

## 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 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 their 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, resulting 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. Each laboratory's Campus Strategy identifies activities and infrastructure investments (e.g., Line-Item (LI) Construction and General Plant Projects (GPPs)) required to support the core capabilities and achieve the scientific vision of the laboratory. 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 \$650 million in maintenance, repair, and upgrades in FY 2020. These investments came from a variety of funding sources including Federal appropriations for line-item and general plant projects and overhead funding of Institutional GPP (IGPP) projects and maintenance and repair. The SLI investments in line-item construction and science-supporting infrastructure are key elements of this overall investment strategy.

### Highlights of the FY 2022 Request

The SLI program Request continues to focus on improving infrastructure across the SC national laboratory complex. The FY 2022 Request includes funding for two new construction starts: the Critical Infrastructure Modernization Project at ORNL and the Thomas Jefferson Infrastructure Improvements project at Thomas Jefferson National Accelerator Facility (TJNAF).

The Request also supports sixteen ongoing construction projects: the Princeton Plasma Innovation Center at Princeton Plasma Physics Laboratory (PPPL), the Critical Infrastructure Recovery & Renewal project at PPPL, the Ames Infrastructure Modernization project at Ames Laboratory, the Critical Utilities Rehabilitation Project at Brookhaven National Laboratory (BNL), the Seismic and Safety Modernization project at Lawrence Berkeley National Laboratory (LBNL), the Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion project at TJNAF, the Large Scale Collaboration Center at SLAC National Accelerator Laboratory (SLAC), the Tritium System Demolition and Disposal project at PPPL, the Argonne Utilities Upgrade project at Argonne National Laboratory (ANL), the Linear Assets Modernization Project at LBNL, the Critical Utilities Infrastructure Revitalization project at SLAC, the Utilities Infrastructure Project at Fermi National Accelerator Laboratory (FNAL), the Science User Support Center at BNL, the Translational Research Capability project at ORNL, the Biological and Environmental Program Integration Center (BioEPIC) at LBNL, and provides final funding for the Integrated Engineering Research Center at FNAL. These ongoing projects, along with the newly proposed 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 2022 Request also includes funding for general purpose infrastructure projects that will address high priority core infrastructure and utility needs across SC laboratories and facilities. The laboratory infrastructure needs and priorities are evaluated annually by SLI. Projects considered 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)

	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
<b>Science Laboratories Infrastructure</b>				
Payment In Lieu of Taxes (PILT)	4,540	4,650	4,820	+170
OR Landlord	5,610	5,860	6,430	+570
Facilities and Infrastructure	56,850	29,790	17,200	-12,590
Oak Ridge Nuclear Operations	26,000	26,000	20,000	-6,000
<b>Subtotal, Science Laboratories Infrastructure</b>	<b>93,000</b>	<b>66,300</b>	<b>48,450</b>	<b>-17,850</b>
<b>Construction</b>				
22-SC-71, Critical Infrastructure Modernization Project (CIMP), ORNL	–	–	1,000	+1,000
22-SC-72, Thomas Jefferson Infrastructure Improvements (TJII), TJNAF	–	–	1,000	+1,000
21-SC-71, Princeton Plasma Innovation Center (PPIC), PPPL	–	150	7,750	+7,600
21-SC-72, Critical Infrastructure Recovery & Renewal (CIRR), PPPL	–	150	2,000	+1,850
21-SC-73, Ames Infrastructure Modernization (AIM)	–	150	2,000	+1,850
20-SC-71, Critical Utilities Rehabilitation Project (CURP), BNL	20,000	20,000	26,000	+6,000
20-SC-72, Seismic and Safety Modernization (SSM), LBNL	10,000	5,000	27,500	+22,500
20-SC-73, CEBAF Renovation and Expansion (CEBAF), TJNAF	2,000	2,000	10,000	+8,000

(dollars in thousands)

	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
20-SC-74, Craft Resources Support Facility (CRSF), ORNL	15,000	25,000	–	-25,000
20-SC-75, Large Scale Collaboration Center (LSCC), SLAC	11,000	11,000	12,000	+1,000
20-SC-76, Tritium System Demolition and Disposal (TSDD), PPPL	13,000	13,000	6,400	-6,600
20-SC-77, Argonne Utilities Upgrade (AU2), ANL	500	500	10,000	+9,500
20-SC-78, Linear Assets Modernization Project (LAMP), LBNL	500	500	12,850	+12,350
20-SC-79, Critical Utilities Infrastructure Revitalization (CUIR), SLAC	500	500	10,000	+9,500
20-SC-80, Utilities Infrastructure Project (UIP), FNAL	500	500	13,300	+12,800
19-SC-71, Science User Support Center (SUSC), BNL	20,000	20,000	38,000	+18,000
19-SC-72 - Electrical Capacity and Distribution Capability, ANL	30,000	–	–	–
19-SC-73, Translational Research Capability (TRC), ORNL	25,000	22,000	21,500	-500
19-SC-74, BioEPIC, LBNL	15,000	20,000	35,000	+15,000
18-SC-71, Energy Sciences Capability (ESC), PNNL	23,000	23,000	–	-23,000
17-SC-71, Integrated Engineering Research Center (IERC), FNAL	22,000	10,250	10,250	–
<b>Subtotal, Construction</b>	<b>208,000</b>	<b>173,700</b>	<b>246,550</b>	<b>+72,850</b>
<b>Total, Science Laboratories Infrastructure</b>	<b>301,000</b>	<b>240,000</b>	<b>295,000</b>	<b>+55,000</b>

**Science Laboratories Infrastructure  
Explanation of Major Changes**

(dollars in thousands)

<b>FY 2022 Request vs FY 2021 Enacted</b>
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**Infrastructure Support**

The Request continues funding to support Payment in Lieu of Taxes (PILT), nuclear facilities at ORNL, and landlord responsibilities at the Oak Ridge Reservation. Funding for critical core infrastructure across the SC complex decreases in FY 2022.

-17,850

**Construction**

Funding supports sixteen ongoing line-item projects at Ames, FNAL, LBNL, ANL, ORNL, BNL, SLAC, PPPL, and TJNAF. The increase also supports the initiation of two new line-item projects at ORNL and TJNAF.

+72,850

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**Total, Science Laboratories Infrastructure**

+55,000

### **Program Accomplishments**

Since FY 2006, the SLI program has invested over \$1.5 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 eleven 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 1,200,000 gsf of new space and modernized more than 450,000 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 over \$184,000,000 in laboratory core infrastructure improvements including \$133,000,000 in electrical and utility improvements, \$34,000,000 in building renovations, and \$17,000,000 in safety and environmental projects. Examples of recent SLI investments in core infrastructure include building HVAC upgrades at BNL and access control upgrades at Ames and Fermi. SLI also funded electrical substation and building HVAC system improvements at LBNL, upgrades to the cryogenics facility at TJNAF and facility improvement including fire protection at OSTI.

#### *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 upgraded or replaced when they approach end-of-life, have improved reliability, efficiency, and performance, and that excess space is removed so that it no longer requires operation and maintenance funding and frees up valuable space for re-utilization. This investment enables SC laboratories to keep up with needed upgrades and repairs. The funded activities include core infrastructure upgrades at various laboratories, general infrastructure support, and support for nuclear operations at ORNL.

This subprogram also funds Payment In Lieu of Taxes (PILT) to local communities around ANL, BNL, and ORNL, as well as stewardship-type needs (e.g., roads and grounds maintenance) across the Oak Ridge Reservation.

### Facilities and Infrastructure

This activity supports investments that focus on laboratory core infrastructure and operations. 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. Each year, the SLI program continues this focus and collaborates with the SC research programs to review proposed investments and maintains an active list of critical core infrastructure needs. Projects considered 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 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 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
<b>Infrastructure Support</b>	<b>\$66,300</b>	<b>\$48,450</b>
		<b>-\$17,850</b>
Facilities and Infrastructure	\$29,790	\$17,200
		-\$12,590
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 continue to support the most critical nuclear operations and facilities at ORNL.
OR Landlord	\$5,860	\$6,430
		+\$570
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	\$4,820
		+\$170
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 increase to support anticipated PILT requirements.



## Science Laboratories Infrastructure Construction

### Description

The SLI Construction 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 as well as funding to replace the 50 plus year old basic infrastructure supporting the SC national laboratories to ensure the new infrastructure provides for the critical needs of the future science initiatives and world class user facilities.

The FY 2022 Request includes funding for:

Two new line-item construction projects:

- Critical Infrastructure Modernization Project at ORNL; and
- Thomas Jefferson Infrastructure Improvements at TJNAF.

Sixteen ongoing line-item construction projects:

- Princeton Plasma Innovation Center at PPPL;
- Critical Infrastructure Recovery & Renewal at PPPL;
- Ames Infrastructure Modernization at Ames;
- Critical Utilities Rehabilitation Project at BNL;
- Seismic and Safety Modernization at LBNL;
- CEBAF Renovation and Expansion at TJNAF;
- Large Scale Collaboration Center at SLAC;
- Tritium System Demolition and Disposal at PPPL;
- Argonne Utilities Upgrade at ANL;
- Linear Assets Modernization Project at LBNL;
- Critical Utilities Infrastructure Revitalization at SLAC;
- Utilities Infrastructure Project at FNAL;
- Science User Support Center at BNL;
- Translational Research Capability at ORNL;
- Biological and Environmental Program Integration Center at LBNL; and
- Integrated Engineering Research Center at FNAL.

### 22-SC-71, Critical Infrastructure Modernization Project, ORNL

The Critical Infrastructure and Modernization Project (CIMP) is proposed to upgrade critical infrastructure systems which may include upgrades/replacement to the following systems: potable water, sanitary sewer/wastewater treatment, storm water, chilled water, steam, electrical, natural gas, compressed air, telecommunications, etc.

DOE Order 413.3B Critical Decision (CD)-0, Approve Mission Need, was achieved on October 26, 2020. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the 4th 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 \$221,000,000 to \$415,000,000. The preliminary Total Project Cost (TPC) range for this project is \$225,000,000 to \$419,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$419,000,000.

### 22-SC-72, Thomas Jefferson Infrastructure Improvements, TJNAF

The Thomas Jefferson National Accelerator Facility (TJNAF) requires additional laboratory space and modern utility systems that are safer and more operationally efficient for employees and visitors of TJNAF. This project is proposed to address the lack of efficient high-bay laboratory space, growing repair needs and deferred maintenance, and safety and security risks currently posed by intermingling of operations, projects, and users. It would renovate/modernize 54,000 square feet and construct 65,000-80,000 square feet of new space to facilitate renovation/modernization efforts and support projected

workload. Additionally, there will be improvements to the water, sanitary and communication utilities, roads, sidewalks and parking infrastructure.

DOE Order 413.3B Critical Decision (CD)-0, Approve Mission Need, was achieved on December 8, 2020. The preliminary estimate for 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 TEC range for this project is \$76,000,000 to \$98,000,000. The preliminary TPC range for this project is \$77,000,000 to \$99,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$99,000,000.

#### 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, approved on January 22, 2021. The preliminary estimate for CD-2 Approve Performance Baseline, is anticipated in the fourth quarter of FY 2023. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$78,300,000 to \$96,300,000. The preliminary TPC range for this project is \$80,500,000 to \$98,500,000. These cost ranges encompass the most feasible preliminary alternative at this time. The preliminary TPC estimate for this project is \$98,500,000.

#### 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 considered 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 preliminary TEC range for this project is \$78,000,000 to \$94,100,000. The preliminary TPC range for this project is \$79,900,000 to \$96,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$89,000,000.

#### 21-SC-73, Ames Infrastructure Modernization

The Ames Infrastructure Modernization (AIM) project will support the SC mission by providing a more operationally efficient campus and safer environment for the employees, visitors, and guests at Ames, as well as reduce deferred maintenance costs. This project is designed to support DOE mission-critical programs and initiatives, increase the reliability of utility infrastructure, minimize facility costs through effective and efficient operations, and modernize laboratories in Ames Laboratory's research buildings, thereby enhancing Ames Laboratory's ability to continue to deliver on SC's mission across multiple program offices.

Specifically, this project will provide updated infrastructure building systems in existing research and operations buildings at Ames Laboratory, such as plumbing systems; building envelopes; electrical systems-emergency, backup power, and uninterruptible power supplies; and telecommunication systems. In addition, some of the laboratory spaces will be modernized to support the SC mission and associated equipment.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on September 16, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the first 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 \$22,000,000 to \$89,000,000. The preliminary TPC range for this project is \$23,000,000 to \$90,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$31,000,000.

#### 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 second 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 TPC 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, specifically related to facilities with large congregation areas as well as improve facilities that are necessary for emergency response personnel and to maintain continuity of operations. 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 2022. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$76,300,000 to \$95,400,000. The preliminary TPC range for this project is \$78,500,000 to \$97,600,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC 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 compromised 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 first 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 \$47,000,000 to \$96,000,000. The preliminary TPC range for this project is \$50,000,000 to \$99,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$90,000,000.

#### 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 lab 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 office spaces that enable researchers to benefit from collaboration with subject matter experts in computational science, machine learning, artificial intelligence, exascale computing, data management, data acquisition, simulation, imaging, visualization, and modeling are 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. The preliminary TEC range for this project is \$56,000,000 to \$90,400,000. The preliminary TPC range for this project is \$58,000,000 to \$92,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$66,000,000.

#### 20-SC-76, Tritium System Demolition and Disposal, PPPL

The Tritium System Demolition and Disposal (TSDD) project at PPPL will remove tritium-contaminated items, components, equipment, sub-systems, etc., through demolition and disposal off-site. Execution of the TSDD project will result in reducing the risk of tritium release, reducing the risk of worker exposure to tritium, and reducing expenditures on a legacy system.

The most recent DOE Order 413.3B Critical Decision (CD) CD-0, Approve Mission Need, was approved on September 16, 2019. The preliminary estimate for approval of combined CD-1, Approve Alternative Selection and Cost Range, CD-2, Approve Performance Baseline, and CD-3, Approve Start of Construction, is anticipated in the third quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$19,500,000 to \$32,400,000. The preliminary TPC range for this project is \$20,500,000 to \$33,400,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$33,400,000.

#### 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-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the third quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$72,000,000 to \$215,000,000. The preliminary TPC range for this project is \$73,000,000 to \$216,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$216,000,000.

#### 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 communication.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the first 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 \$142,000,000 to \$236,000,000. The preliminary TPC range for this project is \$146,000,000 to \$240,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$240,000,000.

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

The primary objective of Critical Utilities Infrastructure Revitalization (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-0, Approve Mission Need, approved May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the fourth quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$80,000,000 to \$186,000,000. The preliminary TPC range for this project is \$83,000,000 to \$189,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$189,000,000.

#### 20-SC-80, Utilities Infrastructure Project, FNAL

The Utilities Infrastructure Project at FNAL will identify, recapitalize, and upgrade 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 recapitalized or replaced 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-0, Approve Mission Need, approved on May 17, 2019. The preliminary estimate for CD-1, Approve Alternative Selection and Cost Range, is anticipated in the first 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 \$146,000,000 to \$310,000,000. The preliminary TPC range for this project is \$150,000,000 to \$314,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$314,000,000.

#### 19-SC-71, Science User Support Center, BNL

Construction of the Science User Support Center will provide convenient and efficient facilities for processing and supporting the users of BNL's premier research facilities by replacing the current dispersed and inefficient facilities. It will also provide conference facilities to support the collaborative science and research agenda for the user community and BNL scientists. BNL user facilities and capabilities supported by DOE and partnering agencies attract over 40,000 visiting scientists, guests, users, and contractors annually to conduct research in a broad range of basic and applied sciences. However, the ability to efficiently process and support the needs of this growing community of researchers is limited by the age, deteriorated condition, and dispersed nature of BNL's current facilities.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, approved on December 18, 2018. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the first 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 \$70,800,000 to \$94,800,000. The preliminary TPC range for this project is \$72,000,000 to \$96,000,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$86,200,000.

#### 19-SC-73, Translational Research Capability, ORNL

The Translational Research Capability project will provide a new building with laboratory space to support mission-critical research sponsored by ASCR, BES, FES and HEP. Currently, ORNL has a shortage of modern, flexible, and adaptable space, wet and dry laboratories, and high bay space needed to support research directed by these SC programs. Aging infrastructure and utilities have caused severe temperature, humidity and power quality problems, particularly in the advanced materials development and research. Finally, dispersed research space across the ORNL campus remains a

challenge in supporting the increasingly interdisciplinary and collaborative research required to advance SC program mission areas.

The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Performance Baseline and Approve Start of Construction/Execution approved on April 3, 2020. This project has a TEC of \$93,500,000 and a TPC of \$95,000,000.

#### 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. The new building will consolidate much of the widely dispersed biological sciences program at LBNL and off-site and will facilitate 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, Approve Alternative Selection and Cost Range, approved on May 9, 2019. The preliminary estimate for CD-2, Approve Performance Baseline, is anticipated in the fourth quarter of FY 2021. This project is pre-CD-2; therefore, schedule estimates are preliminary and subject to change. The preliminary TEC range for this project is \$110,000,000 to \$190,000,000. The preliminary TPC range for this project is \$112,200,000 to \$192,200,000. These cost ranges encompass the most feasible preliminary alternatives at this time. The preliminary TPC estimate for this project is \$142,200,000.

#### 17-SC-71, Integrated Engineering Research Center, FNAL

The Integrated Engineering Research Center project will construct a scientific user support facility to accommodate increased collaboration and interactions among staff at FNAL, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments. Currently, FNAL staff and their associated manufacturing, assembly, engineering, and technical facilities are scattered among three parts of the campus. The Integrated Engineering Research Center will provide FNAL with a collaborative, multi-divisional and interdisciplinary research center, will reduce the overall footprint of outdated facilities and collocate engineering and associated research staff near the central campus, and will improve operational efficiency and collaboration because groups working on key projects would be in close proximity.

The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-2/3 Approve Project Baseline and Approve Start of Construction Activities, which was approved on September 30, 2020. This project has a TEC of \$85,000,000 and a TPC of \$86,000,000.

**Science Laboratories Infrastructure  
Construction**

**Activities and Explanation of Changes**

(dollars in thousands)

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
<b>Construction</b>	<b>\$173,700</b>	<b>\$246,550</b>
		<b>+\$72,850</b>
22-SC-71, Critical Infrastructure Modernization Project, ORNL	\$ —	\$1,000
No funding requested.	The Request will initiate Project Engineering and Design (PED) activities.	Funding will support the initiation of PED activities for this new project.
22-SC-72, Thomas Jefferson Infrastructure Improvements, TJNAF	\$ —	\$1,000
No funding requested.	The Request will initiate PED activities.	Funding will support the initiation of PED activities for this new project.
21-SC-71, Princeton Plasma Innovation Center, PPPL	\$150	\$7,750
Funding initiates PED activities.	The Request will support ongoing PED activities.	Funding will support the continuation of PED activities for this project.
21-SC-72, Critical Infrastructure Recovery & Renewal, PPPL	\$150	\$2,000
Funding initiates PED activities.	The Request will support ongoing PED activities.	Funding will support the continuation of PED activities for this project.
21-SC-73, Ames Infrastructure Modernization	\$150	\$2,000
Funding initiates PED activities.	The Request will support ongoing PED activities.	Funding will support the continuation of PED activities for this project.

(dollars in thousands)

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
20-SC-71, Critical Utilities Rehabilitation Project, BNL \$20,000	\$26,000	+\$6,000
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	\$10,000	+\$8,000
Funding supports ongoing PED activities.	The Request will support ongoing PED activities and initiate construction activities.	Funding will support ongoing PED activities and the initiation of 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	\$12,000	+\$1,000
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	\$6,400	-\$6,600
Funding supports ongoing construction activities.	The Request will support final construction activities.	Final funding for this project is requested in FY 2022.



(dollars in thousands)

FY 2021 Enacted	FY 2022 Request	Explanation of Changes FY 2022 Request vs FY 2021 Enacted
20-SC-77, Argonne Utilities Upgrade, ANL Funding supports ongoing PED activities.	\$500 The Request will support ongoing PED activities.	\$10,000 Funding will support ongoing PED activities for this project.
20-SC-78, Linear Assets Modernization Project, LBNL Funding supports ongoing PED activities.	\$500 The Request will support ongoing PED activities and initiate early construction activities.	\$12,850 Funding will support ongoing PED activities and the initiation of early construction activities for this project.
20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC Funding supports ongoing PED activities.	\$500 The Request will support ongoing PED activities and initiate early construction activities.	\$10,000 Funding will support ongoing PED activities and the initiation of early construction activities for this project.
20-SC-80, Utilities Infrastructure Project, FNAL Funding supports ongoing PED activities.	\$500 The Request will support ongoing PED activities and initiate early construction activities.	\$13,300 Funding will support ongoing PED activities and the initiation of early construction activities for this project.
19-SC-71, Science User Support Center, BNL Funding supports construction activities.	\$20,000 The Request will support construction activities.	\$38,000 Funding will support ongoing construction activities for this project.
19-SC-73, Translational Research Capability, ORNL Funding supports construction activities.	\$22,000 The Request will support construction activities.	\$21,500 Funding will support ongoing construction activities for this project.

(dollars in thousands)

<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>Explanation of Changes FY 2022 Request vs FY 2021 Enacted</b>
19-SC-74, BioEPIC, LBNL Funding supports construction activities.	\$20,000 The Request will support ongoing construction activities.	\$35,000 Funding will support ongoing construction activities for this project.
18-SC-71, Energy Sciences Capability, PNNL Funding supports the completion of construction activities.	\$23,000 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 Funding supports construction activities.	\$10,250 The Request will support final construction activities.	\$10,250 Final funding for this project is requested in FY 2022.

**Science Laboratories Infrastructure  
Capital Summary**

(dollars in thousands)

	<b>Total</b>	<b>Prior Years</b>	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
<b>Capital Operating Expenses</b>						
Capital Equipment	N/A	N/A	-	-	-	-
Minor Construction Activities						
General Plant Projects	N/A	N/A	38,578	29,590	17,000	-12,590
<b>Total, Capital Operating Expenses</b>	<b>N/A</b>	<b>N/A</b>	<b>38,578</b>	<b>29,590</b>	<b>17,000</b>	<b>-12,590</b>

**Science Laboratories Infrastructure  
Minor Construction Activities**

(dollars in thousands)

	<b>Total</b>	<b>Prior Years</b>	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
<b>General Plant Projects (GPP)</b>						
GPPs (greater than or equal to \$5M and less than \$20M)						
Advanced PFAS Characterization and Remediation at BNL	10,900	-	10,900	-	-	-
Grizzly Substation Yard Expansion at LBNL	15,000	-	15,000	-	-	-
Village Sanitary Improvements/Lift Station at FNAL	6,000	-	6,000	-	-	-
Cryogenics Test Facility (CTF) Upgrade at TJNAF	5,200	-	5,200	-	-	-
Welcome and Access Center at FNAL	12,500	-	-	1,000	11,500	+10,500
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	+1,600
<b>Total GPPs (greater than or equal to \$5M and less than \$20M)</b>	<b>N/A</b>	<b>N/A</b>	<b>37,100</b>	<b>24,700</b>	<b>13,100</b>	<b>-11,600</b>
<b>Total GPPs less than \$5M</b>	<b>N/A</b>	<b>N/A</b>	<b>1,478</b>	<b>4,890</b>	<b>3,900</b>	<b>-990</b>
<b>Total, General Plant Projects (GPP)</b>	<b>N/A</b>	<b>N/A</b>	<b>38,578</b>	<b>29,590</b>	<b>17,000</b>	<b>-12,590</b>
<b>Total, Minor Construction Activities</b>	<b>N/A</b>	<b>N/A</b>	<b>38,578</b>	<b>29,590</b>	<b>17,000</b>	<b>-12,590</b>

*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.*

(dollars in thousands)

Total	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
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**Institutional General Plant Projects (IGPP)**

IGPPs (greater than or equal to \$5M and less than \$20M)

Chilled Water Capacity Upgrades at ANL	5,320	5,320	—	—	—
Site Security Upgrades - North/West Gates at ANL	7,200	7,200	—	—	—
B77 Enclosure at LBNL	6,970	6,970	—	—	—
Transit Hub and Site Utilities at LBNL	14,865	14,865	—	—	—
B73 Seismic Upgrade at LBNL	12,060	12,060	—	—	—
B77 Metrology Lab at LBNL	6,800	6,800	—	—	—
Secondary Sewage Treatment at ORNL	19,500	19,500	—	—	—
Multi-Program Office Building #1 at ORNL	9,563	9,563	—	—	—
Mission Support Facility at ORNL	19,140	19,140	—	—	—
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

(dollars in thousands)

	<b>Total</b>	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
<b>Institutional General Plant Projects (IGPP)</b>					
IGPPs (greater than or equal to \$5M and less than \$20M)					
Electric Switch station (SW-A3) Replacement at LBNL	12,600	—	—	12,600	+12,600
TRU Waste Certification and Loading Support Building at ORNL	18,000	—	—	18,000	+18,000
High Bandwidth Network at ORNL	9,600	—	—	9,600	+9,600
EGCR Campus Utilities at ORNL	7,000	—	—	7,000	+7,000
Utilities Modernization at ORNL	10,100	—	—	10,100	+10,100
7667 LLW Site Improvements at ORNL	7,000	—	—	7,000	+7,000
Campus Parking Areas at ORNL	5,000	—	—	5,000	+5,000
Richland North Office Building at PNNL	13,000	—	—	13,000	+13,000
Total IGPPs (greater than or equal to \$5M and less than \$20M)	275,618	101,418	91,900	82,300	-9,600
Total IGPPs less than \$5M	80,026	19,596	37,780	22,650	-15,130
<b>Total, Institutional General Plant Projects (IGPP)</b>	<b>355,644</b>	<b>121,014</b>	<b>129,680</b>	<b>104,950</b>	<b>-24,730</b>
<b>Total, Minor Construction Activities</b>	<b>440,812</b>	<b>159,592</b>	<b>159,270</b>	<b>121,950</b>	<b>-37,320</b>

*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)

	<b>Total</b>	<b>Prior Years</b>	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
<b>22-SC-71, Critical Infrastructure Modernization Project, ORNL</b>						
Total Estimated Cost (TEC)	415,000	–	–	–	1,000	+1,000
Other Project Cost (OPC)	4,000	–	500	750	750	–
<b>Total Project Cost (TPC)</b>	<b>419,000</b>	<b>–</b>	<b>500</b>	<b>750</b>	<b>1,750</b>	<b>+1,000</b>
<b>22-SC-72, Thomas Jefferson Infrastructure Improvements, TJNAF</b>						
Total Estimated Cost (TEC)	98,000	–	–	–	1,000	+1,000
Other Project Cost (OPC)	1,000	–	–	1,000	–	-1,000
<b>Total Project Cost (TPC)</b>	<b>99,000</b>	<b>–</b>	<b>–</b>	<b>1,000</b>	<b>1,000</b>	<b>–</b>
<b>21-SC-71, Princeton Plasma Innovation Center, PPPL</b>						
Total Estimated Cost (TEC)	96,300	–	–	150	7,750	+7,600
Other Project Cost (OPC)	2,200	10	1,400	90	–	-90
<b>Total Project Cost (TPC)</b>	<b>98,500</b>	<b>10</b>	<b>1,400</b>	<b>240</b>	<b>7,750</b>	<b>+7,510</b>
<b>21-SC-72, Critical Infrastructure Recovery &amp; Renewal, PPPL</b>						
Total Estimated Cost (TEC)	87,100	–	–	150	2,000	+1,850
Other Project Cost (OPC)	1,900	6	1,046	300	–	-300
<b>Total Project Cost (TPC)</b>	<b>89,000</b>	<b>6</b>	<b>1,046</b>	<b>450</b>	<b>2,000</b>	<b>+1,550</b>
<b>21-SC-73, Ames Infrastructure Modernization</b>						
Total Estimated Cost (TEC)	30,000	–	–	150	2,000	+1,850
Other Project Cost (OPC)	1,000	25	50	200	225	+25
<b>Total Project Cost (TPC)</b>	<b>31,000</b>	<b>25</b>	<b>50</b>	<b>350</b>	<b>2,225</b>	<b>+1,875</b>

(dollars in thousands)

	Total	Prior Years	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
<b>20-SC-71, Critical Utilities Rehabilitation Project, BNL</b>						
Total Estimated Cost (TEC)	92,000	–	20,000	20,000	26,000	+6,000
Other Project Cost (OPC)	1,000	–	410	590	–	-590
<b>Total Project Cost (TPC)</b>	<b>93,000</b>	<b>–</b>	<b>20,410</b>	<b>20,590</b>	<b>26,000</b>	<b>+5,410</b>
<b>20-SC-72, Seismic and Safety Modernization, LBNL</b>						
Total Estimated Cost (TEC)	95,400	–	10,000	5,000	27,500	+22,500
Other Project Cost (OPC)	2,200	1,050	20	–	–	–
<b>Total Project Cost (TPC)</b>	<b>97,600</b>	<b>1,050</b>	<b>10,020</b>	<b>5,000</b>	<b>27,500</b>	<b>+22,500</b>
<b>20-SC-73, CEBAF Renovation and Expansion, TJNAF</b>						
Total Estimated Cost (TEC)	87,000	–	2,000	2,000	10,000	+8,000
Other Project Cost (OPC)	3,000	1,000	467	–	–	–
<b>Total Project Cost (TPC)</b>	<b>90,000</b>	<b>1,000</b>	<b>2,467</b>	<b>2,000</b>	<b>10,000</b>	<b>+8,000</b>
<b>20-SC-74, Craft Resources Support Facility, ORNL</b>						
Total Estimated Cost (TEC)	40,000	–	15,000	25,000	–	-25,000
Other Project Cost (OPC)	1,000	590	260	–	–	–
<b>Total Project Cost (TPC)</b>	<b>41,000</b>	<b>590</b>	<b>15,260</b>	<b>25,000</b>	<b>–</b>	<b>-25,000</b>
<b>20-SC-75, Large Scale Collaboration Center, SLAC</b>						
Total Estimated Cost (TEC)	64,000	–	11,000	11,000	12,000	+1,000
Other Project Cost (OPC)	2,000	500	4	–	–	–
<b>Total Project Cost (TPC)</b>	<b>66,000</b>	<b>500</b>	<b>11,004</b>	<b>11,000</b>	<b>12,000</b>	<b>+1,000</b>



(dollars in thousands)

	Total	Prior Years	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
<b>20-SC-76, Tritium System Demolition and Disposal, PPPL</b>						
Total Estimated Cost (TEC)	32,400	–	13,000	13,000	6,400	-6,600
Other Project Cost (OPC)	1,000	100	800	100	–	-100
<b>Total Project Cost (TPC)</b>	<b>33,400</b>	<b>100</b>	<b>13,800</b>	<b>13,100</b>	<b>6,400</b>	<b>-6,700</b>
<b>20-SC-77, Argonne Utilities Upgrade, ANL</b>						
Total Estimated Cost (TEC)	215,000	–	500	500	10,000	+9,500
Other Project Cost (OPC)	1,000	100	600	300	–	-300
<b>Total Project Cost (TPC)</b>	<b>216,000</b>	<b>100</b>	<b>1,100</b>	<b>800</b>	<b>10,000</b>	<b>+9,200</b>
<b>20-SC-78, Linear Assets Modernization Project, LBNL</b>						
Total Estimated Cost (TEC)	236,000	–	500	500	12,850	+12,350
Other Project Cost (OPC)	4,000	172	398	1,230	500	-730
<b>Total Project Cost (TPC)</b>	<b>240,000</b>	<b>172</b>	<b>898</b>	<b>1,730</b>	<b>13,350</b>	<b>+11,620</b>
<b>20-SC-79, Critical Utilities Infrastructure Revitalization, SLAC</b>						
Total Estimated Cost (TEC)	186,000	–	500	500	10,000	+9,500
Other Project Cost (OPC)	3,000	–	323	1,000	–	-1,000
<b>Total Project Cost (TPC)</b>	<b>189,000</b>	<b>–</b>	<b>823</b>	<b>1,500</b>	<b>10,000</b>	<b>+8,500</b>
<b>20-SC-80, Utilities Infrastructure Project, FNAL</b>						
Total Estimated Cost (TEC)	310,000	–	500	500	13,300	+12,800
Other Project Cost (OPC)	4,000	–	–	1,530	500	-1,030
<b>Total Project Cost (TPC)</b>	<b>314,000</b>	<b>–</b>	<b>500</b>	<b>2,030</b>	<b>13,800</b>	<b>+11,770</b>
<b>19-SC-71, Science User Support Center, BNL</b>						
Total Estimated Cost (TEC)	85,000	7,000	20,000	20,000	38,000	+18,000
Other Project Cost (OPC)	1,200	1,200	–	–	–	–
<b>Total Project Cost (TPC)</b>	<b>86,200</b>	<b>8,200</b>	<b>20,000</b>	<b>20,000</b>	<b>38,000</b>	<b>+18,000</b>

(dollars in thousands)

	Total	Prior Years	FY 2020 Enacted	FY 2021 Enacted	FY 2022 Request	FY 2022 Request vs FY 2021 Enacted
<b>19-SC-72, Electrical Capacity and Distribution Capability, ANL</b>						
Total Estimated Cost (TEC)	60,000	30,000	30,000	–	–	–
Other Project Cost (OPC)	1,000	1,000	–	–	–	–
<b>Total Project Cost (TPC)</b>	<b>61,000</b>	<b>31,000</b>	<b>30,000</b>	<b>–</b>	<b>–</b>	<b>–</b>
<b>19-SC-73, Translational Research Capability, ORNL</b>						
Total Estimated Cost (TEC)	93,500	25,000	25,000	22,000	21,500	-500
Other Project Cost (OPC)	1,500	1,400	–	–	–	–
<b>Total Project Cost (TPC)</b>	<b>95,000</b>	<b>26,400</b>	<b>25,000</b>	<b>22,000</b>	<b>21,500</b>	<b>-500</b>
<b>19-SC-74, BioEPIC</b>						
Total Estimated Cost (TEC)	140,000	5,000	15,000	20,000	35,000	+15,000
Other Project Cost (OPC)	2,200	1,500	21	–	–	–
<b>Total Project Cost (TPC)</b>	<b>142,200</b>	<b>6,500</b>	<b>15,021</b>	<b>20,000</b>	<b>35,000</b>	<b>+15,000</b>
<b>18-SC-71, Energy Sciences Capability, PNNL</b>						
Total Estimated Cost (TEC)	90,000	44,000	23,000	23,000	–	-23,000
Other Project Cost (OPC)	3,000	1,236	126	–	1,638	+1,638
<b>Total Project Cost (TPC)</b>	<b>93,000</b>	<b>45,236</b>	<b>23,126</b>	<b>23,000</b>	<b>1,638</b>	<b>-21,362</b>
<b>17-SC-71, Integrated Engineering Research Center, FNAL</b>						
Total Estimated Cost (TEC)	85,000	42,500	22,000	10,250	10,250	–
Other Project Cost (OPC)	1,000	950	–	–	50	+50
<b>Total Project Cost (TPC)</b>	<b>86,000</b>	<b>43,450</b>	<b>22,000</b>	<b>10,250</b>	<b>10,300</b>	<b>+50</b>
<b>Total, Construction</b>						
Total Estimated Cost (TEC)	N/A	N/A	208,000	173,700	246,550	+72,850
Other Project Cost (OPC)	N/A	N/A	6,425	7,090	3,663	-3,427
<b>Total Project Cost (TPC)</b>	<b>N/A</b>	<b>N/A</b>	<b>214,425</b>	<b>180,790</b>	<b>250,213</b>	<b>+69,423</b>

**Science Laboratories Infrastructure  
Funding Summary**

(dollars in thousands)

	<b>FY 2020 Enacted</b>	<b>FY 2021 Enacted</b>	<b>FY 2022 Request</b>	<b>FY 2022 Request vs FY 2021 Enacted</b>
Projects				
Line Item Construction (LIC)	208,000	173,700	246,550	+72,850
<b>Total, Projects</b>	<b>208,000</b>	<b>173,700</b>	<b>246,550</b>	<b>+72,850</b>
Other	93,000	66,300	48,450	-17,850
<b>Total, Science Laboratories Infrastructure</b>	<b>301,000</b>	<b>240,000</b>	<b>295,000</b>	<b>+55,000</b>



**22-SC-71, Critical Infrastructure Modernization Project, ORNL  
Oak Ridge National Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Critical Infrastructure Modernization Project is \$1,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$221,000,000 to \$415,000,000. The preliminary Total Project Cost (TPC) range for this project is \$225,000,000 to \$419,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$419,000,000.

Oak Ridge National Laboratory (ORNL) requires utilities infrastructure improvements that provide reliable, available, safe, compliant, maintainable, redundant, energy and cost efficient, and flexible and expandable operations to address current and emerging research needs. Modernization, renewal, and expansion of existing degraded and/or at designed capacity site utility infrastructure is required to operate and maintain modern, world-class facilities for scientific discovery at ORNL in support of the SC mission. Investment in utility infrastructure to meet future utility needs in support of new SC missions and/or growth of SC missions at ORNL is also needed.

**Significant Changes**

This project is a new start in FY 2022. DOE Order 413.3B Critical Decision (CD)-0, Approve Mission Need, was achieved on October 26, 2020. FY 2022 funds will support the initiation of Project Engineering and Design (PED) activities.

A Federal Project Director with the appropriate certification will be 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 2022	10/26/20	4Q FY 2022	4Q FY 2022	4Q FY 2024	2Q FY 2024	4Q FY 2026	N/A	4Q 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 2022	4Q FY 2024	4Q FY 2024

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

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2022	50,000	365,000	415,000 <sup>b</sup>	4,000	N/A	4,000	419,000 <sup>b</sup>

## **2. Project Scope and Justification**

### **Scope**

The scope of the Critical Infrastructure Modernization Project (CIMP) at ORNL will address critical utility infrastructure capability gaps due to deterioration, non-redundancy, lack of availability, and or capacity limitations in infrastructure systems such as electrical distribution, potable water distribution, chilled water and steam generation and distribution, sanitary wastewater collection and treatment, natural gas distribution, compressed air distribution, storm water collection, etc.

Prioritized scope will be finalized as the project matures and will focus on system capability gaps associated with the greatest risk probability/impact of a system failure, impacts to science operations, and meeting the demand required to support future scientific endeavors.

### **Justification**

Advancing the SC mission requires modern, reliable, and operationally efficient infrastructure. At ORNL, the site utility infrastructure supporting all core capabilities and all SC programs is degraded and needs to be modernized. To continue to deliver scientific and technical breakthroughs needed to realize solutions in energy and national security and provide economic benefit to the nation, ORNL requires utilities infrastructure improvements that provide reliable, available, safe, compliant, maintainable, redundant, energy and cost efficient, and flexible and expandable operations to address current and emerging research needs.

Many of ORNL's utilities were installed prior to the 1950's as part of the Manhattan Project. The systems are beyond useful life, suffer from parts obsolescence, and were not designed to support the experimental parameters needed for scientific research today and the future. With deteriorating infrastructure that has an average age greater than 50 years old, ORNL is experiencing increasing failure rates and costs for emergency repairs. The failure of critical utility systems disrupts science research, production, operations, and support activities in offices, laboratories, industrial areas, and major user facilities.

CIMP 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 transfer power to minimize impacts to mission critical scientific operations. Additionally, modern utility systems will be more efficient and sustainable. Every element of this project will be designed to consider best available/most efficient technology resulting in energy savings. Additionally, the utilities 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 O 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.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project is pre-CD-2; therefore, funding estimate are preliminary.

Performance Measure	Threshold	Objective
Rehabilitate, expand, and/or upgrade ORNL's major utility systems	Renovate and modernize highest priority utilities including generation and/or distribution systems and components for systems which, at this preconceptual stage, may include: <ul style="list-style-type: none"> <li>▪ Electrical</li> <li>▪ Natural Gas</li> <li>▪ Potable water supply, Sanitary Storm water</li> <li>▪ Steam</li> <li>▪ chilled water, and/or</li> <li>▪ Compressed Air</li> <li>▪ Establish system redundancy for critical systems</li> </ul>	Establish, expand, and/or renovate additional utility systems

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2022	1,000	1,000	500
Outyears	49,000	49,000	49,500
<b>Total, Design (TEC)</b>	<b>50,000</b>	<b>50,000</b>	<b>50,000</b>
Construction (TEC)			
Outyears	365,000	365,000	365,000
<b>Total, Construction (TEC)</b>	<b>365,000</b>	<b>365,000</b>	<b>365,000</b>
Total Estimated Cost (TEC)			
FY 2022	1,000	1,000	500
Outyears	414,000	414,000	414,500
<b>Total, TEC</b>	<b>415,000</b>	<b>415,000</b>	<b>415,000</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Other Project Cost (OPC)</b>			
FY 2020	500	500	500
FY 2021	750	750	750
FY 2022	750	750	750
Outyears	2,000	2,000	2,000
<b>Total, OPC</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
FY 2020	500	500	500
FY 2021	750	750	750
FY 2022	1,750	1,750	1,250
Outyears	416,000	416,000	416,500
<b>Total, TPC</b>	<b>419,000</b>	<b>419,000</b>	<b>419,000</b>



#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	42,500	N/A	N/A
Design - Contingency	7,500	N/A	N/A
<b>Total, Design (TEC)</b>	<b>50,000</b>	<b>N/A</b>	<b>N/A</b>
Construction	275,000	N/A	N/A
Construction - Contingency	90,000	N/A	N/A
<b>Total, Construction (TEC)</b>	<b>365,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>415,000</b>	<b>N/A</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>97,500</i>	<i>N/A</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Design	2,100	N/A	N/A
Start-up	1,100	N/A	N/A
OPC - Contingency	800	N/A	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>4,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>4,000</b>	<b>N/A</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>800</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>419,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>98,300</b>	<b>N/A</b>	<b>N/A</b>

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2022	TEC	—	—	1,000	414,000	415,000 <sup>a</sup>
	OPC <sup>b</sup>	500	750	750	2,000	4,000
	TPC	500	750	1,750	416,000	419,000 <sup>a</sup>

#### 6. Related Operations and Maintenance Funding Requirements

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

<sup>a</sup> This project is pre-CD-2; therefore, funding estimate are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

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	TBD	N/A	TBD
Utilities	N/A	TBD	N/A	TBD
Maintenance and Repair	N/A	TBD	N/A	TBD
Total, Operations and Maintenance	N/A	TBD	N/A	TBD

**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 Oak Ridge National Laboratory .....	N/A
Area of D&D in this project at Oak Ridge National Laboratory .....	N/A
Area at Oak Ridge National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	N/A
Area of D&D in this project at other sites .....	N/A
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	N/A
Total area eliminated .....	N/A

**8. Acquisition Approach**

The Oak Ridge National Laboratory Management and Operating (M&O) contractor, UT-Battelle, will perform the acquisition for this project, overseen by the ORNL 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.

**22-SC-72, Thomas Jefferson Infrastructure Improvements, TJNAF  
Thomas Jefferson National Accelerator Facility  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Thomas Jefferson Infrastructure Improvements project is \$1,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$76,000,000 to \$98,000,000. The preliminary Total Project Cost (TPC) range for this project is \$77,000,000 to \$99,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$99,000,000.

Thomas Jefferson National Accelerator Facility (TJNAF) needs additional laboratory space and modern utility systems that are safer and more operationally efficient for employees and visitors of TJNAF. This project will address the lack of efficient high-bay laboratory space, growing repair needs and deferred maintenance, and safety and security risks currently posed by intermingling of operations, projects, and users. It will renovate/modernize 54,000 square feet and construct 65,000-80,000 square feet of new space to facilitate renovation/modernization efforts and support projected workload.

Additionally, there will be improvements to the water, sanitary and communications utilities, and roads, sidewalks, and parking infrastructure.

**Significant Changes**

This project is a new start in FY 2022. DOE Order 413.3B Critical Decision (CD)-0, Approve Mission Need, was achieved on December 8, 2020. FY 2022 funds will support the initiation of Project Engineering and Design (PED) 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) will be 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 2022	12/8/20	4Q FY 2021	2Q FY 2022	4Q FY 2023	3Q FY 2025	4Q FY 2024	N/A	4Q FY 2030

**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 2022	4Q FY 2023

**Project Cost History**

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2022	10,000	88,000	98,000 <sup>b</sup>	1,000	N/A	1,000	99,000 <sup>b</sup>

**2. Project Scope and Justification**

**Scope**

The scope of the Thomas Jefferson Infrastructure Improvements project will include renovating 54,000 gross square feet (gsf) of existing space and providing 65,000 to 80,000 gsf of additional office and laboratory space. The renovation will include reconfiguration to provide more functional, flexible, and efficient spaces that meet current code standards. The project will upgrade the mechanical systems in the existing Experimental Equipment Lab (EEL), Technology and Engineering Development (TED) building, and Test Lab Center, which have exceeded their service life. The renovated building will be energy sustainable and will meet high performance building standards, including energy conservation, green building principles, and sustainable design.

Additional infrastructure improvements include the consolidation of facilities for technical shops and logistics staff, improvements to the water, sanitary and communication utilities, as well as improvements to roads, sidewalks and parking infrastructure. Utilities require improvement to correct deficiencies and provide added capability to align with the current and projected mission need. Road, sidewalk, and parking improvements support and align with general site needs to support new construction and renovation projects.

**Justification**

At TJNAF, superconducting radio frequency (SRF) cryomodule production, cryogenics fabrication, and the development, assembly, and staging of experiments prior to installation in the experimental halls primarily occur in high bay space in the EEL building, TED building, and Test Lab. Growing SRF cryomodule production work, forecasted high-volume experiment assembly, and ongoing cryogenics fabrication exceed high bay and associated staging and storage capacity in these buildings. This work supports large-scale and complex experiment assembly (Measurement of a Lepton-Lepton Electroweak Reaction (MOLLER), Solenoidal Large Intensity Device (SoLID for the Nuclear Physics (NP) program and major line-item projects Linac Coherent Light Source-II High Energy (LCLS-II HE), Spallation Neutron Source (SNS) for the Basic Energy Sciences (BES) Program. The aforementioned intermingling of operations, projects, and users is inefficient, creates many safety and security challenges (e.g., frequent overhead crane work and high-dollar-value items in areas open to multiple groups), and forces a dependence on supplemental off-site leased space as a stop-gap measure.

In addition to space over-utilization issues, the EEL building is in substandard condition—with repair needs and deferred maintenance quickly escalating, as major building systems approach and exceed their service life. Additionally, meeting this mission need will mitigate intermingling of operations, projects, and users which poses an increased safety risk to staff and visiting scientists. This risk is growing and will continue with the forecasted workload and scheduled near-term 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

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<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.  
<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

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
EEL, TED, Test Lab Renovation	54,000 gsf	N/A
New Construction	65,000 gsf	80,000 gsf
Water, Sanitary, Communications	5000 lf	20,000 lf
Roadway Improvements	0.25 mi	2.0 mi

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2022	1,000	1,000	500
Outyears	9,000	9,000	9,500
<b>Total, Design (TEC)</b>	<b>10,000</b>	<b>10,000</b>	<b>10,000</b>
Construction (TEC)			
Outyears	88,000	88,000	88,000
<b>Total, Construction (TEC)</b>	<b>88,000</b>	<b>88,000</b>	<b>88,000</b>
Total Estimated Cost (TEC)			
FY 2022	1,000	1,000	500
Outyears	97,000	97,000	97,500
<b>Total, TEC</b>	<b>98,000</b>	<b>98,000</b>	<b>98,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2021	1,000	1,000	1,000
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2021	1,000	1,000	1,000
FY 2022	1,000	1,000	500
Outyears	97,000	97,000	97,500
<b>Total, TPC</b>	<b>99,000</b>	<b>99,000</b>	<b>99,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,000	N/A	N/A
Design - Contingency	2,000	N/A	N/A
<b>Total, Design (TEC)</b>	<b>10,000</b>	<b>N/A</b>	<b>N/A</b>
Construction	72,000	N/A	N/A
Construction - Contingency	16,000	N/A	N/A
<b>Total, Construction (TEC)</b>	<b>88,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>98,000</b>	<b>N/A</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>18,000</i>	<i>N/A</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	600	N/A	N/A
Conceptual Design	300	N/A	N/A
OPC - Contingency	100	N/A	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,000</b>	<b>N/A</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>100</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>99,000</b>	<b>N/A</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>18,100</b>	<b>N/A</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2022	TEC	—	—	—	1,000	97,000	98,000 <sup>a</sup>
	OPC <sup>b</sup>	—	—	1,000	—	—	1,000
	TPC	—	—	1,000	1,000	97,000	99,000 <sup>a</sup>

**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	4Q FY 2078

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	63	N/A	3,160
Utilities	N/A	213	N/A	10,666
Maintenance and Repair	N/A	642	N/A	32,087
<b>Total, Operations and Maintenance</b>	<b>N/A</b>	<b>918</b>	<b>N/A</b>	<b>45,913</b>

**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.....	65,000-116,000
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 <sup>c</sup>
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

<sup>a</sup> This project is pre CD-2; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.

## **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.



**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 2022 Request for the Princeton Plasma Innovation Center (PPIC) project is \$7,750,000. The preliminary Total Estimated Cost (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 2022 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	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

**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

**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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2021	9,000	100,000 <sup>b</sup>	109,000	2,500	N/A	2,500	111,500 <sup>b</sup>
FY 2022	8,900	87,400 <sup>b</sup>	96,300	2,200	N/A	2,200	98,500 <sup>b</sup>

## 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

In order 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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

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
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2021	150	150	150
FY 2022	7,750	7,750	6,000
Outyears	1,000	1,000	2,750
<b>Total, Design (TEC)</b>	<b>8,900</b>	<b>8,900</b>	<b>8,900</b>
Construction (TEC)			
Outyears	87,400	87,400	87,400
<b>Total, Construction (TEC)</b>	<b>87,400</b>	<b>87,400</b>	<b>87,400</b>
Total Estimated Cost (TEC)			
FY 2021	150	150	150
FY 2022	7,750	7,750	6,000
Outyears	88,400	88,400	90,150
<b>Total, TEC</b>	<b>96,300</b>	<b>96,300</b>	<b>96,300</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	10	10	10
FY 2020	1,400	1,400	1,400
FY 2021	90	90	90
Outyears	700	700	700
<b>Total, OPC</b>	<b>2,200</b>	<b>2,200</b>	<b>2,200</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	10	10	10
FY 2020	1,400	1,400	1,400
FY 2021	240	240	240
FY 2022	7,750	7,750	6,000
Outyears	89,100	89,100	90,850
<b>Total, TPC</b>	<b>98,500</b>	<b>98,500</b>	<b>98,500</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	7,900	7,500	N/A
Design - Contingency	1,000	1,500	N/A
<b>Total, Design (TEC)</b>	<b>8,900</b>	<b>9,000</b>	<b>N/A</b>
Construction	72,000	83,300	N/A
Construction - Contingency	15,400	16,700	N/A
<b>Total, Construction (TEC)</b>	<b>87,400</b>	<b>100,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>96,300</b>	<b>109,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>16,400</i>	<i>18,200</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	300	300	N/A
Conceptual Design	1,700	2,000	N/A
OPC - Contingency	200	200	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>2,200</b>	<b>2,500</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>2,200</b>	<b>2,500</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>98,500</b>	<b>111,500</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>16,600</b>	<b>18,400</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	—	2,000	—	107,000	109,000 <sup>a</sup>
	OPC <sup>b</sup>	300	2,000	—	—	200	2,500
	TPC	300	2,000	2,000	—	107,200	111,500 <sup>a</sup>
FY 2022	TEC	—	—	150	7,750	88,400	96,300 <sup>a</sup>
	OPC <sup>b</sup>	10	1,400	90	—	700	2,200
	TPC	10	1,400	240	7,750	89,100	98,500 <sup>a</sup>

**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	4Q FY 2078

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs <sup>c</sup>	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	1,336	N/A	46,774
Utilities	N/A	198	N/A	6,936
Maintenance and Repair	N/A	1,518	N/A	53,154
Total, Operations and Maintenance	N/A	3,052	N/A	106,864

**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 <sup>d</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> Life-Cycle costs will be performed as part of CD-1.

<sup>d</sup> 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.

## **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 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.

**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 2022 Request for the Critical Infrastructure Recovery & Renewal (CIRR) project is \$2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$78,000,000 to \$94,100,000. The preliminary Total Project Cost (TPC) range for this project is \$79,900,000 to \$96,000,000. 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) deteriorating utility infrastructure is non-redundant and increasingly unreliable, which negatively impacts 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 initiated in FY 2021. 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 2022 funds will continue Project Engineering and Design (PED) activities.

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	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	12/31/20	2/23/21	3Q FY 2024	1Q FY 2024	3Q FY 2024	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
FY 2021	4Q FY 2022	1Q FY 2023
FY 2022	3Q FY 2024	3Q FY 2023

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

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2021	8,000	72,400 <sup>b</sup>	80,400	1,500	N/A	1,500	81,900 <sup>b</sup>
FY 2022	9,800	77,300 <sup>b</sup>	87,100	1,900	N/A	1,900	89,000 <sup>b</sup>

## **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. In order to maintain system operability, it is essential to have reliable infrastructure in place. The current systems are outdated, 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 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 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 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 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.

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<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.



Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> <li>▪ Rehabilitate and selectively upgrade PPPL’s existing major utility systems.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Improve configuration and efficiency of the Central Chilled Water Plant to ensure distribution of 1,200 tons of cooling capacity to the site.</li> <li>▪ Improve data infrastructure cabling and components by replacing existing copper cable with 2,000 linear feet of cat 6 cable.</li> <li>▪ Provide 2,500 linear feet of 48 strand network fiber cable connected to the Princeton University Computer Center.</li> <li>▪ Provide 15,000 linear feet of 24 strand fiber optic cable to support site wide communication.</li> <li>▪ Create redundancy and improve mission readiness of the primary electrical distribution system in the 138 kV yard.</li> <li>▪ Provide site-wide capacity of standby generation at 3,500 KW.</li> <li>▪ Upgrade 8 Substations for priority buildings and facilities.</li> <li>▪ Upgrade 8 HVAC system equipment for priority buildings on C-Site and D-Site.</li> <li>▪ Replace all failed critical underground piping, valves, and components for campus utilities.</li> <li>▪ Replace 1,700 linear feet of electrical feeders (26kv) for improved reliability.</li> <li>▪ Upgrade 9,500 sqft of Storm Retention Basin liner.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Threshold plus upgrade additional communication system components to improve security, reliability, and flexibility.</li> <li>▪ Increase site-wide capacity of standby generation up to 4,350 KW.</li> <li>▪ Upgrade up to 10 substations for additional buildings/facilities to improve flexibility for maintenance and operations.</li> <li>▪ Upgrade up to 14 HVAC system equipment for additional buildings to meet sustainability goals and improve maintenance and operations.</li> <li>▪ Threshold plus upgrade additional underground system components to improve maintenance and reliability.</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2021	150	150	150
FY 2022	2,000	2,000	1,750
Outyears	7,650	7,650	7,900
<b>Total, Design (TEC)</b>	<b>9,800</b>	<b>9,800</b>	<b>9,800</b>
Construction (TEC)			
Outyears	77,300	77,300	77,300
<b>Total, Construction (TEC)</b>	<b>77,300</b>	<b>77,300</b>	<b>77,300</b>
Total Estimated Cost (TEC)			
FY 2021	150	150	150
FY 2022	2,000	2,000	1,750
Outyears	84,950	84,950	85,200
<b>Total, TEC</b>	<b>87,100</b>	<b>87,100</b>	<b>87,100</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	6	6	6
FY 2020	1,046	1,046	1,046
FY 2021	300	300	300
Outyears	548	548	548
<b>Total, OPC</b>	<b>1,900</b>	<b>1,900</b>	<b>1,900</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	6	6	6
FY 2020	1,046	1,046	1,046
FY 2021	450	450	450
FY 2022	2,000	2,000	1,750
Outyears	85,498	85,498	85,748
<b>Total, TPC</b>	<b>89,000</b>	<b>89,000</b>	<b>89,000</b>

**4. Details of Project Cost Estimate**

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	7,600	6,700	N/A
Design - Contingency	2,200	1,300	N/A
<b>Total, Design (TEC)</b>	<b>9,800</b>	<b>8,000</b>	<b>N/A</b>
Construction	59,400	60,300	N/A
Construction - Contingency	17,900	12,100	N/A
<b>Total, Construction (TEC)</b>	<b>77,300</b>	<b>72,400</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>87,100</b>	<b>80,400</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>20,100</i>	<i>13,400</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	200	100	N/A
Conceptual Design	1,500	1,200	N/A
OPC - Contingency	200	200	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,900</b>	<b>1,500</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,900</b>	<b>1,500</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>89,000</b>	<b>81,900</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>20,300</b>	<b>13,600</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	—	2,000	—	78,400	80,400 <sup>a</sup>
	OPC <sup>b</sup>	100	1,200	—	—	200	1,500
	TPC	100	1,200	2,000	—	78,600	81,900 <sup>a</sup>
FY 2022	TEC	—	—	150	2,000	84,950	87,100 <sup>a</sup>
	OPC <sup>b</sup>	6	1,046	300	—	548	1,900
	TPC	6	1,046	450	2,000	85,498	89,000 <sup>a</sup>

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> 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	N/A

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs <sup>a</sup>	
	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
<b>Total, Operations and Maintenance</b>	<b>2,100</b>	<b>2,100</b>	<b>105,000</b>	<b>105,000</b>

**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 <sup>b</sup>
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.

<sup>a</sup> Life-Cycle costs will be performed as part of CD-1.

<sup>b</sup> 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-73, Ames Infrastructure Modernization  
Ames Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Ames Infrastructure Modernization (AIM) project is \$2,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$22,000,000 to \$89,000,000. The preliminary Total Project Cost (TPC) range for this project is \$23,000,000 to \$90,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$31,000,000.

AIM’s objective is to support the SC mission by providing a safer and more operationally efficient campus for the employees, visitors, and guests at Ames, as well as to reduce deferred maintenance costs. This project is designed to support DOE mission-critical programs and initiatives, increase the reliability of utility infrastructure, minimize facility costs through effective and efficient operations, and modernize laboratories in Ames Laboratory’s research buildings, thereby enhancing Ames Laboratory’s ability to continue to deliver on SC mission across multiple program offices.

**Significant Changes**

This project was initiated in FY 2021. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved September 16, 2019. FY 2022 funds will support Project Engineering and Design (PED) activities and initiate long lead procurement and early construction activities upon 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	9/16/19	4Q FY 2020	3Q FY 2021	3Q FY 2022	1Q FY 2023	2Q FY 2023	N/A	4Q FY 2026
FY 2022	9/16/19	3Q FY 2021	1Q FY 2022	2Q FY 2023	2Q FY 2023	3Q FY 2023	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	CD-3A
FY 2021	3Q FY 2022	3Q FY 2022
FY 2022	2Q FY 2023	2Q FY 2023

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

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2021	3,000	27,000 <sup>b</sup>	30,000	1,000	N/A	1,000	31,000 <sup>b</sup>
FY 2022	3,000	27,000 <sup>b</sup>	30,000	1,000	N/A	1,000	31,000 <sup>b</sup>

## **2. Project Scope and Justification**

### **Scope**

The AIM project will provide updated infrastructure building systems in existing research and operations buildings at Ames Laboratory, such as: plumbing systems; building envelopes; electrical distribution systems, emergency backup power, and uninterruptible power supplies; and telecommunication systems. In addition, some existing laboratory spaces will be modernized to support the SC mission and associated equipment.

### **Justification**

SC utilizes the capabilities of Ames Laboratory to execute three of SC's 24 core capabilities and the mission of multiple SC program offices, including research by the offices of Basic Energy Sciences, Advanced Scientific Computing Research, Biological and Environment Research, and to a lesser extent, Fusion Energy Sciences. These core capabilities are 1) Condensed Matter Physics and Materials Science, 2) Chemical and Molecular Science, and 3) Applied Materials Science and Engineering. Ames Laboratory is dedicated to delivering critical materials for the Nation. Ames Laboratory provides SC with the ability for research in the discovery, synthesis, analysis, and use of new materials, novel chemistries, and transformational analytical tools. In pursuing its SC Mission to deliver scientific discoveries, Ames Laboratory invents materials with new physical and chemical functionalities, especially those that harness the potential of rare-earth elements, through creative and innovative synthesis techniques; determines novel physics and chemistry of quantum materials and molecules using instrumentation developed at Ames Laboratory; shares these materials and knowledge with partners and collaborates nationwide and worldwide to advance fundamental knowledge in physics, chemistry, and materials science; and promotes the applications of these materials for economic and national security through in-house activities and external collaborations.

The current condition of the building systems and infrastructure impedes the execution and advancement of the SC mission for the following reasons: 1) deteriorating plumbing systems result in unplanned events such as sanitary sewer or major water leaks that lead to disruption of scientific operations, jeopardizing instrumentation, and presenting a safety and health risk to personnel; 2) deteriorating building envelopes negatively impact the SC mission through increased operational costs, elevated risk to research equipment, and a poor work environment for Ames Laboratory staff; 3) lack of an adequate electrical supply and distribution, including reliability during outages, places sensitive scientific equipment at risk of damage, prevents program expansion, and limits SC continued investment in state-of-the-art equipment and instrumentation; 4) inadequate telecommunication systems impede program expansion and limits SC investment in state-of-the-art equipment and instrumentation; and 5) limited amount of modern research laboratory space impacts SC mission through several outcomes, such as the inability to house state-of-the-art equipment and instrumentation; implement best safety management practices; create collaborative environments; and attract, recruit, and retain the scientific talent.

Therefore, to better accommodate the current and future DOE Office of Science mission, minimize disruptions to critical research activities, reduce risks to operations, and improve the safety and reliability, Ames Laboratory needs improved infrastructure systems and workspaces.

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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

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
<ul style="list-style-type: none"> <li>▪ Rehabilitate and selectively upgrade existing building systems</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace and upgrade plumbing systems in mission critical buildings. Replace 2,700 linear feet of domestic supply piping and 5,000 linear feet of sanitary sewer piping.</li> <li>▪ Upgrade building envelopes for mission critical buildings. Upgrade 30,000 square feet of past end-of-life built up roofs.</li> <li>▪ Improve emergency/backup power systems. Replace two existing backup generators.</li> <li>▪ Improve telecommunications systems. Establish two new telecom rooms and install 200,000 linear feet of new CAT6A cabling.</li> <li>▪ Modernize existing laboratory spaces in mission critical buildings. Renovate 10,000 square feet of wet labs, dry labs, and office space.</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace 4,000 linear feet of domestic supply piping and 7,500 linear feet of sanitary sewer piping.</li> <li>▪ Upgrade 68,450 square feet of past end-of-life built up roofs.</li> <li>▪ Replace three existing backup generators.</li> <li>▪ Establish three new telecom rooms and install 300,000 linear feet of new CAT6A cabling.</li> <li>▪ Renovate 15,000 square feet of wet labs, dry labs, and office space.</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2021	150	150	–
FY 2022	2,000	2,000	2,150
Outyears	850	850	850
<b>Total, Design (TEC)</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>
Construction (TEC)			
Outyears	27,000	27,000	27,000
<b>Total, Construction (TEC)</b>	<b>27,000</b>	<b>27,000</b>	<b>27,000</b>
Total Estimated Cost (TEC)			
FY 2021	150	150	–
FY 2022	2,000	2,000	2,150
Outyears	27,850	27,850	27,850
<b>Total, TEC</b>	<b>30,000</b>	<b>30,000</b>	<b>30,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	25	25	25
FY 2020	50	50	50
FY 2021	200	200	200
FY 2022	225	225	225
Outyears	500	500	500
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>



(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	25	25	25
FY 2020	50	50	50
FY 2021	350	350	200
FY 2022	2,225	2,225	2,375
Outyears	28,350	28,350	28,350
<b>Total, TPC</b>	<b>31,000</b>	<b>31,000</b>	<b>31,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	2,500	2,500	N/A
Design - Contingency	500	500	N/A
<b>Total, Design (TEC)</b>	<b>3,000</b>	<b>3,000</b>	<b>N/A</b>
Construction	22,500	22,500	N/A
Construction - Contingency	4,500	4,500	N/A
<b>Total, Construction (TEC)</b>	<b>27,000</b>	<b>27,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>30,000</b>	<b>30,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>5,000</i>	<i>5,000</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	250	250	N/A
Conceptual Design	250	250	N/A
OPC - Contingency	500	500	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,000</b>	<b>1,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>500</i>	<i>500</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>31,000</b>	<b>31,000</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>5,500</b>	<b>5,500</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	—	2,000	—	28,000	30,000 <sup>a</sup>
	OPC <sup>b</sup>	—	250	250	—	500	1,000
	TPC	—	250	2,250	—	28,500	31,000 <sup>a</sup>
FY 2022	TEC	—	—	150	2,000	27,850	30,000 <sup>a</sup>
	OPC <sup>b</sup>	25	50	200	225	500	1,000
	TPC	25	50	350	2,225	28,350	31,000 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2027
Expected Useful Life	25 years
Expected Future Start of D&D of this capital asset	4Q FY 2052

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs <sup>c</sup>	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	N/A	335	N/A	8,375
Utilities	N/A	1,024	N/A	25,600
Maintenance and Repair	N/A	1,685	N/A	42,125
Total, Operations and Maintenance	N/A	3,044	N/A	76,100

**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 Ames Laboratory.....	None
Area of D&D in this project at Ames Laboratory.....	None
Area at Ames Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	None <sup>d</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> Life-Cycle costs will be performed as part of CD-1.

<sup>d</sup> 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.

## **8. Acquisition Approach**

The Ames Management and Operating (M&O) contractor, Iowa State University, will perform the acquisition for this project, overseen by the Ames Site Office. It will evaluate various acquisition approaches and consider project delivery methods prior to achieving CD-1. The M&O contractor will be responsible for awarding and administering all subcontracts related to this project. The M&O contractor's annual performance evaluation and measurement plan will include project performance metrics on which it will be evaluated.



**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 2022 Request for the Critical Utilities Rehabilitation Project (CURP) is \$26,000,000. The preliminary Total Estimated Cost (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.

**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 has initiated long lead procurements in accordance with the approve CD-3A scope. FY 2022 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

**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

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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2020	8,500	76,500	85,000 <sup>b</sup>	800	N/A	800	85,800 <sup>b</sup>
FY 2021	7,100	84,900	92,000 <sup>b</sup>	800	N/A	800	92,800 <sup>b</sup>
FY 2022	6,700	85,300	92,000 <sup>b</sup>	1,000	N/A	1,000	93,000 <sup>b</sup>

## 2. Project Scope and Justification

### Scope

CURP's scope is to revitalize and upgrade 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, and older feeder cables and inadequate breakers along Cornell Avenue, which will 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 21<sup>st</sup> 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. 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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

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
<ul style="list-style-type: none"> <li>▪ Rehabilitate and selectively upgrade BNL’s existing major utility systems including steam, water, sanitary sewer, chilled water and electrical systems</li> </ul>	<p><b>Chilled Water</b></p> <ul style="list-style-type: none"> <li>▪ Replace one 1250 ton Centrifugal Chiller, refrigerant alarm, and chemical injection system at the Central Chilled Water Facility (CCWF)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Install new Reduced Pressure Zone's and chemical injection systems on various cooling towers</li> <li>▪ Replace additional Chillers</li> </ul>
	<p><b>Steam</b></p> <ul style="list-style-type: none"> <li>▪ Replace 1 Manhole</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace manholes, steam and condensate piping, valves and equipment within 18 manholes</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Replace 3,000 LF steam/condensate</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace up to approximately 10 miles steam and/or condensate piping site wide</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Replace obsolete control systems, install economizer on boiler and build 200SF extension on B610</li> </ul>	<ul style="list-style-type: none"> <li>▪ Upgrade B610 Building Envelope</li> <li>▪ Replace generators and associated switchgear.</li> <li>▪ Replace Boiler 1A &amp; stack in B610</li> </ul>
	<p><b>Potable Water</b></p> <ul style="list-style-type: none"> <li>▪ Rebuild Wellhouse # 12 &amp; Granular Activated Carbon System (CD-3A)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace up to approximately 35 miles of water mains, valves, hydrants and service lines site wide</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Replace and demolish 300,000-gallon water tank (CD-3A)</li> </ul>	<ul style="list-style-type: none"> <li>▪ Repair/revitalize 1 Million Gallon water tank</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Replace/add 5 isolation valves</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace/add up to 40 isolation valves</li> </ul>
	<p><b>Electrical</b></p> <ul style="list-style-type: none"> <li>▪ Install new 13.8KV feeder B603 to B600 to serve as an alternate to B600 &amp; NSLS II</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace 69KV Oil Circuit Breaker</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Refurbish 30 magnablast breakers in substation 603</li> </ul>	<ul style="list-style-type: none"> <li>▪ Install new 13.8KV feeder from substation 603 to Renaissance Road</li> <li>▪ Install new 13.8KV feeder from Renaissance to Technology Drive</li> </ul>
	<p><b>Sanitary Sewer</b></p> <ul style="list-style-type: none"> <li>▪ Replace 4 lift stations site wide</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace up to 40 lift stations site wide</li> </ul>
	<ul style="list-style-type: none"> <li>▪ Re-line 200LF of sewer lines &amp; refurbish 1 manhole</li> </ul>	<ul style="list-style-type: none"> <li>▪ Re-line up to approximately 35 miles of sewer lines &amp; replace 40 manholes</li> <li>▪ Install storage facility chemical dosing system at B575</li> <li>▪ Recoat aeration and aerobic digester tanks</li> <li>▪ Demolish primary clarifier tank</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	10,000	10,000	–
FY 2021	400	400	740
FY 2022	–	–	7,190
Outyears	–	–	2,470
<b>Total, Design (TEC)</b>	<b>10,400</b>	<b>10,400</b>	<b>10,400</b>
Construction (TEC)			
FY 2020	10,000	10,000	89
FY 2021	19,600	19,600	200
FY 2022	26,000	26,000	26,000
Outyears	26,000	26,000	55,311
<b>Total, Construction (TEC)</b>	<b>81,600</b>	<b>81,600</b>	<b>81,600</b>
Total Estimated Cost (TEC)			
FY 2020	20,000	20,000	89
FY 2021	20,000	20,000	940
FY 2022	26,000	26,000	33,190
Outyears	26,000	26,000	57,781
<b>Total, TEC</b>	<b>92,000</b>	<b>92,000</b>	<b>92,000</b>

(dollars in thousands)

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



(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2020	20,410	20,410	499
FY 2021	20,590	20,590	1,530
FY 2022	26,000	26,000	33,190
Outyears	26,000	26,000	57,781
<b>Total, TPC</b>	<b>93,000</b>	<b>93,000</b>	<b>93,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,320	5,680	N/A
Design - Contingency	2,080	1,420	N/A
<b>Total, Design (TEC)</b>	<b>10,400</b>	<b>7,100</b>	<b>N/A</b>
Construction	65,280	70,320	N/A
Construction - Contingency	16,320	14,580	N/A
<b>Total, Construction (TEC)</b>	<b>81,600</b>	<b>84,900</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>92,000</b>	<b>92,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>18,400</i>	<i>16,000</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Design	1,000	N/A	N/A
Other OPC Costs	N/A	800	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,000</b>	<b>800</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,000</b>	<b>800</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>93,000</b>	<b>92,800</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>18,400</b>	<b>16,000</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	—	12,000	—	—	73,000	85,000 <sup>a</sup>
	OPC <sup>b</sup>	800	—	—	—	—	800
	TPC	800	12,000	—	—	73,000	85,800 <sup>a</sup>
FY 2021	TEC	—	20,000	15,000	—	57,000	92,000 <sup>a</sup>
	OPC <sup>b</sup>	800	—	—	—	—	800
	TPC	800	20,000	15,000	—	57,000	92,800 <sup>a</sup>
FY 2022	TEC	—	20,000	20,000	26,000	26,000	92,000 <sup>a</sup>
	OPC <sup>b</sup>	—	410	590	—	—	1,000
	TPC	—	20,410	20,590	26,000	26,000	93,000 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	N/A
Expected Useful Life	Varies by System
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	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 <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.

## **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.



**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 2022 Request for the Seismic and Safety Modernization (SSM) project is \$27,500,000. The preliminary Total Estimated Cost (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 2022 funds will support long-lead procurement, early construction activities, and 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

**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 2021	N/A	N/A
FY 2021	3Q FY 2021	3Q FY 2021	N/A
FY 2022	1Q FY 2022	1Q FY 2022	N/A

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

**CD-3B** – Approve Remaining Construction Activities

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2020	10,000	85,400	95,400 <sup>b</sup>	2,200	N/A	2,200	97,600 <sup>b</sup>
FY 2021	10,000	85,400	95,400 <sup>b</sup>	2,200	N/A	2,200	97,600 <sup>b</sup>
FY 2022	9,000	86,400	95,400 <sup>b</sup>	2,200	N/A	2,200	97,600 <sup>b</sup>

## **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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

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	<ul style="list-style-type: none"> <li>▪ 35,000 gross square feet (gsf)</li> <li>▪ Meet requirements of Risk Category III of the CBC</li> </ul>	<ul style="list-style-type: none"> <li>▪ 60,000 gsf</li> <li>▪ Meet requirements of Risk Category III of the CBC</li> </ul>
Seismic Upgrade of B48 (Fire House)	<ul style="list-style-type: none"> <li>▪ Meet requirements of Risk Category IV of CBC</li> </ul>	N/A

**3. Financial Schedule**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	9,000	9,000	3,000
FY 2021	–	–	5,000
FY 2022	–	–	1,000
<b>Total, Design (TEC)</b>	<b>9,000</b>	<b>9,000</b>	<b>9,000</b>
Construction (TEC)			
FY 2020	1,000	1,000	–
FY 2021	5,000	5,000	–
FY 2022	27,500	27,500	6,000
Outyears	52,900	52,900	80,400
<b>Total, Construction (TEC)</b>	<b>86,400</b>	<b>86,400</b>	<b>86,400</b>
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	7,000
Outyears	52,900	52,900	80,400
<b>Total, TEC</b>	<b>95,400</b>	<b>95,400</b>	<b>95,400</b>

(dollars in thousands)

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

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
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	7,000
Outyears	54,030	54,030	81,530
<b>Total, TPC</b>	<b>97,600</b>	<b>97,600</b>	<b>97,600</b>



#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,300	8,300	N/A
Design - Contingency	700	1,700	N/A
<b>Total, Design (TEC)</b>	<b>9,000</b>	<b>10,000</b>	<b>N/A</b>
Construction	71,400	70,400	N/A
Construction - Contingency	15,000	15,000	N/A
<b>Total, Construction (TEC)</b>	<b>86,400</b>	<b>85,400</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>95,400</b>	<b>95,400</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>15,700</i>	<i>16,700</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
OPC, Except D&D	N/A	2,000	N/A
Conceptual Planning	200	N/A	N/A
Conceptual Design	1,800	N/A	N/A
OPC - Contingency	200	200	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>2,200</b>	<b>2,200</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>2,200</b>	<b>2,200</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>97,600</b>	<b>97,600</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>15,900</b>	<b>16,900</b>	<b>N/A</b>

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	—	5,000	—	—	90,400	95,400 <sup>a</sup>
	OPC <sup>b</sup>	1,500	—	—	—	700	2,200
	TPC	1,500	5,000	—	—	91,100	97,600 <sup>a</sup>
FY 2021	TEC	—	10,000	10,000	—	75,400	95,400 <sup>a</sup>
	OPC <sup>b</sup>	1,500	100	—	—	600	2,200
	TPC	1,500	10,100	10,000	—	76,000	97,600 <sup>a</sup>
FY 2022	TEC	—	10,000	5,000	27,500	52,900	95,400 <sup>a</sup>
	OPC <sup>b</sup>	1,050	20	—	—	1,130	2,200
	TPC	1,050	10,020	5,000	27,500	54,030	97,600 <sup>a</sup>

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2076

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
<b>Total, Operations and Maintenance</b>	<b>371</b>	<b>371</b>	<b>18,540</b>	<b>18,540</b>

**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 <sup>a</sup>
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
<b>Total area eliminated .....</b>	<b>15,000 - 60,000</b>

**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 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.

<sup>a</sup> 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 2022 Request for the Continuous Electron Beam Accelerator Facility (CEBAF) Renovation and Expansion (CRE) project is \$10,000,000. 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 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.

**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 2022 funds will support Project Engineering and Design (PED) activities and initiate 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	2Q FY 2020	4Q FY 2020	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2026
FY 2022	7/20/18	10/16/19	3/18/19	1Q FY 2022	3Q FY 2022	4Q FY 2022	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	N/A	N/A
FY 2021	4Q FY 2020	4Q FY 2020	4Q FY 2021
FY 2022	1Q FY 2022	1Q 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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2020	4,200	61,800	66,000 <sup>b</sup>	1,900	N/A	1,900	67,900 <sup>b</sup>
FY 2021	5,000	82,000	87,000 <sup>b</sup>	2,300	N/A	2,300	89,300 <sup>b</sup>
FY 2022	8,000	79,000	87,000 <sup>b</sup>	3,000	N/A	3,000	90,000 <sup>b</sup>

## **2. Project Scope and Justification**

### **Scope**

The scope of the CRE project will include renovating 123,000 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. Additionally, there is a potential increase in anticipated usage in the near future.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

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	82,000 gsf
ARC Renovation	57,000 gsf	121,000 gsf

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	2,000	2,000	39
FY 2021	1,000	1,000	2,000
Outyears	5,000	5,000	5,961
<b>Total, Design (TEC)</b>	<b>8,000</b>	<b>8,000</b>	<b>8,000</b>
Construction (TEC)			
FY 2021	1,000	1,000	–
FY 2022	10,000	10,000	6,000
Outyears	68,000	68,000	73,000
<b>Total, Construction (TEC)</b>	<b>79,000</b>	<b>79,000</b>	<b>79,000</b>
Total Estimated Cost (TEC)			
FY 2020	2,000	2,000	39
FY 2021	2,000	2,000	2,000
FY 2022	10,000	10,000	6,000
Outyears	73,000	73,000	78,961
<b>Total, TEC</b>	<b>87,000</b>	<b>87,000</b>	<b>87,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	1,000	1,000	1,000
FY 2020	467	467	467
Outyears	1,533	1,533	1,533
<b>Total, OPC</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	1,000	1,000	1,000
FY 2020	2,467	2,467	506
FY 2021	2,000	2,000	2,000
FY 2022	10,000	10,000	6,000
Outyears	74,533	74,533	80,494
<b>Total, TPC</b>	<b>90,000</b>	<b>90,000</b>	<b>90,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	6,500	4,200	N/A
Design - Contingency	1,500	800	N/A
<b>Total, Design (TEC)</b>	<b>8,000</b>	<b>5,000</b>	<b>N/A</b>
Construction	62,000	68,300	N/A
Construction - Contingency	17,000	13,700	N/A
<b>Total, Construction (TEC)</b>	<b>79,000</b>	<b>82,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>87,000</b>	<b>87,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>18,500</i>	<i>14,500</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
OPC, Except D&D	N/A	2,300	N/A
Conceptual Planning	2,400	N/A	N/A
Conceptual Design	400	N/A	N/A
OPC - Contingency	200	N/A	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>3,000</b>	<b>2,300</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>3,000</b>	<b>2,300</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>200</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>90,000</b>	<b>89,300</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>18,700</b>	<b>14,500</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	—	2,000	—	—	64,000	66,000 <sup>a</sup>
	OPC <sup>b</sup>	1,485	—	—	—	415	1,900
	TPC	1,485	2,000	—	—	64,415	67,900 <sup>a</sup>
FY 2021	TEC	—	2,000	2,000	—	83,000	87,000 <sup>a</sup>
	OPC <sup>b</sup>	1,000	700	—	—	600	2,300
	TPC	1,000	2,700	2,000	—	83,600	89,300 <sup>a</sup>
FY 2022	TEC	—	2,000	2,000	10,000	73,000	87,000 <sup>a</sup>
	OPC <sup>b</sup>	1,000	467	—	—	1,533	3,000
	TPC	1,000	2,467	2,000	10,000	74,533	90,000 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2076

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
<b>Total, Operations and Maintenance</b>	<b>1,728</b>	<b>1,728</b>	<b>86,400</b>	<b>86,400</b>

**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 <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.



## **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.



**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 2022 Request for the Large Scale Collaboration Center (LSCC) is \$12,000,000. The preliminary Total Estimated Cost (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 2022 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	1Q FY 2022	1Q FY 2023	1Q FY 2023	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

**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	N/A
FY 2021	TBD	1Q FY 2020	1Q FY 2023
FY 2022	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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2020	6,000	54,000 <sup>b</sup>	60,000 <sup>b</sup>	1,000	N/A	1,000	61,000 <sup>b</sup>
FY 2021	9,000	55,000 <sup>b</sup>	64,000 <sup>b</sup>	2,000	N/A	2,000	66,000 <sup>b</sup>
FY 2022	7,000	57,000 <sup>b</sup>	64,000 <sup>b</sup>	2,000	N/A	2,000	66,000 <sup>b</sup>

## **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-

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

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. Without it, SLAC will be unable to collocate 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
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	11,000	11,000	314
FY 2021	–	–	1,931
FY 2022	–	–	8,755
<b>Total, Design (TEC)</b>	<b>11,000</b>	<b>11,000</b>	<b>11,000</b>
Construction (TEC)			
FY 2021	11,000	11,000	–
FY 2022	12,000	12,000	13,000
Outyears	30,000	30,000	40,000
<b>Total, Construction (TEC)</b>	<b>53,000</b>	<b>53,000</b>	<b>53,000</b>
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
Outyears	30,000	30,000	40,000
<b>Total, TEC</b>	<b>64,000</b>	<b>64,000</b>	<b>64,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	500	500	500
FY 2020	4	4	4
Outyears	1,496	1,496	1,496
<b>Total, OPC</b>	<b>2,000</b>	<b>2,000</b>	<b>2,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
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
Outyears	31,496	31,496	41,496
<b>Total, TPC</b>	<b>66,000</b>	<b>66,000</b>	<b>66,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,800	7,200	N/A
Design - Contingency	2,200	1,800	N/A
<b>Total, Design (TEC)</b>	<b>11,000</b>	<b>9,000</b>	<b>N/A</b>
Construction	42,400	45,000	N/A
Construction - Contingency	10,600	10,000	N/A
<b>Total, Construction (TEC)</b>	<b>53,000</b>	<b>55,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>64,000</b>	<b>64,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>12,800</i>	<i>11,800</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Design	2,000	N/A	N/A
Other OPC Costs	N/A	1,600	N/A
OPC - Contingency	N/A	400	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>2,000</b>	<b>2,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>2,000</b>	<b>2,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>N/A</i>	<i>400</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>66,000</b>	<b>66,000</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>12,800</b>	<b>12,200</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	—	3,000	—	—	57,000	60,000 <sup>a</sup>
	OPC <sup>b</sup>	700	—	—	—	300	1,000
	TPC	700	3,000	—	—	57,300	61,000 <sup>a</sup>
FY 2021	TEC	—	11,000	8,000	—	45,000	64,000 <sup>a</sup>
	OPC <sup>b</sup>	500	200	1,300	—	—	2,000
	TPC	500	11,200	9,300	—	45,000	66,000 <sup>a</sup>
FY 2022	TEC	—	11,000	11,000	12,000	30,000	64,000 <sup>a</sup>
	OPC <sup>b</sup>	500	4	—	—	1,496	2,000
	TPC	500	11,004	11,000	12,000	31,496	66,000 <sup>a</sup>

**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 Accelerator Laboratory.....	34,000-45,000
Area of D&D in this project at SLAC National Accelerator Laboratory.....	8,260
Area at SLAC National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	None <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.



## **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.



**20-SC-76, Tritium System Demolition and Disposal, PPPL  
Princeton Plasma Physics Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Tritium System Demolition and Disposal (TSDD) project is \$6,400,000. The preliminary Total Estimated Cost (TEC) range for this project is \$19,500,000 to \$32,400,000. The preliminary Total Project Cost (TPC) range for this project is \$20,500,000 to \$33,400,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$33,400,000.

This project will remove tritium contaminated legacy systems at the Princeton Plasma Physics Laboratory (PPPL).

**Significant Changes**

This project was initiated through FY 2020 Enacted Appropriations. The most recent DOE Order 413.3B approved Critical Decision (CD) is CD-0, Approve Mission Need, which was approved September 16, 2019. FY 2022 funds will support construction activities after the appropriate CD approvals.

A Federal Project Director with the appropriate certification level (Level I: TPC greater than \$5,000,000 and equal to or less than \$50,000,000) 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	9/16/19	2Q FY 2020	4Q FY 2020	4Q FY 2021	4Q FY 2021	4Q FY 2021	N/A	2Q FY 2025
FY 2022	9/16/19	3/6/20	3Q FY 2021	3Q FY 2021	9/18/20	3Q FY 2021	N/A	2Q 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
FY 2021	4Q FY 2021
FY 2022	3Q FY 2021

**Project Cost History**

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2021	4,000	28,400 <sup>b</sup>	32,400 <sup>b</sup>	1,000	N/A	1,000	33,400 <sup>b</sup>
FY 2022	4,000	28,400 <sup>b</sup>	32,400 <sup>b</sup>	1,000	N/A	1,000	33,400 <sup>b</sup>

**2. Project Scope and Justification**

**Scope**

The Tritium System Demolition and Disposal (TSDD) project’s scope includes removing tritium contaminated items, components, equipment, and sub-systems, including glove boxes, gas holding tanks, tritium purification system (TPS) process piping, contaminated HVAC ductwork and neutral beam boxes, through demolition and disposal.

**Justification**

The aging tritium systems pose a risk to personnel at PPPL, are expensive to maintain, and take up valuable space that could be put to better use. The TSDD project would remove and dispose of the legacy tritium that remains on PPPL by:

- Eliminating risk of tritium release on-site and off-site,
- Eliminating worker exposure to tritium,
- Attenuating operational costs by reducing radiological monitoring, compliance and oversight. This includes greatly reducing the need for (tritium) occupational radiological worker safety requirements (for most of the site) at the conclusion of the work, and
- Creating available high value research space.

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
PPPL Tritium Areas	<ul style="list-style-type: none"> <li>▪ Remove and dispose of all the tritium contaminated process equipment, contaminated ductwork, and waste from PPPL Tritium Areas</li> <li>▪ Eliminate or reduce surface contamination in contaminated areas</li> </ul>	N/A

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

Performance Measure	Threshold	Objective
TFTR Test Cell (TTC)	<ul style="list-style-type: none"> <li>▪ Remove, and dispose of tritium-contaminated Neutral Beam Boxes from the TTC — with the exception of any parts identified for re-use on NSTX-U</li> <li>▪ Remove all Tritium contaminated ductwork</li> <li>▪ Decontaminate or encapsulate floors and walls</li> </ul>	N/A

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	4,000	4,000	4,000
<b>Total, Design (TEC)</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>
Construction (TEC)			
FY 2020	9,000	9,000	–
FY 2021	13,000	13,000	20,000
FY 2022	6,400	6,400	8,400
<b>Total, Construction (TEC)</b>	<b>28,400</b>	<b>28,400</b>	<b>28,400</b>
Total Estimated Cost (TEC)			
FY 2020	13,000	13,000	4,000
FY 2021	13,000	13,000	20,000
FY 2022	6,400	6,400	8,400
<b>Total, TEC</b>	<b>32,400</b>	<b>32,400</b>	<b>32,400</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	100	100	100
FY 2020	800	800	800
FY 2021	100	100	100
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	100	100	100
FY 2020	13,800	13,800	4,800
FY 2021	13,100	13,100	20,100
FY 2022	6,400	6,400	8,400
<b>Total, TPC</b>	<b>33,400</b>	<b>33,400</b>	<b>33,400</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	3,200	3,200	N/A
Design - Contingency	800	800	N/A
<b>Total, Design (TEC)</b>	<b>4,000</b>	<b>4,000</b>	<b>N/A</b>
Construction	23,400	23,400	N/A
Construction - Contingency	5,000	5,000	N/A
<b>Total, Construction (TEC)</b>	<b>28,400</b>	<b>28,400</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>32,400</b>	<b>32,400</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>5,800</i>	<i>5,800</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	200	200	N/A
Conceptual Design	800	800	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,000</b>	<b>1,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>33,400</b>	<b>33,400</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>5,800</b>	<b>5,800</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	13,000	19,400	—	—	32,400 <sup>a</sup>
	OPC <sup>b</sup>	100	800	100	—	—	1,000
	TPC	100	13,800	19,500	—	—	33,400 <sup>a</sup>
FY 2022	TEC	—	13,000	13,000	6,400	—	32,400 <sup>a</sup>
	OPC <sup>b</sup>	100	800	100	—	—	1,000
	TPC	100	13,800	13,100	6,400	—	33,400 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

N/A

**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 .....	None
Area of D&D in this project at Princeton Plasma Physics Laboratory .....	13,400
Area at Princeton Plasma Physics Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	None <sup>c</sup>
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 (M&O) contractor, Princeton University, will perform the acquisition for this project, overseen by the Princeton 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.

<sup>a</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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 2022 Request for the Argonne Utilities Upgrade (AU2) project is \$10,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$72,000,000 to \$215,000,000. The preliminary Total Project Cost (TPC) range for this project is \$73,000,000 to \$216,000,000. 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 2022 funds will support Project Engineering and Design (PED) activities.

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	4Q FY 2021	4Q FY 2022	N/A	4Q FY 2026
FY 2022	5/17/19	11/20/20	3Q FY 2021	4Q FY 2023	2Q FY 2024	4Q FY 2024	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	CD-3B
FY 2021	4Q FY 2021	1Q FY 2021	N/A
FY 2022	2Q FY 2024	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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2021	37,500	177,500	215,000 <sup>b</sup>	1,000	N/A	1,000	216,000 <sup>b</sup>
FY 2022	37,500	177,500	215,000 <sup>b</sup>	1,000	N/A	1,000	216,000 <sup>b</sup>

**2. Project Scope and Justification**

**Scope**

The AU2 project is in the pre-conceptual stage of development, and the preliminary scope 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; a failure of this plant during the winter season would result in 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
<ul style="list-style-type: none"> <li>▪ Utility Plants (Chilled Water, Steam &amp; Condensate)</li> </ul>	<ul style="list-style-type: none"> <li>▪ 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</li> </ul>	<ul style="list-style-type: none"> <li>▪ Equipment &amp; controls upgrades at the 371, 450, and 528 chilled water plants</li> <li>▪ Repair five domestic water tanks</li> <li>▪ Potential capacity upgrades, new equipment, equipment replacements, and various other utility system reliability projects to increase reliability of laboratory internal utilities</li> </ul>

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.  
<sup>b</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> <li>Utility Piping (Chilled Water, Steam &amp; Condensate, Sewer, Domestic, Lab, &amp; Canal Water)</li> </ul>	<ul style="list-style-type: none"> <li>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.)</li> </ul>	<ul style="list-style-type: none"> <li>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.)</li> <li>Install between 50 and 250 new smart meters</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	10,000	10,000	10,500
Outyears	26,500	26,500	26,500
<b>Total, Design (TEC)</b>	<b>37,500</b>	<b>37,500</b>	<b>37,500</b>
Construction (TEC)			
Outyears	177,500	177,500	177,500
<b>Total, Construction (TEC)</b>	<b>177,500</b>	<b>177,500</b>	<b>177,500</b>
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	10,000	10,000	10,500
Outyears	204,000	204,000	204,000
<b>Total, TEC</b>	<b>215,000</b>	<b>215,000</b>	<b>215,000</b>

(dollars in thousands)

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

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
FY 2019	100	100	100
FY 2020	1,100	1,100	600
FY 2021	800	800	800
FY 2022	10,000	10,000	10,500
Outyears	204,000	204,000	204,000
<b>Total, TPC</b>	<b>216,000</b>	<b>216,000</b>	<b>216,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

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

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	500	2,000	—	212,500	215,000 <sup>a</sup>
	OPC <sup>b</sup>	100	600	300	—	—	1,000
	TPC	100	1,100	2,300	—	212,500	216,000 <sup>a</sup>
FY 2022	TEC	—	500	500	10,000	204,000	215,000 <sup>a</sup>
	OPC <sup>b</sup>	100	600	300	—	—	1,000
	TPC	100	1,100	800	10,000	204,000	216,000 <sup>a</sup>

#### 6. Related Operations and Maintenance Funding Requirements

N/A

<sup>a</sup> This project is pre-CD-2; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

**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 <sup>a</sup>
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.

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<sup>a</sup> 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 2022 Request for the Linear Assets Modernization Project (LAMP) at Lawrence Berkeley National Laboratory (LBNL) is \$12,850,000. The preliminary Total Estimated Cost (TEC) range for this project is \$142,000,000 to \$236,000,000. The preliminary Total Project Cost (TPC) range for this project is \$146,000,000 to \$240,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$240,000,000.

LAMP will upgrade high priority utility systems to increase the reliability, capability, 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 2022 funds will support Project Engineering and Design (PED) activities and will initiate long-lead procurements 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 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

**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

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

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2021	48,000 <sup>b</sup>	188,000 <sup>b</sup>	236,000 <sup>b</sup>	4,000	N/A	4,000	240,000 <sup>b</sup>
FY 2022	23,500 <sup>b</sup>	212,500 <sup>b</sup>	236,000 <sup>b</sup>	4,000	N/A	4,000	240,000 <sup>b</sup>

## **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. 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 such as improvements to roadways or other traffic circulation elements, 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 the 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 phase of the LAMP project will enable the National Energy Research Scientific Computing Center (NERSC)-10 upgrade which will play a central role in discovery breakthrough science in the climate arena.

LAMP 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 transfer 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.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.



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
<ul style="list-style-type: none"> <li>▪ Rehabilitate and selectively upgrade LBNL’s existing major utility systems</li> </ul>	<ul style="list-style-type: none"> <li>▪ Renovate and modernize highest priority utility systems including distribution systems and components for:                             <ul style="list-style-type: none"> <li>• Electrical</li> <li>• Natural Gas</li> <li>• Domestic water supply/Sanitary/ storm water; and/or</li> <li>• Data and communication</li> </ul> </li> <li>▪ Establish critical loops for redundancy</li> </ul>	<ul style="list-style-type: none"> <li>▪ Establish and renovate additional utility corridors</li> </ul>

**3. Financial Schedule**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	9,000	9,000	6,000
Outyears	13,500	13,500	17,500
<b>Total, Design (TEC)</b>	<b>23,500</b>	<b>23,500</b>	<b>23,500</b>
Construction (TEC)			
FY 2022	3,850	3,850	–
Outyears	208,650	208,650	212,500
<b>Total, Construction (TEC)</b>	<b>212,500</b>	<b>212,500</b>	<b>212,500</b>
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	12,850	12,850	6,000
Outyears	222,150	222,150	230,000
<b>Total, TEC</b>	<b>236,000</b>	<b>236,000</b>	<b>236,000</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Other Project Cost (OPC)</b>			
FY 2019	172	172	172
FY 2020	398	398	398
FY 2021	1,230	1,230	1,230
FY 2022	500	500	500
Outyears	1,700	1,700	1,700
<b>Total, OPC</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
FY 2019	172	172	172
FY 2020	898	898	398
FY 2021	1,730	1,730	1,230
FY 2022	13,350	13,350	6,500
Outyears	223,850	223,850	231,700
<b>Total, TPC</b>	<b>240,000</b>	<b>240,000</b>	<b>240,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	19,500	38,000	N/A
Design - Contingency	4,000	10,000	N/A
<b>Total, Design (TEC)</b>	<b>23,500</b>	<b>48,000</b>	<b>N/A</b>
Construction	162,500	150,000	N/A
Construction - Contingency	50,000	38,000	N/A
<b>Total, Construction (TEC)</b>	<b>212,500</b>	<b>188,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>236,000</b>	<b>236,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>54,000</i>	<i>48,000</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Design	2,200	1,700	N/A
Start-up	1,000	1,600	N/A
OPC - Contingency	800	700	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>4,000</b>	<b>4,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>4,000</b>	<b>4,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>800</i>	<i>700</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>240,000</b>	<b>240,000</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>54,800</b>	<b>48,700</b>	<b>N/A</b>

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	500	2,000	—	233,500	236,000 <sup>a</sup>
	OPC <sup>b</sup>	300	1,700	—	—	2,000	4,000
	TPC	300	2,200	2,000	—	235,500	240,000 <sup>a</sup>
FY 2022	TEC	—	500	500	12,850	222,150	236,000 <sup>a</sup>
	OPC <sup>b</sup>	172	398	1,230	500	1,700	4,000
	TPC	172	898	1,730	13,350	223,850	240,000 <sup>a</sup>

#### 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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

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	1,500	75,000	75,000
Utilities	12	12	600	600
Maintenance and Repair	4,200	4,200	210,000	210,000
<b>Total, Operations and Maintenance</b>	<b>5,712</b>	<b>5,712</b>	<b>285,600</b>	<b>285,600</b>

**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 <sup>a</sup>
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
<b>Total area eliminated .....</b>	<b>None</b>

**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.

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<sup>a</sup> 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 2022 Request for the Critical Utilities Infrastructure Revitalization (CUIR) project is \$10,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$80,000,000 to \$186,000,000. The preliminary Total Project Cost (TPC) range for this project is \$83,000,000 to \$189,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$189,000,000.

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-0, Approve Mission Need, which was approved May 17, 2019. FY 2022 funds will support Project Engineering and Design (PED) activities and initiate 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 2032
FY 2022	FY 2022	5/17/19	4Q FY 2021	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	1Q FY 2024	4Q FY 2021

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 <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2021	20,000	166,000 <sup>b</sup>	186,000	3,000	N/A	3,000	189,000 <sup>b</sup>
FY 2022	20,000	166,000 <sup>b</sup>	186,000	3,000	N/A	3,000	189,000 <sup>b</sup>

## **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, 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.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

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
<ul style="list-style-type: none"> <li>▪ Deliver identified underground utility capabilities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Repair/Replace 1,500 linear feet (LF) sanitary sewer piping and one lift station</li> <li>▪ Repair/Replace 9,000 LF of domestic water/fire protection piping</li> <li>▪ Repair/Replace 1,500 LF of storm water drain piping and one lift station</li> </ul>	<ul style="list-style-type: none"> <li>▪ Repair/Replace 5,000 LF of sanitary sewer piping and two lift stations</li> <li>▪ Repair/Replace 28,000 LF of domestic water/fire protection piping</li> <li>▪ Repair/Replace 6,000 LF of storm water drain piping and three lift stations</li> </ul>
<ul style="list-style-type: none"> <li>▪ Deliver identified cooling capabilities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provides one new 5 megawatt (MW) cooling towers at Linac</li> <li>▪ Increase the existing underground cooling tower header pipe capacity to 18 inches</li> </ul>	<ul style="list-style-type: none"> <li>▪ Provides two new 5 MW cooling towers at Linac</li> <li>▪ Increase the existing underground cooling tower header pipe capacity to 20 inches.</li> <li>▪ Install new non-radioactive Low Conductivity Water systems for cooling at sectors 4-10</li> <li>▪ Provide new controls and instrumentation for the LCW system at sectors 4-10</li> </ul>
<ul style="list-style-type: none"> <li>▪ Deliver identified electrical power capabilities</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace one Motor Control Center on Linac</li> <li>▪ Replace five electrical switchgear in substations in Linac</li> <li>▪ Install two new 12 kilovolt (kV) electrical feeder and switching equipment for Linac</li> <li>▪ Provide integration trial project for supervisory control and data acquisition (SCADA) for the SLAC power system in master substation and Linac</li> </ul>	<ul style="list-style-type: none"> <li>▪ Replace twelve Motor Control Centers on Linac</li> <li>▪ Replace sixteen electrical switchgear in substations in Linac</li> <li>▪ Replace six 12kV electrical feeders across site</li> <li>▪ Provide complete SCADA for the SLAC power system in master substation and Linac</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	2,000	2,000	1,000
Outyears	17,000	17,000	18,500
<b>Total, Design (TEC)</b>	<b>20,000</b>	<b>20,000</b>	<b>20,000</b>
Construction (TEC)			
FY 2022	8,000	8,000	–
Outyears	158,000	158,000	166,000
<b>Total, Construction (TEC)</b>	<b>166,000</b>	<b>166,000</b>	<b>166,000</b>
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	500
FY 2022	10,000	10,000	1,000
Outyears	175,000	175,000	184,500
<b>Total, TEC</b>	<b>186,000</b>	<b>186,000</b>	<b>186,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2020	323	323	323
FY 2021	1,000	1,000	1,000
Outyears	1,677	1,677	1,677
<b>Total, OPC</b>	<b>3,000</b>	<b>3,000</b>	<b>3,000</b>



(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2020	823	823	323
FY 2021	1,500	1,500	1,500
FY 2022	10,000	10,000	1,000
Outyears	176,677	176,677	186,177
<b>Total, TPC</b>	<b>189,000</b>	<b>189,000</b>	<b>189,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	16,000	16,000	N/A
Design - Contingency	4,000	4,000	N/A
<b>Total, Design (TEC)</b>	<b>20,000</b>	<b>20,000</b>	<b>N/A</b>
Construction	132,000	132,000	N/A
Construction - Contingency	34,000	34,000	N/A
<b>Total, Construction (TEC)</b>	<b>166,000</b>	<b>166,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>186,000</b>	<b>186,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>38,000</i>	<i>38,000</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
OPC, Except D&D	N/A	3,000	N/A
Conceptual Planning	2,200	N/A	N/A
Conceptual Design	800	N/A	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>3,000</b>	<b>3,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>3,000</b>	<b>3,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>N/A</i>	<i>N/A</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>189,000</b>	<b>189,000</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>38,000</b>	<b>38,000</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	500	2,000	—	183,500	186,000 <sup>a</sup>
	OPC <sup>b</sup>	1,000	1,000	—	1,000	3,000
	TPC	1,500	3,000	—	184,500	189,000 <sup>a</sup>
FY 2022	TEC	500	500	10,000	175,000	186,000 <sup>a</sup>
	OPC <sup>b</sup>	323	1,000	—	1,677	3,000
	TPC	823	1,500	10,000	176,677	189,000 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2032
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	4Q FY 2082

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	7,805	N/A	885,000
Utilities	N/A	14,940	N/A	158,930
Maintenance and Repair	N/A	5,700	N/A	702,000
Total, Operations and Maintenance	N/A	28,445	N/A	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 <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.

## **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.



**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 2022 Request for the Utilities Infrastructure Project (UIP) is \$13,300,000. The preliminary Total Estimated Cost (TEC) range for this project is \$146,000,000 to \$310,000,000. The preliminary Total Project Cost (TPC) range for this project is \$150,000,000 to \$314,000,000. 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-0, Approve Mission Need, which was approved on May 17, 2019. FY 2022 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

**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

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

## **Project Cost History**

(dollars in thousands)

<b>Fiscal Year</b>	<b>TEC, Design</b>	<b>TEC, Construction</b>	<b>TEC, Total</b>	<b>OPC, Except D&amp;D<sup>a</sup></b>	<b>OPC, D&amp;D</b>	<b>OPC, Total</b>	<b>TPC</b>
FY 2021	73,000	237,000 <sup>b</sup>	310,000	4,000	N/A	4,000	314,000 <sup>b</sup>
FY 2022	28,300	281,700 <sup>b</sup>	310,000	4,000	N/A	4,000	314,000 <sup>b</sup>

## **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, replacing inefficient boilers and improving electrical metering 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.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval, therefore, funding estimates are preliminary.

Performance Measure	Threshold	Objective
<ul style="list-style-type: none"> <li>▪ Rehabilitate and selectively upgrade FNAL’s existing major utility systems</li> </ul>	<ul style="list-style-type: none"> <li>▪ Revitalize 5 miles of the Industrial Cooling Water (ICW) system extending from backbone</li> <li>▪ Replace 10 miles of the Domestic Water System (DWS) identified as inadequate or sub-standard</li> <li>▪ Replace 10 miles of the Sanitary Sewer &amp; Storm Collection systems identified as inadequate or sub-standard</li> <li>▪ Replace 2 miles of underground Natural Gas lines</li> <li>▪ Construct a new building for chilled water production and renovate the existing Central Utility Building to ensure viability for current and near future (PIP-II, IERC, LBNF-Dune) projects</li> <li>▪ Replace/Upgrade to Kautz Road Substation to improve safety and reliability</li> </ul>	<ul style="list-style-type: none"> <li>▪ Revitalize 16 miles of the ICW system extending from backbone</li> <li>▪ Replace 20 miles of the DWS identified as inadequate or sub-standard</li> <li>▪ Replace 27 miles of the Sanitary Sewer &amp; Storm Collection systems identified as inadequate or sub-standard</li> <li>▪ Replace 22 miles of underground Natural Gas lines</li> <li>▪ Provide Safety / Reliability upgrades to Master Substation</li> </ul>

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	11,300	11,300	11,000
Outyears	16,000	16,000	17,300
<b>Total, Design (TEC)</b>	<b>28,300</b>	<b>28,300</b>	<b>28,300</b>
Construction (TEC)			
FY 2022	2,000	2,000	–
Outyears	279,700	279,700	281,700
<b>Total, Construction (TEC)</b>	<b>281,700</b>	<b>281,700</b>	<b>281,700</b>
Total Estimated Cost (TEC)			
FY 2020	500	500	–
FY 2021	500	500	–
FY 2022	13,300	13,300	11,000
Outyears	295,700	295,700	299,000
<b>Total, TEC</b>	<b>310,000</b>	<b>310,000</b>	<b>310,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2021	1,530	1,530	1,530
FY 2022	500	500	500
Outyears	1,970	1,970	1,970
<b>Total, OPC</b>	<b>4,000</b>	<b>4,000</b>	<b>4,000</b>



(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2020	500	500	–
FY 2021	2,030	2,030	1,530
FY 2022	13,800	13,800	11,500
Outyears	297,670	297,670	300,970
<b>Total, TPC</b>	<b>314,000</b>	<b>314,000</b>	<b>314,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	24,000	60,800	N/A
Design - Contingency	4,300	12,200	N/A
<b>Total, Design (TEC)</b>	<b>28,300</b>	<b>73,000</b>	<b>N/A</b>
Construction	220,000	197,500	N/A
Construction - Contingency	61,700	39,500	N/A
<b>Total, Construction (TEC)</b>	<b>281,700</b>	<b>237,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>310,000</b>	<b>310,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>66,000</i>	<i>51,700</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
OPC, Except D&D	N/A	3,300	N/A
Conceptual Planning	2,300	N/A	N/A
Conceptual Design	700	N/A	N/A
OPC - Contingency	1,000	700	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>4,000</b>	<b>4,000</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>4,000</b>	<b>4,000</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>1,000</i>	<i>700</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>314,000</b>	<b>314,000</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>67,000</b>	<b>52,400</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2021	TEC	—	500	2,000	—	307,500	310,000 <sup>a</sup>
	OPC <sup>b</sup>	100	1,900	—	—	2,000	4,000
	TPC	100	2,400	2,000	—	309,500	314,000 <sup>a</sup>
FY 2022	TEC	—	500	500	13,300	295,700	310,000 <sup>a</sup>
	OPC <sup>b</sup>	—	1,530	—	500	1,970	4,000
	TPC	—	2,030	500	13,800	297,670	314,000 <sup>a</sup>

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2032
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	TBD <sup>c</sup>

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	TBD	N/A	TBD
Utilities	TBD	TBD	TBD	TBD
Maintenance and Repair	TBD	TBD	TBD	TBD
Total, Operations and Maintenance	TBD	TBD	TBD	TBD

**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.....	TBD
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 <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval, therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.

## **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.



**19-SC-71, Science User Support Center, BNL  
Brookhaven National Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Science User Support Center (SUSC) is \$38,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$70,800,000 to \$94,800,000. The preliminary Total Project Cost (TPC) range for this project is \$72,000,000 to \$96,000,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for this project is \$86,200,000.

This project will provide a facility to serve the research community and improve scientific and operational productivity by consolidating visitor and support services.

**Significant Changes**

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-1, Approve Alternative Selection and Cost Range, which was approved on December 18, 2018. FY 2022 funds will support construction and associated activities.

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 2019	12/12/16	4Q FY 2018	2Q FY 2019	4Q FY 2020	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2025
FY 2020	12/12/16	9/7/18	12/18/18	4Q FY 2020	3Q FY 2021	4Q FY 2021	N/A	4Q FY 2025
FY 2021	12/12/16	9/7/18	12/18/18	4Q FY 2020	3Q FY 2021	3Q FY 2021	N/A	4Q FY 2026
FY 2022	12/12/16	9/7/18	12/18/18	1Q FY 2022	1Q FY 2022	1Q 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 2019	4Q FY 2020	N/A
FY 2020	4Q FY 2020	4Q FY 2019
FY 2021	4Q FY 2020	4Q FY 2020
FY 2022	1Q FY 2022	N/A

CD-3A – Approve Long Lead Procurements and Site Preparation

### **Project Cost History**

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2019	9,400	75,600 <sup>b</sup>	85,000 <sup>b</sup>	1,000	N/A	1,000	86,000 <sup>b</sup>
FY 2020	9,400	75,600 <sup>b</sup>	85,000 <sup>b</sup>	1,200	N/A	1,200	86,200 <sup>b</sup>
FY 2021	9,400	75,600 <sup>b</sup>	85,000 <sup>b</sup>	1,200	N/A	1,200	86,200 <sup>b</sup>
FY 2022	9,400	75,600 <sup>b</sup>	85,000 <sup>b</sup>	1,200	N/A	1,200	86,200 <sup>b</sup>

## **2. Project Scope and Justification**

### **Scope**

The scope of the SUSC project is to construct a multi-story office building of approximately 70,000 to 120,000 gross square feet (gsf) to consolidate and provide space for visitor processing, offices for approximately 200-350 occupants, space for conferences, extension of utilities to the building, and related roadway modifications and parking lot development. Demolition of excess facilities to meet offsetting space requirements will be done off-project unless specific facilities are required to be included on-project. Additional supporting functions such as utilities or site modifications may be included in the project if they are deemed necessary.

### **Justification**

Brookhaven National Laboratory (BNL) has nine user facilities that attract over 40,000 visiting scientists, guests, users, and contractors annually to conduct research in a broad range of basic and applied sciences; however, the ability to efficiently process and support the needs of this growing community of researchers is limited by the condition and dispersed nature of BNL's current facilities. The Laboratory's scientific impact can be improved by a facility that centralizes its administrative support functions and provides easier visitor access to conferencing and collaboration space to support the Office of Science (SC) research mission. BNL also has many World War II era facilities dispersed around the site that house research support organizations in deteriorated facilities that are no longer sustainable and contribute to operational inefficiencies. Construction of the SUSC is conceived to provide convenient and efficient facilities for processing and supporting the users of BNL's premier research facilities, which would enable for the demolition of the current facilities. It will also provide conference facilities to support the collaborative science and research mission for the user community and BNL scientists.

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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval, therefore, funding estimates are preliminary.

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	70,000 gsf	120,000 gsf

**3. Financial Schedule**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2019	7,000	7,000	400
FY 2020	2,400	2,400	5,200
FY 2021	–	–	2,200
FY 2022	–	–	1,600
<b>Total, Design (TEC)</b>	<b>9,400</b>	<b>9,400</b>	<b>9,400</b>
Construction (TEC)			
FY 2020	17,600	17,600	–
FY 2021	20,000	20,000	–
FY 2022	38,000	38,000	34,000
Outyears	–	–	41,600
<b>Total, Construction (TEC)</b>	<b>75,600</b>	<b>75,600</b>	<b>75,600</b>
Total Estimated Cost (TEC)			
FY 2019	7,000	7,000	400
FY 2020	20,000	20,000	5,200
FY 2021	20,000	20,000	2,200
FY 2022	38,000	38,000	35,600
Outyears	–	–	41,600
<b>Total, TEC</b>	<b>85,000</b>	<b>85,000</b>	<b>85,000</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Other Project Cost (OPC)</b>			
FY 2017	700	700	700
FY 2018	300	300	300
FY 2019	200	200	200
<b>Total, OPC</b>	<b>1,200</b>	<b>1,200</b>	<b>1,200</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
FY 2017	700	700	700
FY 2018	300	300	300
FY 2019	7,200	7,200	600
FY 2020	20,000	20,000	5,200
FY 2021	20,000	20,000	2,200
FY 2022	38,000	38,000	35,600
Outyears	–	–	41,600
<b>Total, TPC</b>	<b>86,200</b>	<b>86,200</b>	<b>86,200</b>



#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,200	7,800	N/A
Design - Contingency	1,200	1,600	N/A
<b>Total, Design (TEC)</b>	<b>9,400</b>	<b>9,400</b>	<b>N/A</b>
Construction	64,000	63,000	N/A
Construction - Contingency	11,600	12,600	N/A
<b>Total, Construction (TEC)</b>	<b>75,600</b>	<b>75,600</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>85,000</b>	<b>85,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>12,800</i>	<i>14,200</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	700	500	N/A
Conceptual Design	500	500	N/A
OPC - Contingency	N/A	200	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>1,200</b>	<b>1,200</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>1,200</b>	<b>1,200</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>N/A</i>	<i>200</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>86,200</b>	<b>86,200</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>12,800</b>	<b>14,400</b>	<b>N/A</b>

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2019	TEC	2,000	7,400	—	—	75,600	85,000 <sup>a</sup>
	OPC <sup>b</sup>	1,000	—	—	—	—	1,000
	TPC	3,000	7,400	—	—	75,600	86,000 <sup>a</sup>
FY 2020	TEC	7,000	6,400	—	—	71,600	85,000 <sup>a</sup>
	OPC <sup>b</sup>	1,200	—	—	—	—	1,200
	TPC	8,200	6,400	—	—	71,600	86,200 <sup>a</sup>
FY 2021	TEC	7,000	20,000	7,000	—	51,000	85,000 <sup>a</sup>
	OPC <sup>b</sup>	1,200	—	—	—	—	1,200
	TPC	8,200	20,000	7,000	—	51,000	86,200 <sup>a</sup>
FY 2022	TEC	7,000	20,000	20,000	38,000	—	85,000 <sup>a</sup>
	OPC <sup>b</sup>	1,200	—	—	—	—	1,200
	TPC	8,200	20,000	20,000	38,000	—	86,200 <sup>a</sup>

<sup>a</sup> This project has not received CD-2 approval, therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	4Q FY 2026
Expected Useful Life	60 years
Expected Future Start of D&D of this capital asset	4Q FY 2086

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	166	166	8,307	8,307
Utilities	78	78	3,879	3,879
Maintenance and Repair	384	384	19,200	19,200
Total, Operations and Maintenance	628	628	31,386	31,386

**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 Brookhaven National Laboratory .....	70,000 - 120,000
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 <sup>a</sup>
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 and will be responsible for awarding and managing all subcontracts related to the project. The M&O contractor evaluated various acquisition 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 will evaluate potential benefits of using single or multiple contracts for site preparation activities. The M&O Contractor’s annual performance and evaluation measurement plan includes Project performance metrics on which it will be evaluated.

<sup>a</sup> 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-73, Translational Research Capability, ORNL  
Oak Ridge National Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Translational Research Capability (TRC) project is \$21,500,000. The Total Estimated Cost (TEC) for this project \$93,500,000. The Total Project Cost (TPC) for this project is \$95,000,000.

This project will provide low-vibration, wet, and dry laboratory space; high bay space; office space; and collaboration space to support advancement in high-performance computing and materials science in support of multidisciplinary research. In particular, SC’s Basic Energy Sciences (BES) program research on energy storage and design will be improved and consolidated allowing for state-of-the-art, cross-cutting theory, synthesis, and characterization capabilities, and enhanced control over the synthesis of atomic architectures could transform our basic scientific understanding of materials and pave the way for new classes of devices for quantum computing, and spin sensing. Also, SC’s Advanced Scientific Computing Research (ASCR) program will further strengthen its exascale initiative by leveraging Beyond Moore’s Law technologies developed and advanced in technical spaces that support translational computing technologies such as quantum computing and neuromorphic computing.

**Significant Changes**

This project was initiated in FY 2019. The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Performance Baseline and Construction Start, which was approved on April 3, 2020. FY 2022 funds will support 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	10/26/17	7/20/18	11/2/18	1Q FY 2020	4Q FY 2019	1Q FY 2020	N/A	4Q FY 2025
FY 2021	10/26/17	7/20/18	11/2/18	3Q FY 2020	4Q FY 2019	3Q FY 2020	N/A	4Q FY 2025
FY 2022	10/26/17	7/20/18	11/2/18	4/3/20	3Q FY 2021	4/3/20	N/A	1Q 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	CD-3B
FY 2020	N/A	2Q FY 2019	N/A
FY 2021	N/A	2/5/19	N/A
FY 2022	4/3/20	2/5/19	N/A

**CD-2/3** – Approve Performance Baseline and Start of Construction Activities

**CD-3A** – Approve Long-Lead Procurements

**CD-3B** – Approve Remaining Construction Activities

### Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2020	9,700	83,800	93,500 <sup>b</sup>	1,500	N/A	1,500	95,000 <sup>b</sup>
FY 2021	7,400	86,100	93,500 <sup>b</sup>	1,500	N/A	1,500	95,000 <sup>b</sup>
FY 2022	9,250	84,250	93,500	1,500	N/A	1,500	95,000

## 2. Project Scope and Justification

### Scope

The scope of the TRC project is to provide 79,700 to 115,000 gross square feet (gsf) of laboratory, high bay, office, and collaboration space to support advancement in high-performance computing and materials science in support of multidisciplinary research. Currently, it is envisioned that the project will construct a 97,050 gsf facility. Additional supporting functions such as utilities or site modifications may be included in the project if they are deemed necessary.

### Justification

The Office of Science (SC) has 24 core capabilities distributed across 10 of the world-class national laboratories with the following four core capabilities that are relevant to this project in support of the SC mission at Oak Ridge National Laboratory (ORNL): advanced computer science, visualization, and data; materials science and engineering; decision science and analysis; and plasma and fusion energy science. Several SC Advisory Committee reports support the continuing need for these core capabilities encouraging development and integration of several multidisciplinary efforts, such as developing computational tools and the increasing necessity for interdisciplinary collaboration. This project will provide modern, flexible, and adaptable space that is that will enable ORNL to respond to the pressing demand to support advancement in computing and materials science in support of multidisciplinary research.

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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not yet received CD-2 approval; therefore, funding estimates are preliminary.

Key Performance Parameters (KPPs)

The KPPs have been established/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
Multifunction Laboratory and Office Building	79,700 gsf	115,000 gsf

**3. Financial Schedule**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2019	9,250	9,250	680
FY 2020	–	–	4,400
FY 2021	–	–	4,170
<b>Total, Design (TEC)</b>	<b>9,250</b>	<b>9,250</b>	<b>9,250</b>
Construction (TEC)			
FY 2019	15,750	15,750	1,700
FY 2020	25,000	25,000	1,700
FY 2021	22,000	22,000	15,000
FY 2022	21,500	21,500	53,000
Outyears	–	–	12,850
<b>Total, Construction (TEC)</b>	<b>84,250</b>	<b>84,250</b>	<b>84,250</b>
Total Estimated Cost (TEC)			
FY 2019	25,000	25,000	2,380
FY 2020	25,000	25,000	6,100
FY 2021	22,000	22,000	19,170
FY 2022	21,500	21,500	53,000
Outyears	–	–	12,850
<b>Total, TEC</b>	<b>93,500</b>	<b>93,500</b>	<b>93,500</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Other Project Cost (OPC)</b>			
FY 2017	190	190	190
FY 2018	1,000	1,000	1,000
FY 2019	210	210	210
Outyears	100	100	100
<b>Total, OPC</b>	<b>1,500</b>	<b>1,500</b>	<b>1,500</b>

(dollars in thousands)

	<b>Budget Authority (Appropriations)</b>	<b>Obligations</b>	<b>Costs</b>
<b>Total Project Cost (TPC)</b>			
FY 2017	190	190	190
FY 2018	1,000	1,000	1,000
FY 2019	25,210	25,210	2,590
FY 2020	25,000	25,000	6,100
FY 2021	22,000	22,000	19,170
FY 2022	21,500	21,500	53,000
Outyears	100	100	12,950
<b>Total, TPC</b>	<b>95,000</b>	<b>95,000</b>	<b>95,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,250	6,400	8,250
Design - Contingency	1,000	1,000	1,000
<b>Total, Design (TEC)</b>	<b>9,250</b>	<b>7,400</b>	<b>9,250</b>
Construction	72,000	70,100	72,080
Construction - Contingency	12,250	16,000	12,170
<b>Total, Construction (TEC)</b>	<b>84,250</b>	<b>86,100</b>	<b>84,250</b>
<b>Total, TEC</b>	<b>93,500</b>	<b>93,500</b>	<b>93,500</b>
<i>Contingency, TEC</i>	<i>13,250</i>	<i>17,000</i>	<i>13,170</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	500	500	500
Conceptual Design	800	800	800
OPC - Contingency	200	200	200
<b>Total, Except D&amp;D (OPC)</b>	<b>1,500</b>	<b>1,500</b>	<b>1,500</b>
<b>Total, OPC</b>	<b>1,500</b>	<b>1,500</b>	<b>1,500</b>
<i>Contingency, OPC</i>	<i>200</i>	<i>200</i>	<i>200</i>
<b>Total, TPC</b>	<b>95,000</b>	<b>95,000</b>	<b>95,000</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>13,450</b>	<b>17,200</b>	<b>13,370</b>

#### 5. Schedule of Appropriations Requests

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	25,000	15,000	—	—	53,500	93,500 <sup>a</sup>
	OPC <sup>b</sup>	1,190	—	—	—	310	1,500
	TPC	26,190	15,000	—	—	53,810	95,000 <sup>a</sup>
FY 2021	TEC	25,000	25,000	10,000	—	33,500	93,500 <sup>a</sup>
	OPC <sup>b</sup>	1,190	—	—	—	100	1,500
	TPC	26,190	25,000	10,000	—	33,600	95,000 <sup>a</sup>
FY 2022	TEC	25,000	25,000	22,000	21,500	—	93,500
	OPC <sup>b</sup>	1,400	—	—	—	100	1,500
	TPC	26,400	25,000	22,000	21,500	100	95,000

<sup>a</sup> This project has not yet received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	1Q FY 2025
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q FY 2075

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	742	742	26,823	26,823
Utilities	258	258	9,030	9,030
Maintenance and Repair	720	720	25,201	25,201
Total, Operations and Maintenance	1,720	1,720	61,054	61,054

**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 Oak Ridge National Laboratory .....	79,700-115,000
Area of D&D in this project at Oak Ridge National Laboratory .....	None
Area at Oak Ridge National Laboratory to be transferred, sold, and/or D&D outside the project, including area previously "banked" .....	None <sup>a</sup>
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 .....	79,700-115,000

**8. Acquisition Approach**

The ORNL Management and Operating (M&O) Contractor, UT-Battelle, will perform the acquisition for this project overseen by the ORNL Site Office and will be responsible for awarding and managing all subcontracts related to the project. The M&O contractor evaluated various acquisition and project delivery methods prior to achieving CD-1 and selected a design/build best value technical qualification approach as the best method to deliver the project. The M&O Contractor’s annual performance and evaluation measurement plan includes project performance metrics on which it will be evaluated.

<sup>a</sup> 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 2022 Request for the Biological and Environmental Program Integration Center (BioEPIC) project is \$35,000,000. The preliminary Total Estimated Cost (TEC) range for this project is \$110,000,000 to \$190,000,000. The preliminary Total Project Cost (TPC) range for this project is \$112,200,000 to \$192,200,000. Currently, these cost ranges encompass the most feasible preliminary alternatives. The preliminary TPC estimate for the project is \$142,200,000.

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 collocated 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-1, Approve Alternative Selection and Cost Range, which was approved on May 9, 2019. FY 2022 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

**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

## Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2020	13,000 <sup>b</sup>	127,000 <sup>b</sup>	140,000 <sup>b</sup>	2,200	N/A	2,200	142,200 <sup>b</sup>
FY 2021	13,000 <sup>b</sup>	127,000 <sup>b</sup>	140,000 <sup>b</sup>	2,200	N/A	2,200	142,200 <sup>b</sup>
FY 2022	13,000 <sup>b</sup>	127,000 <sup>b</sup>	140,000 <sup>b</sup>	2,200	N/A	2,200	142,200 <sup>b</sup>

## 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 gap by providing a state-of-the-art facility that will collocate biosciences research and other programs.

The BioEPIC building will bring together important Office of Science (BER) 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, 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 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*.

<sup>a</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

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
Biosciences and other research space	55,000 gsf	90,000 gsf

**3. Financial Schedule**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2019	5,000	5,000	5,000
FY 2020	8,000	8,000	6,919
FY 2021	–	–	1,081
<b>Total, Design (TEC)</b>	<b>13,000</b>	<b>13,000</b>	<b>13,000</b>
Construction (TEC)			
FY 2020	7,000	7,000	–
FY 2021	20,000	20,000	2,000
FY 2022	35,000	35,000	30,000
Outyears	65,000	65,000	95,000
<b>Total, Construction (TEC)</b>	<b>127,000</b>	<b>127,000</b>	<b>127,000</b>
Total Estimated Cost (TEC)			
FY 2019	5,000	5,000	5,000
FY 2020	15,000	15,000	6,919
FY 2021	20,000	20,000	3,081
FY 2022	35,000	35,000	30,000
Outyears	65,000	65,000	95,000
<b>Total, TEC</b>	<b>140,000</b>	<b>140,000</b>	<b>140,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2019	1,500	1,500	1,500
FY 2020	21	21	21
Outyears	679	679	679
<b>Total, OPC</b>	<b>2,200</b>	<b>2,200</b>	<b>2,200</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2019	6,500	6,500	6,500
FY 2020	15,021	15,021	6,940
FY 2021	20,000	20,000	3,081
FY 2022	35,000	35,000	30,000
Outyears	65,679	65,679	95,679
<b>Total, TPC</b>	<b>142,200</b>	<b>142,200</b>	<b>142,200</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	10,600	10,600	N/A
Design - Contingency	2,400	2,400	N/A
<b>Total, Design (TEC)</b>	<b>13,000</b>	<b>13,000</b>	<b>N/A</b>
Construction	105,000	105,000	N/A
Construction - Contingency	22,000	22,000	N/A
<b>Total, Construction (TEC)</b>	<b>127,000</b>	<b>127,000</b>	<b>N/A</b>
<b>Total, TEC</b>	<b>140,000</b>	<b>140,000</b>	<b>N/A</b>
<i>Contingency, TEC</i>	<i>24,400</i>	<i>24,400</i>	<i>N/A</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	1,500	N/A	N/A
Conceptual Design	600	1,500	N/A
Start-up	N/A	600	N/A
OPC - Contingency	100	100	N/A
<b>Total, Except D&amp;D (OPC)</b>	<b>2,200</b>	<b>2,200</b>	<b>N/A</b>
<b>Total, OPC</b>	<b>2,200</b>	<b>2,200</b>	<b>N/A</b>
<i>Contingency, OPC</i>	<i>100</i>	<i>100</i>	<i>N/A</i>
<b>Total, TPC</b>	<b>142,200</b>	<b>142,200</b>	<b>N/A</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>24,500</b>	<b>24,500</b>	<b>N/A</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2020	TEC	5,000	6,000	—	—	129,000	140,000 <sup>a</sup>
	OPC <sup>b</sup>	1,500	—	—	—	700	2,200
	TPC	6,500	6,000	—	—	129,700	142,200 <sup>a</sup>
FY 2021	TEC	5,000	15,000	6,000	—	114,000	140,000 <sup>a</sup>
	OPC <sup>b</sup>	1,500	—	—	—	700	2,200
	TPC	6,500	15,000	6,000	—	114,700	142,200 <sup>a</sup>
FY 2022	TEC	5,000	15,000	20,000	35,000	65,000	140,000 <sup>a</sup>
	OPC <sup>b</sup>	1,500	21	—	—	679	2,200
	TPC	6,500	15,021	20,000	35,000	65,679	142,200 <sup>a</sup>

**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	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	150	150	5,700	5,700
Utilities	270	270	11,900	11,900
Maintenance and Repair	530	530	20,600	20,600
<b>Total, Operations and Maintenance</b>	<b>950</b>	<b>950</b>	<b>38,200</b>	<b>38,200</b>

**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 <sup>c</sup>
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

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

<sup>c</sup> 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.

## **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 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.

**17-SC-71, Integrated Engineering Research Center, FNAL  
Fermi National Accelerator Laboratory  
Project is for Design and Construction**

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

**Summary**

The FY 2022 Request for the Integrated Engineering Research Center (IERC) project is \$10,250,000. The Total Estimated Cost (TEC) for this project is \$85,000,000. The Total Project Cost (TPC) is \$86,000,000.

This project will construct new space to accommodate increased collaboration and interactions among Fermi National Accelerator Laboratory (FNAL) staff. The project is intended to support the establishment of an international neutrino campus, which was recommended by the Particle Physics Project Prioritization Panel (P5).

**Significant Changes**

This project was initiated in FY 2017. The most recent DOE Order 413.3B Critical Decision (CD) is CD-2/3, Approve Performance Baseline and Approve Start of Construction which was approved on September 30, 2020. FY 2022 funds will support the continuation of construction and associated 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 2017	7/17/15	N/A	1Q FY 2017	3Q FY 2018	N/A	3Q FY 2019	N/A	4Q FY 2023
FY 2018	7/17/15	N/A	4/18/17	3Q FY 2019	N/A	3Q FY 2020	N/A	4Q FY 2024
FY 2019	7/17/15	3Q FY 2018	4/18/17	3Q FY 2019	3Q FY 2019	3Q FY 2020	N/A	4Q FY 2024
FY 2020	7/17/15	4/18/17	4/18/17	3Q FY 2019	3Q FY 2019	3Q FY 2019	N/A	2Q FY 2024
FY 2021	7/17/15	4/18/17	4/18/17	4Q FY 2020	2Q FY 2020	4Q FY 2020	N/A	3Q FY 2024
FY 2022	7/17/15	4/18/17	4/18/17	9/30/20	3/11/20	9/30/20	N/A	1Q FY 2024

**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 2017	N/A	N/A
FY 2018	N/A	N/A
FY 2019	3Q FY 2019	N/A
FY 2020	4/18/18	N/A
FY 2021	4/18/18	7/16/19
FY 2022	9/30/20	7/16/19

CD-3A – Approve Long-Lead Procurements

### **Project Cost History**

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D <sup>a</sup>	OPC, D&D	OPC, Total	TPC
FY 2017	10,000	75,000 <sup>b</sup>	85,000 <sup>b</sup>	2,000	N/A	2,000	87,000 <sup>b</sup>
FY 2018	10,000	75,000 <sup>b</sup>	85,000 <sup>b</sup>	1,000	N/A	1,000	86,000 <sup>b</sup>
FY 2019	7,000	78,000 <sup>b</sup>	85,000 <sup>b</sup>	1,000	N/A	1,000	86,000 <sup>b</sup>
FY 2020	7,000	78,000	85,000 <sup>b</sup>	1,000	N/A	1,000	86,000 <sup>b</sup>
FY 2021	7,000	78,000	85,000 <sup>b</sup>	1,000	N/A	1,000	86,000 <sup>b</sup>
FY 2022	8,547	76,453	85,000	1,000	N/A	1,000	86,000

## **2. Project Scope and Justification**

### **Scope**

The IERC project will construct an approximately 79,200 gross square feet (gsf) building to accommodate increased collaboration and interactions among staff at (FNAL, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments.

### **Justification**

In May 2014, the Particle Physics Project Prioritization Panel (P5) issued a report that included recommendations to “...develop a coherent short- and long-baseline neutrino program hosted at Fermilab,” and to “reformulate the long-baseline neutrino program as an internationally designed, coordinated, and funded program with [Fermi National Accelerator Laboratory, FNAL or Fermilab] as host.” SC and the High Energy Physics (HEP) program accepted the recommendations in the P5 report and are committed to implementing a successful program based on this new vision.

Implementing these recommendations will require significantly increased collaboration and interactions among FNAL staff, who will in turn be working with scientific collaborators and international partners in the design, construction, and operation of physics experiments. Currently, these staff and their associated manufacturing, assembly, engineering, and technical facilities are scattered among three parts of the campus – the Silicon Detector Complex, the Village, and Wilson Hall. As a result, they are unable to efficiently collaborate on ongoing and planned projects in support of the laboratory’s mission.

<sup>a</sup> Other project costs (OPC) are funded through laboratory overhead.

<sup>b</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.



Collocation of these staff will improve collaboration because it will increase interactions among the various groups and reduce down-time spent traveling across the site. From an infrastructure standpoint, however, FNAL currently lacks sufficient space to do this. Continuing the previous example, groups from the three Divisions noted above total approximately 300 staff occupying more than 170,000 square feet of laboratories, technical areas, and offices in 15 buildings and trailers. In addition, many of these spaces are inadequate to accommodate current and planned scientific programs because they are obsolete (e.g., leaking roofs, inadequate HVAC systems) and do not support the configuration or specification needs of current and future technical programs. The IERC will provide FNAL with a collaborative, multi-divisional, and interdisciplinary research center, which will close existing capability and infrastructure gaps by reducing the overall footprint of outdated facilities, and collocating engineering and associated research staff in a new or renovated facility near the central campus. This approach will complement the ongoing and planned renovations of Wilson Hall by establishing the main campus as the anchor point of the site. It will improve operational efficiency and collaboration because groups working on key projects would be in close proximity to one another. Such a facility will provide technical and engineering staff the necessary environment for interdisciplinary collaboration necessary to establish an international neutrino program and support other HEP science opportunities described in the P5 report.

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
Multistory Laboratory/Office Building	67,000 gsf	134,000 gsf

### 3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Estimated Cost (TEC)</b>			
Design (TEC)			
FY 2017	2,500	2,500	38
FY 2018	6,047	6,047	804
FY 2019	–	–	4,844
FY 2020	–	–	2,794
FY 2021	–	–	67
<b>Total, Design (TEC)</b>	<b>8,547</b>	<b>8,547</b>	<b>8,547</b>
Construction (TEC)			
FY 2018	13,953	13,953	–
FY 2019	20,000	20,000	2,296
FY 2020	22,000	22,000	7,701
FY 2021	10,250	10,250	31,735
FY 2022	10,250	10,250	28,000
Outyears	–	–	6,721
<b>Total, Construction (TEC)</b>	<b>76,453</b>	<b>76,453</b>	<b>76,453</b>
Total Estimated Cost (TEC)			
FY 2017	2,500	2,500	38
FY 2018	20,000	20,000	804
FY 2019	20,000	20,000	7,140
FY 2020	22,000	22,000	10,495
FY 2021	10,250	10,250	31,802
FY 2022	10,250	10,250	28,000
Outyears	–	–	6,721
<b>Total, TEC</b>	<b>85,000</b>	<b>85,000</b>	<b>85,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Other Project Cost (OPC)</b>			
FY 2015	120	120	120
FY 2016	530	530	530
FY 2017	300	300	300
FY 2022	50	50	50
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
<b>Total Project Cost (TPC)</b>			
FY 2015	120	120	120
FY 2016	530	530	530
FY 2017	2,800	2,800	338
FY 2018	20,000	20,000	804
FY 2019	20,000	20,000	7,140
FY 2020	22,000	22,000	10,495
FY 2021	10,250	10,250	31,802
FY 2022	10,300	10,300	28,050
Outyears	–	–	6,721
<b>Total, TPC</b>	<b>86,000</b>	<b>86,000</b>	<b>86,000</b>

#### 4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
<b>Total Estimated Cost (TEC)</b>			
Design	8,547	6,000	8,547
Design - Contingency	N/A	1,000	N/A
<b>Total, Design (TEC)</b>	<b>8,547</b>	<b>7,000</b>	<b>8,547</b>
Construction	61,000	63,000	61,000
Construction - Contingency	15,453	15,000	15,453
<b>Total, Construction (TEC)</b>	<b>76,453</b>	<b>78,000</b>	<b>76,453</b>
<b>Total, TEC</b>	<b>85,000</b>	<b>85,000</b>	<b>85,000</b>
<i>Contingency, TEC</i>	<i>15,453</i>	<i>16,000</i>	<i>15,453</i>
<b>Other Project Cost (OPC)</b>			
Conceptual Planning	120	250	120
Conceptual Design	830	530	830
Other OPC Costs	N/A	150	N/A
OPC - Contingency	50	70	50
<b>Total, Except D&amp;D (OPC)</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>
<b>Total, OPC</b>	<b>1,000</b>	<b>1,000</b>	<b>1,000</b>
<i>Contingency, OPC</i>	<i>50</i>	<i>70</i>	<i>50</i>
<b>Total, TPC</b>	<b>86,000</b>	<b>86,000</b>	<b>86,000</b>
<b>Total, Contingency (TEC+OPC)</b>	<b>15,503</b>	<b>16,070</b>	<b>15,503</b>

**5. Schedule of Appropriations Requests**

(dollars in thousands)

Request Year	Type	Prior Years	FY 2020	FY 2021	FY 2022	Outyears	Total
FY 2017	TEC	2,500	TBD	—	—	TBD	85,000 <sup>a</sup>
	OPC <sup>b</sup>	500	TBD	—	—	TBD	2,000
	TPC	5,000	TBD	—	—	TBD	87,000 <sup>a</sup>
FY 2018	TEC	4,000	TBD	—	—	TBD	85,000 <sup>a</sup>
	OPC <sup>b</sup>	1,000	—	—	—	—	1,000
	TPC	5,000	TBD	—	—	TBD	86,000 <sup>a</sup>
FY 2019	TEC	9,000	20,000	28,096	—	27,904	85,000 <sup>a</sup>
	OPC <sup>b</sup>	930	—	—	—	70	1,000
	TPC	9,930	20,000	28,096	—	27,974	86,000 <sup>a</sup>
FY 2020	TEC	42,500	10,000	—	—	32,500	85,000 <sup>a</sup>
	OPC <sup>b</sup>	930	—	—	—	70	1,000
	TPC	43,430	10,000	—	—	32,570	86,000 <sup>a</sup>
FY 2021	TEC	42,500	22,000	12,000	—	8,500	85,000
	OPC <sup>b</sup>	930	—	—	—	70	1,000
	TPC	43,430	22,000	12,000	—	8,570	86,000
FY 2022	TEC	42,500	22,000	10,250	10,250	—	85,000
	OPC <sup>b</sup>	950	—	—	50	—	1,000
	TPC	43,450	22,000	10,250	10,300	—	86,000

**6. Related Operations and Maintenance Funding Requirements**

Start of Operation or Beneficial Occupancy	3Q FY 2024
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	3Q FY 2074

Related Funding Requirements  
(dollars in thousands)

	Annual Costs		Life Cycle Costs	
	Previous Total Estimate	Current Total Estimate	Previous Total Estimate	Current Total Estimate
Operations	508	508	25,428	25,428
Utilities	94	94	4,670	4,670
Maintenance and Repair	1,525	1,525	76,285	76,285
<b>Total, Operations and Maintenance</b>	<b>2,127</b>	<b>2,127</b>	<b>106,383</b>	<b>106,383</b>

<sup>a</sup> This project has not received CD-2 approval; therefore, funding estimates are preliminary.

<sup>b</sup> Other Project Costs (OPC) are funded through laboratory overhead.

**7. D&D Information**

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

	<b>Square Feet</b>
New area being constructed by this project at Fermi National Accelerator Laboratory.....	79,200
Area of D&D in this project at Fermi National Accelerator Laboratory.....	None
Area at Fermi National Accelerator Laboratory to be transferred, sold, and/or D&D outside the project, including area previously “banked” .....	55,200
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 <sup>a</sup>
Total area eliminated .....	55,200

**8. Acquisition Approach**

The FNAL Management and Operating (M&O) contractor, Fermi Research Alliance, LLC performed the acquisition for this project, overseen by the Fermi 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 (CM/GC) project delivery with best value procurement approach as the overall best delivery method with the lowest risk to DOE. The M&O contractor is responsible for awarding and administering all subcontracts related to this project. The annual performance evaluation and measurement plan includes project performance metrics on which they are evaluated.

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<sup>a</sup> 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.