pipe.	Install up to 1,000 Linear Feet of pipe. (Lawrence Corridor)
		Install up to 2,500 Linear Feet of pipe. (McMillan Corridor)
		Install up to 2,000 Linear Feet of pipe along the electrical distribution loop corridors. (McMillan Corridor)
Compressed Air	*Not Applicable*	Install up to 3,500 Linear Feet of pipe. (Lawrence Corridor)
		Install up to 3,500 Linear Feet of pipe. (East Canyon Corridor)
		Install up to 2,500 Linear Feet of pipe. (McMillan Corridor)
		Install up to 1,500 Linear Feet of pipe along the electrical distribution loop corridors. (McMillan Corridor)

Performance Measure	Threshold	Objective
Controls/Artificial Intelligence	*Not Applicable*	Install up to 40 Smart Meters for new wet utility construction. (Lawrence Corridor)
		Provide integration with SCADA. (Lawrence Corridor)
		Provide integration with Microgrid enhancement. (Lawrence Corridor)
		Install up to 60 Smart Meters for new wet utility construction. (East Canyon Corridor)
		Install up to 50 Smart Meters for new wet utility construction. (McMillan Corridor)
		Provide integration with SCADA. (East Canyon/McMillan Corridors)
		Provide integration with Microgrid enhancement. (East Canyon/McMillan Corridors)

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	500	500	1,000
FY 2023	23,425	23,425	15,000
Outyears	25,075	25,075	34,000
Total, Design (TEC)	**50,000**	**50,000**	**50,000**
Construction (TEC)			
Outyears	186,000	186,000	186,000
Total, Construction (TEC)	**186,000**	**186,000**	**186,000**
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	500	500	1,000
FY 2023	23,425	23,425	15,000
Outyears	211,075	211,075	220,000
Total, TEC	**236,000**	**236,000**	**236,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2019	173	173	173
FY 2020	500	500	500
FY 2021	1,750	1,750	1,750
FY 2022	1,000	1,000	1,000
Outyears	2,577	2,577	2,577
Total, OPC	**6,000**	**6,000**	**6,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2019	173	173	173
FY 2020	1,000	1,000	500
FY 2021	2,250	2,250	1,750
FY 2022	1,500	1,500	2,000
FY 2023	23,425	23,425	15,000
Outyears	213,652	213,652	222,577
Total, TPC	**242,000**	**242,000**	**242,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	49,000	19,500	**N/A**
Design - Contingency	1,000	4,000	**N/A**
Total, Design (TEC)	**50,000**	**23,500**	**N/A**
Construction	135,000	162,500	**N/A**
Construction - Contingency	51,000	50,000	**N/A**
Total, Construction (TEC)	**186,000**	**212,500**	**N/A**
Total, TEC	**236,000**	**236,000**	**N/A**
Contingency, TEC	*52,000*	*54,000*	***N/A***
Other Project Cost (OPC)			
Conceptual Design	3,600	2,200	**N/A**
Start-up	1,200	1,000	**N/A**
OPC - Contingency	1,200	800	**N/A**
Total, Except D&D (OPC)	**6,000**	**4,000**	**N/A**
Total, OPC	**6,000**	**4,000**	**N/A**
Contingency, OPC	*1,200*	*800*	***N/A***
Total, TPC	**242,000**	**240,000**	**N/A**
Total, Contingency (TEC+OPC)	***53,200***	***54,800***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	500	2,000	—	—	233,500	236,000
	OPC	1,700	—	—	—	2,000	3,700
	TPC	2,200	2,000	—	—	235,500	239,700
FY 2022	TEC	500	500	12,850	—	222,150	236,000
	OPC	570	1,230	500	—	1,700	4,000
	TPC	1,070	1,730	13,350	—	223,850	240,000
FY 2023	TEC	500	500	500	23,425	211,075	236,000
	OPC	673	1,750	1,000	—	2,577	6,000
	TPC	1,173	2,250	1,500	23,425	213,652	242,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	2033
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	N/A

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	1,500	1,200	75,000	60,000
Utilities	12	12	600	600
Maintenance and Repair	4,200	3,000	210,000	150,000
Total, Operations and Maintenance	5,712	4,212	285,600	210,600

7. D&D Information

This project replaces critical infrastructure components; no new construction area is anticipated to be constructed in this project and it will not replace existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory	None
Area of D&D in this project at Lawrence Berkeley National Laboratory	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[qqq]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. Various acquisition approaches and project delivery methods will be considered prior to achieving CD-1. Potential methods for project acquisition and completion methods include, but are not limited to, firm fixed price contracts for design-bid-build and design-build. The benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements will be evaluated by the M&O Contractor. Project performance metrics will be performed by in-house management and Project Controls.

[qqq] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with the decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC
SLAC National Accelerator Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Critical Utilities Infrastructure Revitalization (CUIR) project is $25,425,000 of Total Estimated Cost (TEC) funding. The preliminary Total Estimated Cost (TEC) range for this project is $160,000,000 to $306,000,000. The preliminary Total Project Cost (TPC) range for this project is $164,500,000 to $310,500,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $208,500,000.

The primary objective of this project is to close utilities infrastructure gaps, such as utility piping breaks, power fluctuations, faults, and cooling water interruptions to support multi-program science missions at SLAC. Evolving technologies, instruments, experimental parameters, sensitivities, and complexity require increased reliability, resiliency, and service levels in electrical, mechanical, and civil systems site wide. The CUIR project will address the critical campus-wide utility and infrastructure issues by replacing, repairing, and modernizing the highest risk water/fire protection, sanitary sewer, storm drain, electrical, and cooling water system deficiencies. These needs have been identified through condition assessments, inspections, and recommendations from subject matter experts responsible for stewardship of the systems.

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1, Approve Alternatives Selection and Cost Range, which was approved January 21, 2022. FY 2023 funds will support Project Engineering and Design (PED) activities, initiate long-lead procurement and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level II: TPC greater than $50,000,000 and equal to or less than $100,000,000) has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	5/17/19	4Q FY 2020	4Q FY 2020	4Q FY 2021	3Q FY 2022	4Q FY 2022	N/A	4Q FY 2032
FY 2022	5/17/19	4Q FY 2020	4Q FY 2021	1Q FY 2024	4Q FY 2026	1Q FY 2024	N/A	4Q FY 2032
FY 2023	5/17/19	4/15/21	1/21/22	1Q FY 2024	4Q FY 2026	1Q FY 2024	N/A	4Q FY 2032

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021	1Q FY 2021
FY 2022	4Q FY 2021	4Q FY 2021
FY 2023	1Q FY 2024	2Q FY 2023

CD-3A – Approve Long-Lead Procurements, Original Scope

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	38,500	147,500	186,000	3,000	3,000	189,000
FY 2022	20,000	166,000	186,000	3,000	3,000	189,000
FY 2023	15,000	189,000	204,000	4,500	4,500	208,500

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

CUIR's preliminary scope is to provide underground domestic water/fire protection, sanitary sewer, and storm drain systems site-wide. Additionally, it will provide updated major electrical gear, instrumentation, and cooling water systems for the two-mile long klystron gallery and accelerator housing constructed in 1962.

Justification

SLAC is currently implementing a Campus Strategy designed to support the DOE Science Mission, increase reliability, and minimize costs through safe, effective, resilient, and efficient operations. The objective of the CUIR project is to reduce risks and close the capability gaps identified in SLAC's infrastructure assessments and surveys as they relate to storm water, sanitary sewer, domestic water/fire protection, electrical, and cooling water systems.

Disruptions caused by utility piping breaks, power fluctuations, faults, and cooling water interruptions have frequently impacted science research site wide. Electrical systems, pumps, and motors fail, valves on piping systems freeze, and there are inoperable or unsafe electrical components that require broad outages to respond and repair, which impact science research and the greater SLAC population. Workarounds and administrative controls placed on existing equipment and systems, which are underrated, not operating as intended, or not designed/operational for today's science needs, create tremendous inefficiencies and safety concerns, and sub-optimize operations.

The proposed project will retire $18,000,000 in deferred maintenance. The timely delivery of this project is essential for the current and future success of SLAC's science programs. SC will evaluate alternatives during acquisition strategy development prior to CD-1.

The CUIR project will also reduce operational risks in critical infrastructure and utility support systems for all science programs, decrease utilization of unique, old, and outdated equipment; and increase operational reliability, flexibility, and sustainability throughout site infrastructure. If these existing reliability gaps are not fulfilled, the operational efficiency,

reliability, productivity, and competitive viability in science programs and other related science research breakthroughs will continue to be impeded.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. The Objective KPPs are shown adjacent to the applicable Threshold KPPs in the following charts. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Subproject 1: Critical Electrical Work		
	Install and test three (3) 12kV circuits	Install and test (5) 12kV circuits along the 3 km linac to allow independent utility operation of each segment.
	Install and test 12 kV Sub-station to provide 3.5MVA power.	Install and test 12 kV Sub-station to provide 5MVA power.
	Install and test one new 60MVA (or larger) 230/12kV transformer.	Install and test two new 60MVA (or larger) 230/12kV transformer.
	Provide redundant N+1 (N active and one spare) electrical feeder circuits. Install and test Switchgear to allow feeder cable selection.	
	Replace monitoring equipment to provide AI/ML input at 9 substation relay doors with 1 integration hub.	Replace monitoring equipment to provide AI/ML input at 12 substation relay doors with 1 integration hub. Also integrate data from the substation, backup generator and transformer into the data-analytics platform.
	Install and test 1.5MVA backup generator.	

Performance Measure	Threshold	Objective
Subproject 2: Linac Utilities and Equipment		
	Replace and reconfigure medium-voltage equipment for 4 Variable Voltage Substations (VVS).	
	Replace low voltage sections for 10 K-subs, 10 VVS and 16 Motor Control Centers (MCC).	
	Replace 4 klystron water heat exchangers, 4 controls, and 4 pumps.	
	Replace 12,000 linear feet of domestic/fire water piping. Install submeters, flow and pressure sensors at 2 domestic water main branches.	Replace 18,000 linear feet of domestic/fire water piping. Install submeters, flow and pressure sensors at 4 domestic water main branches.
	Replace 2,700 linear feet of water main, laterals, and valves. Install 5 backflow preventors and 5 fire hydrants. Install submeter flow and pressure sensors at 1 domestic water key node.	
	Replace 1,000 linear feet of sanitary sewer piping. Install sensors to measure sewage flow, Total Dissolved Solids (TDS) at 2 effluent stations.	Install sensors to measure sewage flow, Total Dissolved Solids (TDS) at 5 existing effluent stations.
	Replace or re-line 5,000 linear feet of storm drain piping.	Replace or re-line 10,000 linear feet of storm drain piping.
		Integrate substation and water-cooling system monitor output into data-analytics platform.

Performance Measure	Threshold	Objective
Subproject 3: Sitewide Utilities		
	Replace 11 waveguide water heat exchangers, controls, and pumps.	
	Replace 3 klystron water heat exchangers, controls, and pumps.	
	Replace 11 accelerator, klystron, and waveguide monitoring devices.	
	Install 2 natural gas main meters, replace 6 existing BTU energy meter, and integrate each into data analytics platform.	Install 4 main gas meters and 8 gas submeters, replace 12 energy BTU meters and integrate each into the data analytics platform.
		Replace 10 programmable logic controller (PLC) to provide AI/ML input.
		Integrate substation and water-cooling system monitor output into data-analytics platform.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	500	500	500
FY 2023	1,000	1,000	1,000
Outyears	12,500	12,500	13,000
Total, Design (TEC)	**15,000**	**15,000**	**15,000**
Construction (TEC)			
FY 2023	24,425	24,425	15,000
Outyears	164,575	164,575	174,000
Total, Construction (TEC)	**189,000**	**189,000**	**189,000**
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	500	500	500
FY 2023	25,425	25,425	16,000
Outyears	177,075	177,075	187,000
Total, TEC	**204,000**	**204,000**	**204,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2020	323	323	323
FY 2021	1,572	1,572	1,572
Outyears	2,605	2,605	2,605
Total, OPC	**4,500**	**4,500**	**4,500**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2020	823	823	323
FY 2021	2,072	2,072	2,072
FY 2022	500	500	500
FY 2023	25,425	25,425	16,000
Outyears	179,680	179,680	189,605
Total, TPC	**208,500**	**208,500**	**208,500**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	12,000	16,000	**N/A**
Design - Contingency	3,000	4,000	**N/A**
Total, Design (TEC)	**15,000**	**20,000**	**N/A**
Construction	150,000	132,000	**N/A**
Construction - Contingency	39,000	34,000	**N/A**
Total, Construction (TEC)	**189,000**	**166,000**	**N/A**
Total, TEC	**204,000**	**186,000**	**N/A**
Contingency, TEC	*42,000*	*38,000*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	2,700	2,200	**N/A**
Conceptual Design	1,800	800	**N/A**
Total, Except D&D (OPC)	**4,500**	**3,000**	**N/A**
Total, OPC	**4,500**	**3,000**	**N/A**
Contingency, OPC	***N/A***	*N/A*	***N/A***
Total, TPC	**208,500**	**189,000**	**N/A**
Total, Contingency (TEC+OPC)	***42,000***	***38,000***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	500	2,000	—	—	183,500	186,000
	OPC	1,000	1,000	—	—	1,000	3,000
	TPC	1,500	3,000	—	—	184,500	189,000
FY 2022	TEC	500	500	10,000	—	175,000	186,000
	OPC	323	1,000	—	—	1,677	3,000
	TPC	823	1,500	10,000	—	176,677	189,000
FY 2023	TEC	500	500	500	25,425	177,075	204,000
	OPC	323	1,572	—	—	2,605	4,500
	TPC	823	2,072	500	25,425	179,680	208,500

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2032
Expected Useful Life	30 years
Expected Future Start of D&D of this capital asset	4Q FY 2062

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	TBD	7,805	TBD	885,000
Utilities	TBD	14,940	TBD	158,930
Maintenance and Repair	TBD	5,700	TBD	702,000
Total, Operations and Maintenance	TBD	28,445	TBD	1,745,930

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at SLAC National Accelerator Facility	None
Area of D&D in this project at SLAC National Accelerator Facility	None
Area at SLAC National Accelerator Facility to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[rrr]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The SLAC Management and Operating (M&O) contractor, Stanford University, will perform the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor is responsible for awarding and managing all subcontracts related to this project. The M&O contractor will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. Potential acquisition and project delivery methods include, but are not limited to, firm-fixed-price contracts for design-bid-build, construction management, and design-build subcontracts. The M&O contractor will also evaluate potential benefits of using single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for SLAC on which it will be evaluated.

[rrr] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

20-SC-80, Utilities Infrastructure Project, FNAL
Fermi National Accelerator Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Utilities Infrastructure Project (UIP) is $20,000,000 of Total Estimated Cost (TEC) funding. The preliminary Total TEC range for this project is $248,000,000 to $403,000,000. The preliminary Total Project Cost (TPC) range for this project is $252,000,000 to $407,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is $314,000,000.

This project will modernize obsolete and severely deteriorated utilities infrastructure at Fermi National Accelerator Laboratory (FNAL).

Significant Changes

This project was initiated in FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on February 23, 2022. FY 2023 funds will support Project Engineering and Design (PED), long lead procurement, and early construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level will be assigned to this project prior to CD-1 approval.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2021	5/17/19	4Q FY 2020	4Q FY 2020	4Q FY 2021	3Q FY 2022	4Q FY 2022	N/A	4Q FY 2034
FY 2022	5/17/19	4Q FY 2021	1Q FY 2022	4Q FY 2024	2Q FY 2025	2Q FY 2025	N/A	4Q FY 2032
FY 2023	5/17/19	10/2/2021	2/23/22	2Q FY 2024	2Q FY 2024	2Q FY 2024	N/A	4Q FY 2034

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation	CD-3A
FY 2021	4Q FY 2021	4Q FY 2020
FY 2022	4Q FY 2024	2Q FY 2023
FY 2023	4Q FY 2023	4Q FY 2023

CD-3A – Approve Long-Lead Procurements and Start of Early Construction Activities

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2021	73,000	237,000	310,000	4,000	4,000	314,000
FY 2022	28,300	281,700	310,000	4,000	4,000	314,000
FY 2023	43,800	266,200	310,000	4,000	4,000	314,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The UIP's preliminary scope includes upgrading the highest risk major utility systems across the FNAL campus. Specifically, this project will first evaluate the current condition of the industrial cooling water system, potable water distribution system, sanitary sewer and storm collection systems, natural gas distribution system, electrical distribution system, Kautz Road Substation, and the Central Utility Building. Selected portions of the systems will then be replaced to assure safe, reliable, and efficient service to mission critical facilities. In addition, the project will perform upgrades to obsolete, end-of-life components, which will increase capacity, reliability, and personnel safety for critical utilities.

Justification

DOE's Office of Science (SC) advances new experiments, international partnerships, and research programs to transform the understanding of nature and to advance U.S. energy, economic and national security interests. This mission requires the modernization of obsolete and severely deteriorated utilities infrastructure at FNAL. SC has identified a need to recapitalize FNAL's Central Utilities Building and distributed site utility infrastructure to ensure the stewardship of SC's investments and to provide modern, world-class facilities for scientific experiments and research.

Although there has been substantial investment in recent years to modernize and construct new research facilities at FNAL, much of FNAL's utility infrastructure serving these facilities is over 50 years old. Efficient, maintainable, and reliable utilities are critical to the success and mission capability of FNAL's research facilities. Currently, a significant portion of FNAL's utility infrastructure is beyond useful life and suffering from failures, decreased reliability, lack of redundancy, and limitations in capacity. As such, there is an urgent need to revitalize and selectively upgrade FNAL's existing major utility systems to ensure reliable service, meet capacity requirements, and enable readiness of facilities critical to the research mission.

The UIP will deliver a significantly more modern and resilient general-purpose infrastructure. The combination of data collection and artificial intelligent monitoring systems will be able to adjust to trends, predict failures, and react to extreme weather events, such as automatically transferring power to minimize impacts to mission critical scientific operations. Additionally, modern utility systems will be more efficient and sustainable. For example, inefficient boilers will be replaced and electrical metering equipment will be improved in order to identify future energy savings projects.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets*.

Key Performance Parameters (KPPs)

The KPPs are preliminary and may change as the project continues towards CD-2. At CD-2 approval, the KPPs will be baselined. The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Chilled Water Plant and CUB Upgrades	▪ Construct a new building for chilled water production (6,000 tons cooling capacity)	▪ Add additional 25 percent square footage to new chilled water plant for future growth.
	▪ Refurbish the existing Central Utility Building envelope ▪ Replace mechanical infrastructure in the CUB to support the Wilson Hall footprint area	▪ Upgrade existing CUB envelope and roof with environmentally sustainable improvements.
Kautz Road Substation	▪ Replace/ Upgrade the KRS to improve arc flash safety requirements	▪ Upgrade existing CUB envelope and roof with environmentally sustainable improvements.
Linear Utilities Replacement	▪ Revitalize 5 miles of the Industrial Cooling Water (ICW) system	▪ Revitalize 16 miles of the Industrial Cooling Water (ICW) system
	▪ Replace 5 miles of the Domestic Water System (DWS)	▪ Replace 19 miles of the Domestic Water System (DWS)
	▪ Replace 3.5 miles of the Sanitary Sewer systems	▪ Replace 11 miles of the Sanitary Sewer System
	▪ Replace 2 miles of underground Natural Gas lines	▪ Replace 22 miles of underground Natural Gas lines
	▪ Replace 2 miles of electrical distribution feeders and associated unit substations, transformers, etc.	▪ Replace 65 miles of electrical distribution feeders and associated unit substations, transformers, etc. ▪ Provide Electrical Code upgrades to Master Substation ▪ Replace 100 percent of the High-Pressure Sodium exterior lights along sidewalks, roads, and parking lots with LED.

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	500	500	1,000
FY 2023	20,000	20,000	19,500
Outyears	22,300	22,300	23,300
Total, Design (TEC)	**43,800**	**43,800**	**43,800**
Construction (TEC)			
Outyears	266,200	266,200	266,200
Total, Construction (TEC)	**266,200**	**266,200**	**266,200**
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	500	500	1,000
FY 2023	20,000	20,000	19,500
Outyears	288,500	288,500	289,500
Total, TEC	**310,000**	**310,000**	**310,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2020	1,500	1,500	1,500
FY 2021	600	600	600
FY 2022	500	500	500
Outyears	1,400	1,400	1,400
Total, OPC	**4,000**	**4,000**	**4,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2020	2,000	2,000	1,500
FY 2021	1,100	1,100	600
FY 2022	1,000	1,000	1,500
FY 2023	20,000	20,000	19,500
Outyears	289,900	289,900	290,900
Total, TPC	**314,000**	**314,000**	**314,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	33,300	24,000	**N/A**
Design - Contingency	10,500	4,300	**N/A**
Total, Design (TEC)	**43,800**	**28,300**	**N/A**
Construction	192,700	220,000	**N/A**
Construction - Contingency	73,500	61,700	**N/A**
Total, Construction (TEC)	**266,200**	**281,700**	**N/A**
Total, TEC	**310,000**	**310,000**	**N/A**
Contingency, TEC	*84,000*	*66,000*	***N/A***
Other Project Cost (OPC)			
Conceptual Planning	2,300	2,300	**N/A**
Conceptual Design	700	700	**N/A**
OPC - Contingency	1,000	1,000	**N/A**
Total, Except D&D (OPC)	**4,000**	**4,000**	**N/A**
Total, OPC	**4,000**	**4,000**	**N/A**
Contingency, OPC	*1,000*	*1,000*	***N/A***
Total, TPC	**314,000**	**314,000**	**N/A**
Total, Contingency (TEC+OPC)	***85,000***	***67,000***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2021	TEC	500	2,000	—	—	307,500	310,000
	OPC	2,000	—	—	—	2,000	4,000
	TPC	2,500	2,000	—	—	309,500	314,000
FY 2022	TEC	500	500	13,300	—	295,700	310,000
	OPC	—	1,530	500	—	1,970	4,000
	TPC	500	2,030	13,800	—	297,670	314,000
FY 2023	TEC	500	500	500	20,000	288,500	310,000
	OPC	1,500	600	500	—	1,400	4,000
	TPC	2,000	1,100	1,000	20,000	289,900	314,000

Notes:

- *This project has not received CD-2 approval; therefore, funding estimates are preliminary.*
- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2034
Expected Useful Life	30 years
Expected Future Start of D&D of this capital asset	4Q FY 2064

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	TBD	287	TBD	8,600
Utilities	TBD	577	TBD	17,300
Maintenance and Repair	TBD	287	TBD	8,600
Total, Operations and Maintenance	TBD	1,151	TBD	34,500

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Fermi National Accelerator Laboratory.....	10,000 – 30,000
Area of D&D in this project at Fermi National Accelerator Laboratory.....	TBD
Area at Fermi National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[sss]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	TBD

8. Acquisition Approach

The FNAL Management and Operating (M&O) contractor, Fermi Research Alliance LLC, will perform the acquisition for this project. The M&O contractor is responsible for awarding and managing all subcontracts related to this project and will evaluate various acquisition alternatives and project delivery methods prior to achieving CD-1. The M&O will also evaluate potential benefits of using a single or multiple contracts to procure materials, equipment, construction, commissioning, and other project scope elements. Its annual performance and evaluation measurement plan will include project performance metrics for FNAL on which will be evaluated.

[sss] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.

19-SC-74, BioEPIC, LBNL
Lawrence Berkeley National Laboratory
Project is for Design and Construction

1. Summary, Significant Changes, and Schedule and Cost History

Summary

The FY 2023 Request for the Biological and Environmental Program Integration Center (BioEPIC) project is $45,000,000 of Total Estimated Cost (TEC) funding. The Total Estimated Cost (TEC) for this project is $165,000,000. The Total Project Cost (TPC) for the project is $167,200,000.

This project will construct a new building with high performance laboratory space in close proximity to key LBNL facilities and programs. Research operations currently located in commercially leased space and dispersed across the campus will be co-located into this building, allowing for better facilitation of Biological and Environmental Research (BER), Advanced Scientific Computing Research (ASCR), and Basic Energy Sciences (BES) program research activities.

Significant Changes

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Baseline and Start of Construction, which was approved on September 22, 2021. FY 2023 funds will support construction and associated activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level III: TPC greater than $100,000,000 and equal to or less than $400,000,000) has been assigned to this project.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	D&D Complete	CD-4
FY 2020	3/13/18	2Q FY 2019	3Q FY 2019	4Q FY 2020	2Q FY 2022	4Q FY 2021	N/A	4Q FY 2027
FY 2021	3/13/18	5/9/19	5/9/19	4Q FY 2021	2Q FY 2021	4Q FY 2021	N/A	4Q FY 2027
FY 2022	3/13/18	5/9/19	5/9/19	4Q FY 2021	2Q FY 2021	4Q FY 2021	N/A	4Q FY 2027
FY 2023	3/13/18	5/9/19	5/9/19	9/22/21	2/22/21	9/22/21	N/A	4Q FY 2027

CD-0 – Approve Mission Need for a construction project with a conceptual scope and cost range

Conceptual Design Complete – Actual date the conceptual design was completed (if applicable)

CD-1 – Approve Alternative Selection and Cost Range

CD-2 – Approve Performance Baseline

Final Design Complete – Estimated/Actual date the project design will be/was complete(d)

CD-3 – Approve Start of Construction

D&D Complete – Completion of D&D work

CD-4 – Approve Start of Operations or Project Closeout

Fiscal Year	Performance Baseline Validation
FY 2020	4Q FY 2020
FY 2021	4Q FY 2021
FY 2022	4Q FY 2021
FY 2023	9/22/21

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2020	13,000	127,000	140,000	2,200	2,200	142,200
FY 2021	13,000	127,000	140,000	2,200	2,200	142,200
FY 2022	13,000	127,000	140,000	2,200	2,200	142,200
FY 2023	15,000	150,000	165,000	2,200	2,200	167,200

Note:

- *Other Project Costs (OPC) are funded through laboratory overhead.*

2. Project Scope and Justification

Scope

The scope of the BioEPIC project is to construct a new, state-of-the-art facility between 55,000 and 90,000 gross square feet (gsf) with laboratory space to support high performance research by BER, ASCR, and BES programs. This facility will be constructed in close proximity to key LBNL facilities and programs. Research operations currently located in commercially leased space and dispersed across the campus will be collocated to the BioEPIC building. Collocation of researchers in this unique experimental facility, near other important Office of Science (SC) assets, will increase synergy and efficiency, which will better facilitate collaborative research in support of the SC mission.

Justification

The mission need of this project is to increase the synergy and efficiency of biosciences and other SC research at LBNL. LBNL has grown from a pioneering particle and nuclear physics laboratory into a multidisciplinary research facility with broad capabilities in physical, chemical, computational, biological, and environmental systems research in support of the DOE mission. Much of the biological sciences program at LBNL is located off-site, away from the main laboratory, while others are dispersed across several locations on the LBNL campus. This arrangement has produced research and operational capability gaps that limit scientific progress and is a significant roadblock to the kind of collaborative science that is required for understanding, predicting, and harnessing the Earth's microbiome for energy and environmental benefits. This project will close the present capability gaps by providing a state-of-the-art facility that will collocate biosciences research and other programs.

The BioEPIC building will bring together important SC programs and unique capabilities that are currently housed in leased space and buildings both on and off the LBNL campus that are not well-suited to BioEPIC programs. The current facilities are near 'end-of-life', are not energy efficient, and are prone to prolonged outages in the face of regular wildfire risks that trigger power shutdowns by the LBNL's local power authority. The experiments hosted within this resilient new facility will be able to run through power shutdown events because of the modern systems built into BioEPIC. The BioEPIC building is designed to directly address these issues through pursuit of LEED gold certification, optimization of natural lighting, and provision of adequate emergency power. BioEPIC will not use natural gas for space and water heating but rather will have

energy-saving all-electric mechanical and plumbing systems. BioEPIC will bring together the LBNL's four BER 'science focus area' programs to focus on how soil-plant-microbe interactions impact growth of alternative energy feedstocks, agricultural productivity, water resources, and terrestrial carbon storage. Understanding and predicting responses to climate change is a central theme of all four programs.

The project is being conducted in accordance with the project management requirements in DOE Order 413.3B, *Program and Project Management for the Acquisition of Capital Assets.*

Key Performance Parameters (KPPs)

The Threshold KPPs represent the minimum acceptable performance that the project must achieve. The Objective KPPs represent the desired project performance. Achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion.

Performance Measure	Threshold	Objective
Biosciences and other research space	55,000 gsf	90,000 gsf

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2019	5,000	5,000	1,858
FY 2020	10,000	10,000	6,919
FY 2021	–	–	5,024
FY 2022	–	–	1,199
Total, Design (TEC)	**15,000**	**15,000**	**15,000**
Construction (TEC)			
FY 2020	5,000	5,000	–
FY 2021	20,000	20,000	2,740
FY 2022	35,000	35,000	30,000
FY 2023	45,000	45,000	34,000
Outyears	45,000	45,000	83,260
Total, Construction (TEC)	**150,000**	**150,000**	**150,000**
Total Estimated Cost (TEC)			
FY 2019	5,000	5,000	1,858
FY 2020	15,000	15,000	6,919
FY 2021	20,000	20,000	7,764
FY 2022	35,000	35,000	31,199
FY 2023	45,000	45,000	34,000
Outyears	45,000	45,000	83,260
Total, TEC	**165,000**	**165,000**	**165,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
FY 2018	767	767	767
FY 2019	748	748	748
FY 2020	21	21	21
Outyears	664	664	664
Total, OPC	**2,200**	**2,200**	**2,200**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
FY 2018	767	767	767
FY 2019	5,748	5,748	2,606
FY 2020	15,021	15,021	6,940
FY 2021	20,000	20,000	7,764
FY 2022	35,000	35,000	31,199
FY 2023	45,000	45,000	34,000
Outyears	45,664	45,664	83,924
Total, TPC	**167,200**	**167,200**	**167,200**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	15,000	10,600	15,000
Design - Contingency	N/A	2,400	**N/A**
Total, Design (TEC)	**15,000**	**13,000**	**15,000**
Construction	125,000	105,000	125,000
Construction - Contingency	25,000	22,000	25,000
Total, Construction (TEC)	**150,000**	**127,000**	**150,000**
Total, TEC	**165,000**	**140,000**	**165,000**
Contingency, TEC	*25,000*	*24,400*	*25,000*
Other Project Cost (OPC)			
Conceptual Planning	1,500	1,500	**N/A**
Conceptual Design	600	600	**N/A**
OPC - Contingency	100	100	**N/A**
Total, Except D&D (OPC)	**2,200**	**2,200**	**N/A**
Total, OPC	**2,200**	**2,200**	**N/A**
Contingency, OPC	*100*	*100*	***N/A***
Total, TPC	**167,200**	**142,200**	**165,000**
Total, Contingency (TEC+OPC)	***25,100***	***24,500***	***25,000***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2021	FY 2022	FY 2023	Outyears	Total
FY 2020	TEC	11,000	—	—	—	129,000	140,000
	OPC	1,500	—	—	—	700	2,200
	TPC	12,500	—	—	—	129,700	142,200
FY 2021	TEC	20,000	6,000	—	—	114,000	140,000
	OPC	1,500	—	—	—	700	2,200
	TPC	21,500	6,000	—	—	114,700	142,200
FY 2022	TEC	20,000	20,000	35,000	—	65,000	140,000
	OPC	1,521	—	—	—	679	2,200
	TPC	21,521	20,000	35,000	—	65,679	142,200
FY 2023	TEC	20,000	20,000	35,000	45,000	45,000	165,000
	OPC	1,536	—	—	—	664	2,200
	TPC	21,536	20,000	35,000	45,000	45,664	167,200

Note:

- *Other Project Costs (OPC) are funded through laboratory overhead.*

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2077

Related Funding Requirements
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	150	150	5,700	5,700
Utilities	270	270	11,900	11,900
Maintenance and Repair	530	530	20,600	20,600
Total, Operations and Maintenance	950	950	38,200	38,200

7. D&D Information

The new area being constructed in this project is not replacing existing facilities.

	Square Feet
New area being constructed by this project at Lawrence Berkeley National Laboratory	55,000 - 90,000
Area of D&D in this project at Lawrence Berkeley National Laboratory	None
Area at Lawrence Berkeley National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None[ttt]
Area of D&D in this project at other sites	None
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	None
Total area eliminated	None

8. Acquisition Approach

The LBNL Management and Operating (M&O) Contractor, University of California, is performing the acquisition for this project, overseen by the Bay Area Site Office. The M&O contractor evaluated various acquisition approaches and project delivery methods prior to achieving CD-1 and selected a tailored Design-Bid-Build approach with a Construction Manager as General Contractor as the overall best project delivery method with the lowest risk to DOE. The M&O contractor is also responsible for awarding and administering all subcontracts related to this project. The M&O contractor's annual performance evaluation and measurement plan includes project performance metrics on which it will be evaluated.

[ttt] With the implementation of OMB's Reduce the Footprint initiative, DOE no longer maintains the space bank. Footprint is managed using the Facility Information Management System, with decisions on additions and offsets made in accordance with the DOE Real Property Efficiency Plan.