Overview

The Biological and Environmental Research (BER) program's mission is to support transformative science and scientific user facilities to achieve a predictive understanding of complex biological, Earth and environmental systems, in support of DOE's vision to advance innovative solutions for the Nation's energy expansion and national security challenges. BER's fundamental research, conducted at DOE national laboratories and other research institutions, plays a unique role in ensuring national leadership in biotechnology and in the ability to understand and predict the interdependencies involving energy and the environment over a wide range of conditions. Biology remains a vast, largely untapped resource of genomic potential, capable of performing highly complex chemistry that evolves naturally over time while fully intertwined and dependent on surrounding physical and environmental conditions. BER's biological research focuses on gaining the ability to understand and then re-design biomolecules, metabolic pathways, microorganisms, plants, and microbiomes. This focus leads to a comprehensive understanding of biological processes operating at molecular to field scales underpinning broad biotechnology development. Earth and environmental research supports fundamental research and computationally advanced modeling to enhance predictability of dynamically variable integrated energy, environmental, and Earth systems, in support of DOE's mission involving transformative science for energy and national security.

Over the last three decades, BER's scientific impact has been transformative for biology and biotechnology development. Beginning with the DNA sequencing revolution sparked by the Human Genome Project in 1990 to more recent developments in genome editing technology (CRISPR), and Artificial Intelligence (AI) breakthroughs in computational protein design, BER continues to be at the forefront of genomic science. Focused on non-biomedical plants, microorganisms, and ecosystems, BER science fills a niche among federal basic science agencies by addressing key energy and national security challenges. BER remains positioned to lead the fundamental science underpinning new paradigms in biotechnology development.

A crucial goal for BER's basic research is the integration of advanced AI methods with genomic science and automated experimentation. This is the key to unlocking breakthroughs in genomic science and biotechnology. AI, together with advances in genome editing capabilities (i.e. CRISPR) and lab automation, positions BER to accelerate fundamental research on microbes, plants and microbiomes through laboratory-based experimentation and field-based studies. AI techniques can rapidly synthesize new experimental data in the context of previously published information to pose new hypotheses for additional research that builds on prior results and converges on solutions. BER's Joint Genome Institute (JGI) and the Environmental Molecular Science Laboratory (EMSL) facilities and other major projects are pivoting towards integrated, AI-driven automated experimental and data systems. BER's bioimaging and quantum-science efforts (imaging and sensing), data analytics and computational modeling will provide both visual and calculated validation to experimental results. These advances will unlock the ability to not only understand but rapidly re-design biological systems. The scope of biotechnology potential is vast, including designing proteins, cells, microbes, plants and microbiomes for a range of applications including production of fuels, chemicals, materials, recovery of critical minerals, enhancement of soils, and design of robust plants. Biodesign innovations in biotechnology, biofuels, biochemicals, and bioproducts are currently pursued within the Bioenergy Research Centers, using expanding options for renewable plant biomass. BER is primed to drive a revolution in how we understand, design and employ fundamental biological principles for energy, economic and national security benefits.

Since the 1950s, BER has been critical contributors to fundamental earth and environmental research that complements biological and biotechnology sciences. BER advances the DOE flagship Energy Exascale Earth System Model (E3SM) and a suite of energy sector models to provide insight into how environmental conditions can be leveraged to inform energy expansion. BER research tackles those components of the environmental system that are most uncertain and critical for future energy needs, including those involving clouds, aerosols, and integrated land-energy systems.

AI methods are transforming earth and environmental sciences, enabling modeling of finer spatial scales, enhanced accuracy, increased simulation speeds, integration with energy sector models, and quantification of uncertainties over widely varying conditions. E3SM and its interconnected suite of sectoral models are

supplemented with detailed observations for initialization, parameterization development, and validation. Atmospheric and terrestrial research, including detailed biological and ecosystem information, ensure fine-scale fidelity for the models. BER's models are increasingly skillful to provide energy stakeholders with key information needed to expand U.S. energy dominance.

Highlights of the FY 2026 Request

The BER FY 2026 Request of $394.9 million is a decrease of $475.1 million below the FY 2025 Enacted level. BER will initiate new research on Artificial Intelligence (AI) to accelerate biotechnology advances, new Quantum Information Science for bioimaging and sensing applications, and focus on key biodesign research on bio-inspired critical mineral and material extraction, separation, and creation of alternative forms of mineral and materials.

Research

- Genomic Sciences will conduct foundational research on microbial, plant, and microbiome systems and the Bioenergy Research Centers (BRCs) will provide new research both individually and through shared research themes, underpinning energy and biotechnology innovations and biological production of fuels, chemicals, and other products.
- Computational Biosciences efforts are consolidated as BER shifts to include a more AI/ML-centric approach to genomic science and to develop integrated approaches to analyzing both genomic and ecosystem data across platforms and user facilities for advancing biosystems understanding and design.
- Research in Biomolecular Characterization and Imaging Science will focus on quantum information science (QIS)-enabled techniques to visualize and develop new sensing capabilities to understand biological processes.
- Bio-inspired critical minerals and materials (CMM) will support fundamental research to augment or enhance microbes and plants, using synthetic biology approaches to selectively remove or concentrate CMM from source materials and/or dilute solutions. CMM will also explore the biosynthesis of new minerals and materials capable of replacing existing CMMs to provide sustainable, lower-energy manufacturing options.
- Earth and environmental modeling is focused on developing an AI-driven hyper-resolution predictive system for integrated energy and environmental systems, connected to the E3SM model to predict seasonal and near-term (out to 10 years) environmental conditions, and incorporating energy systems to inform regional stakeholders.
- BER activities in environmental system sciences, atmospheric system research, earth system modeling, and data management are all funded under earth system modeling and will be focused on supporting integrated data-driven hybrid modeling with extensive applications of AI in support of science, energy, and national security challenges.

Facility Operations

- The JGI will continue efforts to transition towards a more AI-centric user facility that delivers high-quality genome sequencing, innovative analysis techniques for complex plant and microbiome samples, and advanced AI/ML-driven analytics. Consolidating data analytics and integrating and standardizing data workflows will enable seamless aggregation and harmonization of genomic data, ensuring users benefit from cutting-edge AI-powered insights and streamlined access to comprehensive analytical capabilities.
- EMSL will focus on coupled analyses across multiple analytical capabilities to advance biological and environmental science to uncover the biochemical pathways connecting gene functions to complex biological responses, develop predictive understanding of the mechanistic interplay of physical, biological, and environmental processes and use AI workflows, data analytics, visualization, and computational modeling. EMSL continues the development of a capability for microbial molecular phenotyping.
- The Atmospheric Radiation Measurement (ARM) user facility completes all field campaigns and is closed.

Projects

- The BER FY 2026 Request includes $10.0 million to continue the Microbial Molecular Phenotyping Capability (M2PC) project at the Pacific Northwest National Laboratory.

Biological and Environmental Research
Funding

(dollars in thousands)

	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Biological and Environmental Research				
Genomic Science	319,435	340,900	166,483	-174,417
Biomolecular Characterization and Imaging Science	45,750	45,750	37,000	-8,750
Biological Systems Facilities & Infrastructure	92,250	95,127	93,596	-1,531
Total, Biological Systems Science	**457,435**	**481,777**	**297,079**	**-184,698**
Atmospheric System Research	39,584	28,656	–	-28,656
Environmental System Sciences	127,000	82,800	–	-82,800
Earth and Environmental Systems Modeling	111,281	109,281	30,000	-79,281
Earth and Environmental Systems Sciences Facilities and Infrastructure	154,700	148,486	57,841	-90,645
Total, Earth and Environmental Systems Sciences	**432,565**	**369,223**	**87,841**	**-281,382**
Subtotal, Biological and Environmental Research	**890,000**	**851,000**	**384,920**	**-466,080**
Construction				
24-SC-31 Microbial Molecular Phenotyping Capability (M2PC), PNNL	10,000	19,000	10,000	-9,000
Subtotal, Construction	**10,000**	**19,000**	**10,000**	**-9,000**
Total, Biological and Environmental Research	**900,000**	**870,000**	**394,920**	**-475,080**

SBIR/STTR funding:
- FY 2024 Enacted: SBIR $21,545,000 and STTR $3,030,000
- FY 2025 Enacted: SBIR $20,437,000 and STTR $2,874,000
- FY 2026 Request: SBIR $7,682,000 and STTR $1,080,000

Biological and Environmental Research
Explanation of Major Changes

	(dollars in thousands) FY 2026 Request vs FY 2025 Enacted
Biological Systems Science	-$184,698
Within Genomic Sciences, the Request reduces lower priority efforts across the portfolio while initiating new research in targeted areas. Foundational genomics will reduce and focus the portfolio on core elements of microbial and plant research underpinning biological discoveries for biotechnology development while in critical mineral and materials (CMM) will focus on key biodesign efforts to enhance microbial and plant abilities to recover, separate, and concentrate critical elements from the environment. The Bioenergy Research Centers will downsize teams and reduce efforts to focus on resolving remaining fundamental research challenges to producing fuels, chemicals, and other products from plant biomass. Biopreparedness Research Virtual Environment (BRaVE) efforts will end while low dose radiation research efforts narrow focus to produce experimental datasets for training AI systems on radiation exposure effects. FAIR efforts are completed. Computational Bioscience will pivot towards integrating new AI techniques to integrate data and experimental systems across the portfolio within open-access online platforms for genomics analyses and in coordination with JGI. The National Microbiome Data Collaborative (NMDC) will ramp down and merge capabilities with both KBase and JGI. Environmental Genomics will reduce overall efforts on natural systems and will prioritize plant and microbiome biotechnology. Biomolecular Characterization and Imaging Science research will reduce more established techniques and emphasize quantum-science enabled imaging and sensing concepts. JGI will prioritize user-initiated sequence production support and data infrastructure reorganization for AI. The Energy Earthshot Research Center activities will end.	
Earth and Environmental Systems Sciences	-$281,382
All BER facility and programmatic activities are funded under earth system modeling to support the highest priority research efforts. The consolidation includes the environmental system sciences, atmospheric system research, earth system modeling, and data management programs. The Atmospheric Radiation Measurement User Facility completes all campaigns and will close. BER efforts will continue at the EMSL User Facility. EMSL will focus on biological and environmental molecular science as it prepares new technologies for microbial molecular phenotyping. EMSL's experimental and analytic efforts support BER priorities in biotechnology, critical mineral extraction with biology, using AI analytics and laboratory automation to advance biosystems discovery.	
Construction	-$9,000
Design activities will continue for the Microbial Molecular Phenotyping Capability (M2PC) at Pacific Northwest National Laboratory.	
Total, Biological and Environmental Research	-$475,080

Basic and Applied R&D Coordination

BER research underpins the needs of DOE's energy and environmental missions and is coordinated through internal DOE mechanisms, and more broadly through the National Science and Technology Council (NSTC) and other committees of the Office of Science and Technology Policy (OSTP). BER research includes biological and environmental systems investments in theoretical, experimental, predictive modeling research, and science supporting energy expansion. Basic research on genomics, microbes and plants provides fundamental knowledge that can be used to develop new bioenergy and bioproduct production processes that enhance the bioeconomy. Basic research on ecological processes is used to advance predictive capabilities and resilience of energy systems. Coordination with other federal agencies on priority biotechnology science occurs through the Biomass Research and Development Board, a Congressionally mandated interagency group created by the Biomass Research and Development Act of 2000, as amended by the Energy Policy Act of 2005 and the Agricultural Act of 2014. Coordination of BER's environment, geospatial, and Arctic investments occur within the NSTC Committee on Environment. BER coordinates with DOE's applied energy offices through regular joint DOE working groups, program manager meetings, by participating in their internal program reviews and in joint principal investigator meetings and technical workshops.

BER supports some interagency projects to manage databases (such as the Protein Data Bank) through interagency awards and funding for complementary community resources (such as beamlines and cryo-electron microscopy), particularly with NIH and NSF. BER is a member of the advisory committee for DoD's BioMADE project researching synthetic biology applications.

Program Accomplishments

Notable accomplishments in *Biological Systems Science* include:

- *New technology has great potential for accelerating the improvement of plant traits.* Researchers at the Center for Bioenergy Innovation, a BER Bioenergy Research Center, developed a split selectable marker system that allows for gene-stacking in herbaceous and woody plants which enables faster and more efficient multi-gene transformation in plant feedstocks for use in bioproducts and biofuels production.
- *A hybrid chemical-biological approach can upcycle mixed plastic waste with reduced cost*. A mixture of plastic types can cause cross-contamination issues in existing recycling facilities. Depolymerization of mixed plastic types into one biodegradable type has been demonstrated in a joint effort by the Joint BioEnergy Institute and the Advanced Biofuels Process Demonstration Unit and should result in more efficient recycling of plastics using less energy.
- *A new tool, geNomad, provides fast and precise identification of viruses and plasmids based on their gene content.* The Joint Genome Institute (JGI) designed the new geNomad software using computing resources at the NERSC User Facility with data from the National Microbiome Data Collaborative to process over 2.7 trillion base pairs of sequencing data, leading to the discovery of millions of viruses and plasmids (non-pathogenic).
- *Yeast use plastic waste oils to make high-value chemicals*. Growing a yeast strain on depolymerized plastic oil causes it to shift protein production toward energy and lipid metabolism. The yeast strain, with additional genetic modifications, has good potential to produce high-value chemicals from depolymerized plastics.

Notable accomplishments in *Earth and Environmental Systems Sciences* include:

- *The addition of Antarctic ice shelves in global ocean simulations improves tidal processes*. By including ice shelves in ocean simulations, errors of tidal amplitude and phase were reduced by up to 50% near Antarctica and by 5 to 10% globally, leading to improved predictions relevant to coastal energy, infrastructure, and national security operations.
- *Future water scarcity is primarily driven by human demands*. Future projections of water demand from the Global Change Analysis Model (GCAM) were combined with a land-use spatial downscaling model,

global hydrologic model, and a water withdrawal downscaling model to generate a global gridded monthly sectoral water use dataset for use by scientists, agriculture and water resource planners, and multi-sectoral utilities.

- *High latitude wetland methane emission is growing*. This study analyzed two decades (2002–2021) of methane emissions over the boreal-arctic region and revealed a 9 percent increase. Wetland methane emission increases occurred in early summer and were mainly driven by warming and ecosystem productivity.
- *Drought shifts the type of natural carbon emitted from land to the atmosphere*. The nuclear magnetic resonance and Fourier-Transform Ion Resonance capabilities at the Environmental Molecular Sciences Laboratory were used to track carbon in the form of CO_2 and volatile organic carbon in a tropical rainforest. Drought was found to impact microbial activity and increase emissions of soil carbon to the atmosphere.
- *Lidar observations provide critical information on boundary layer turbulence*. Doppler lidar data from five ARM User Facility sites in Oklahoma were used to study rapid changes in wind speed, known as ramp events. The new science is leading to improved prediction of wind energy production.

Description

The Biological Systems Science subprogram integrates advanced genomics research with computation and user facility capabilities for basic science on plant and microbial systems relevant to DOE mission in energy and national security underpinning U.S. leadership in biotechnology innovation.

Genomic Science

The Genomic Science activity supports basic research in foundational genomics, bioenergy, environmental genomics, and computational bioscience, including the use of AI/ML techniques. This activity reveals the fundamental principles that drive biological systems, enables the design of new biosystems relevant to DOE missions in energy and national security, and provides the breakthrough science needed to accelerate biotechnological innovation ensuring U.S. leadership in a globally competitive bioeconomy.

Foundational Genomics supports basic research on discovery, characterization, and design of mechanisms controlling gene expression in plants and microbes. This fundamental research applies systems biology approaches and biosystems design research to understand, predict, manipulate, and design biological processes to produce fuels, chemicals, materials, and other bioproducts from dedicated plant biomass. Efforts include designing microbes and plants with enhanced capabilities to scavenge and sequester critical minerals such as rare earth elements and to generate critical materials. Biological processes are adept at scavenging low concentrations of elements in the environment. This work will explore and refine engineering biology techniques to boost materials synthesis in organisms to drive rare earth element uptake, sequestration, and recovery.

The DOE Bioenergy Research Centers (BRCs) address key basic science bottlenecks precluding the ability to convert inedible lignocellulosic biomass grown on underutilized lands to fuels, chemicals, materials, and other bioproducts. These multi-disciplinary, multi-institutional centers accelerate the scientific groundwork necessary for biotechnology innovation to ensure secure supply chains of critical products that can be produced from renewable domestic resources. They collaborate with and spawn new industry efforts to move the basic research forward towards market.

Environmental Genomics supports research to understand genome expression in plants and microbial communities. The research not only provides a basis for understanding the cycling of carbon and nutrients in the soils but also serves as a foundation on which to learn how to engineer microbial communities and plant-microbe interactions for specific industrial or environmental purposes relevant to bioenergy and bioproduct development.

Computational Biosciences supports on-line, open access bioinformatics and modeling capabilities within the DOE Systems Biology Knowledgebase (KBase) and the National Microbiome Data Collaborative (NMDC). These integrated resources support large-scale collaborative genomic science investigations of plant and microbial systems to reveal insights into biological processes and new biosystems designs. New efforts include a concerted effort to integrate AI/ML capabilities into the portfolio to accelerate basic research underpinning biotechnology innovation.

Biomolecular Characterization and Imaging Science

Biomolecular characterization and imaging science supports integrative approaches to detect, visualize, and measure biological processes *in-situ* to gain a predictive understanding of cellular function, critical for advanced genomics research and biotechnology development. This effort includes innovative Quantum Information Science (QIS)-enabled imaging concepts and sensor/detector design.

Biological Systems Facilities and Infrastructure

The DOE Joint Genome Institute is the only federally funded major genome sequencing center focused on genome discovery and analysis in plants and microbes for energy, biotechnology, and environmental

applications. This scientific user facility provides high-throughput DNA sequencing and analysis capabilities for plants, microorganisms, and microbial communities as a foundational basis for BER's genomic science research efforts.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Biological Systems Science $481,777	**$297,079**	**-$184,698**
Genomic Science $340,900	$166,483	-$174,417
Foundational Genomics research prioritizes understanding the mechanisms controlling plant and microbial interactions in soils. Funding in the Accelerate and Biotechnology to Transform Advanced Manufacturing initiatives shift to priority bioenergy/bioeconomy research. Biosystems design research continues efforts to accelerate the ability to design plants and microorganisms with specific beneficial bioproduct and biomaterials production traits. Efforts continue to support emerging technologies to develop integrated automated sensors that scale from laboratory fabricated ecosystems to field ecosystems. Support for research on a wide variety of microorganisms and plants with bio-inspired bioproduct-relevant traits continues to broaden the range of platform organisms available for biotechnology. A new effort in critical minerals and materials research explores biosystems design concepts to boost uptake and recovery mechanisms of critical elements within plants and microorganisms broadening the range of metabolic capabilities and platform organisms underpinning biotechnology innovations.	Foundational Genomics prioritizes fundamental systems biology research on plants and microorganisms supporting biotechnology innovation and accelerating biosystems design efforts. Efforts in critical minerals and materials research narrow focus on key synthetic biology objectives to explore designing plants and microorganisms for extraction and recovery of critical elements.	Foundational Genomics efforts in Secure Biosystems Design are completed while efforts in broader Biosystems Design research are reduced. Efforts in Microbial Biofuels research are completed while efforts in sustainability research are reduced. Critical minerals and materials efforts are reduced.
BER concludes Energy Earthshot research initiated in FY 2023 on key biological research challenges at the interface between currently supported basic research and applied research supporting development activities to help speed translation of basic discoveries to industry.	The BER Energy Earthshot Research Centers (EERCs) are completed.	No funding is provided for EERCs.

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Environmental Genomics continues basic plant functional genomics research to understand genotype to phenotype translations leading to bioenergy crop improvement.	Environmental Genomics prioritizes plant functional genomics and environmental microbiome science to enable efforts in plant biotechnology and engineered microbial communities.	Funding opportunities are reduced across Environmental Genomics to prioritize biotechnology development within plants and microbiomes.
Biopreparedness Research Virtual Environment (BRaVE) continues to add functionality to its expanding computational platform and experimental workflows. BRaVE continues to build a distributed network of data and experimental capabilities that can be accessed by multidisciplinary teams of scientists working together on urgent multiprogram priorities and/or emergency situations. BRaVE expands low dose radiation research efforts.	BRaVE efforts are complete. Low dose radiation research prioritizes research on experimental dataset generation to serve as training sets for AI modeling of low dose radiation effects.	No funding for BRaVE efforts. Low dose radiation research is reduced to prioritize on experimental datasets for AI modeling of low dose radiation effects.
Computational Bioscience supports research efforts within Genomic Science by providing bioinformatics, simulation, and modeling capabilities through the KBase platform and within the NMDC. Both platforms continue integrative activities with each other and with the JGI. New efforts include integration of AI/ML capabilities into the KBase platform modeling, and science in concert with JGI data restructuring activities.	Computational Bioscience continue support for Genomic Science by providing bioinformatics, simulation, and modeling capabilities. Efforts expand to integrate AI/ML infrastructure and capabilities across BER User Facilities and KBase.	Funding will support AI/ML integration into the KBase platform and biological sciences while NMDC ramps down and is folded into the JGI and KBase collaborative activities underpinning an advanced AI system supporting genomic science biotechnology innovation.
The BRCs broaden their collaborative activities to accelerate plant and microbial genome engineering with AI/ML techniques to diversify the range of products that can be produced from plant biomass, expand understanding of plant-microbe interactions to create better agronomic practices, develop new plant varieties with expanded capabilities for bioenergy and bioproduct production and increase collaboration among the broader research community where new crop-	The BRCs sharpen their focus on critical basic science needs to accelerate plant and microbial biotechnology innovation including prioritizing on integrating AI/ML techniques into their research plans and shared research objectives.	BRC teams and collaborators will be restructured to focus on priority research activities across the BRC portfolio with emphasis on activities to accelerate the design of plants and microorganisms for biotechnology purposes. The BRCs will focus on leading edge biosystems design techniques to bolster U.S. biotechnology leadership for producing a range of products from plant biomass.

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
based clean energy and bioproduct production could spark new industries and biotechnology development.		
Funding supports EPSCoR Implementation Grants.	Funding will support EPSCoR-State/National Laboratory Partnerships.	Continued support for research in EPSCoR jurisdictions.
Biomolecular Characterizati and Imaging Science $45,750	$37,000	-$8,750
New multimodal bioimaging research provides new capabilities to characterize, measure, visualize and test hypotheses on plant and microbial cell function and metabolism. Quantum-enabled science concepts for imaging techniques will continue.	Imaging and characterization technologies will continue with an emphasis on quantum-science enabled imaging and sensor development tailored to plants and microorganisms, while maintaining capabilities for structural biology.	Research on multi-modal classical bioimaging development will be ramped down while quantum-science for imaging and sensing research ramps up. Capabilities for structural biology are maintained.
Biological Systems Facilities Infrastructure $95,127	$93,596	-$1,531
JGI provides users with high quality genome sequences and new analysis techniques for complex plant and microbiome samples. Integrative activities with KBase and the NMDC provide new cross-platform capabilities for users. Genome-based discovery efforts for natural product production in microbial isolates continues in concert with expanded metagenomics analysis techniques. The multi-year instrument and equipment refresh will continue to support the integrative activities with KBase and the NMDC. New plant transformation research will be conducted to explore techniques to transform a wider variety of plants for genome interrogation and design.	JGI will maintain sequence production capacity to continue to meet the needs of scientific users. JGI will provide users with high quality genome sequences and new analysis techniques for complex plant and microbiome samples. Integrative activities with KBase will continue to provide new cross-platform capabilities for users. Progress on reorganizing JGI's data infrastructure environment will continue as the facility prepares to become a more AI-centric facility for genomic science.	Funding will support continued integrative efforts with KBase to provide new AI/ML analysis capabilities for users. A restructuring of JGI's data portals into a more AI-friendly integrated data infrastructure will continue. These efforts move JGI towards becoming a more AI-centric facility for genomic science and biotechnology innovation.

Note:

- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Description

The Earth and Environmental Systems Sciences subprogram supports fundamental research and scientific user facilities that enable enhanced predictability of dynamically variable environmental and Earth systems, in support of DOE's mission involving transformative science for energy and national security. In FY 2026, all Atmospheric Systems Research and Environmental Systems Sciences activities will be consolidated and funded under the Earth and Environmental Systems Modeling. Research includes improving predictability of variable environmental conditions that influence the design of next generation energy technologies and infrastructure, based on experimental and modeling research on Earth and energy systems. Research includes modeling of the interdependent terrestrial, marine, coastal, cryospheric, and energy components of the Earth system; analysis of energy technologies and infrastructures that are embedded in the Earth system; and uncertainty quantification. This integrated portfolio extends from molecular to regional and global scales and time scales from sub-seasonal to decadal. The research uses the DOE Office of Science (SC) Environmental Molecular Sciences Laboratory (EMSL) user facility to advance basic science through its world-class facilities, multi-modal instrumentation, and scientific leadership that empower and enable researchers to achieve a predictive understanding of complex biological and environmental systems. Modeling activities leverage DOE's exascale leadership computing user facilities and advance with the latest methods in artificial intelligence (AI). The Atmospheric Radiation Measurement (ARM) Office of Science User Facility is closed.

Atmospheric System Research

Atmospheric System Research (ASR) is the primary U.S. research activity advancing the science involving the main source of uncertainty in Earth system models: the interactions and interdependence of cloud, aerosol, precipitation, and radiative transfer processes. Understanding of these processes must be improved for models to inform appropriate deployment of energy systems.

Environmental System Sciences

Environmental System Sciences (ESS) supports research on physical and hydro-biogeochemical processes from the subsurface to the top of the vegetative canopy. ESS combines field research, process modeling, and new multi-scale data sets particularly from regions where energy infrastructures and related sectors are exposed to environmental variabilities and other changes, such as in the Artic, midlatitude boreal zone, urban canopies, rural regions, and coastal watersheds. ESS activities are designed to provide high value science within a next-generation Earth system modeling framework.

Earth and Environmental Systems Modeling

Earth and Environmental Systems Modeling (EESM) develops the physical, biogeochemical, and dynamical science and software capabilities underpinning the design and use of fully coupled Earth System Models (ESMs), that complement and coordinate with other Federal efforts and with a focus on subseasonal (weeks) to decadal timescales. DOE's flagship Energy Exascale Earth System Model (E3SM) is continually being upgraded to apply state-of-the-art AI tools and effectively use DOE's exascale computers. BER invests in data assimilation methodologies, based on field observations, crowd-sourced information, and synthetic data based on AI, to accelerate progress towards new understanding in complex geographic domains relevant to DOE's science, energy, and national security missions.

Earth and Environmental Systems Sciences Facilities and Infrastructure

The Earth and Environmental Systems Sciences Facilities and Infrastructure activity supports data management and the EMSL User Facility. These activities provide the scientific community with data and technical capabilities, scientific expertise, and unique information to facilitate cutting edge science in molecular science areas integral to addressing gaps in understanding and predictive modeling capabilities. EMSL will focus on coupled analyses across multiple analytical capabilities to advance the biological and environmental sciences to uncover the biochemical pathways connecting gene functions to complex biological responses, develop predictive understanding of the mechanistic interplay of physical, biological and environmental processes and

will develop and use AI workflows, laboratory automation, data analytics, visualization and computational modeling. The ARM User Facility is closed.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Earth and Environmental Systems Sciences $369,223	**$87,841**	**-$281,382**
Atmospheric System Research $28,656	$ —	-$28,656
Atmospheric System Research (ASR) completes and closes out most research on clouds, aerosols, and thermodynamic processes, including those with a focus on data from the Atmospheric Radiation Measurement (ARM) facility long-term sites as well as data from the completed TRACER and SAIL campaigns, and the on-going campaigns Cape-K (Cloud and Precipitation Experiment at Kennaook) in Tasmania and CoURAGE (Coast-Urban-Rural Atmospheric Gradient Experiment) in Baltimore, Maryland.	Most ASR research on clouds, aerosols, and thermodynamic processes, analyzing observational datasets is completed except those supporting the modeling activities aligned with administration priorities.	ASR funding will be consolidated under Earth and Environmental Systems Modeling to support the administration's highest priority research.
Environmental System Sciences $82,800	$ —	-$82,800
Environmental System Sciences (ESS) completes most research on permafrost, boreal ecology, and modeling hydrobiogeochemistry of watersheds and terrestrial-aquatic interfaces, with a focus on urban systems and on the coastal zones encompassed by the Delaware and Susquehanna watersheds and the Great Lakes, and Puget Sound.	Most ESS will research on hydro-biogeochemical processes in terrestrial watershed, coastal systems and urban systems is completed except those supporting the modeling activities aligned with administration priorities.	ESS funding will be consolidated under Earth and Environmental Systems Modeling to support the administration's highest priority research.
Earth and Environmental Systems Modeling $109,281	$30,000	-$79,281
Many of the Earth and Environmental Systems Modeling (EESM) are completed. Any Energy Exascale Earth System Model (E3SM) activities involving climate are terminated. EESM focuses on	EESM focuses investments on modeling detailed earth-energy system interactions within regionally refined segments of the E3SM model, achieving hyper-resolution scales and incorporating	Funding will be consolidated under this subprogram to focus on supporting the administration's highest priority research.

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
investments on further refinement of the science serving administration priorities and includes improving underpinning non-hydrostatic adaptive mesh modeling and incorporating the necessary software for deployment of the model onto more advanced exascale computing architectures. E3SM enhances AI capabilities to enable more sophisticated science that demands higher model resolution and greater accuracy. The new E3SM version 3 advances capabilities for exploring the effects of water cycles on watershed and coastal hydrological systems, research involving urban systems and detailed ice-sheet-ocean interactions in polar regions.	state-of-the-art AI techniques as well as the necessary software for deployment of the model onto more advanced exascale computing architectures. New science will be derived from data and new process representations provided from ASR research on cloud-aerosol-precipitation interactions as well as advanced biogeochemical, watershed, and coastal research derived from ESS.	
Earth and Environmental Systems Sciences Facilities and Infrastructure $148,486	$57,841	-$90,645
EMSL emphasizes new science under two efforts: MONet, which obtains standardized soil samples from across the U.S. in a crowdsourced effort to derive microbial genomic/omic data in partnership with the Joint Genome Institute (JGI), and to molecular characterize associated organic matter, and DigiPhen, which uses a variety of EMSL instrumentation to obtain biochemical and genetic information from an initial complement of fungal proteins.	EMSL will undertake regular MONet solicitations for proposals from the scientific community, expand the DigiPhen effort to derive data from fungal proteins from U.S. sites, and initiate first science on phenotyping anerobic microorganisms using a test automation platform.	EMSL economizes by moving user science from small-scale, individual instrument scientific projects to multi-disciplinary scientific projects that use combinations of EMSL's advanced instrumentation, data analytics, and modeling and simulation capabilities through a variety of workflows, which will facilitate complex systems-level understanding relevant to DOE's energy and environmental missions.
The Atmospheric Radiation Measurement (ARM) SC user facility completes ARM mobile facility campaigns and activities at fixed sites in Alaska, Oklahoma, and the Eastern North Atlantic site. ARM conducts remediation of sites and deployments.	ARM campaigns will be completed, and the facility is closed.	ARM campaigns will be completed.

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
The Earth and Environmental Sciences Data Management activity continued support to maintain existing and new critical software and data archives in support of ongoing experimental and modeling research. Essential data archiving and storing protocols, capacity, and provenance are maintained. Advanced analytical methodologies such as AI and Machine Learning are enhanced and used to improve predictability more rapidly using the combination of field observations with Earth system models.	The Earth and Environmental Sciences Data Management activity will continue support to maintain existing and new critical software and data archives in support of ongoing experimental and modeling research.	The Earth and Environmental Sciences Data Management activity will be consolidated under Earth and Environmental Systems Modeling to support the highest priority research proposals.

Note:

- *Funding for the subprogram above includes 3.65 percent of research and development (R&D) funding for the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) Programs, excluding facility operations.*

Description

This subprogram supports line-item construction for the BER program. All Total Estimated Costs (TEC) are funded in this subprogram, including engineering, design, and construction. The FY 2026 Request continues the Microbial Molecular Phenotyping Capability project.

24-SC-31, Microbial Molecular Phenotyping Capability (M2PC), PNNL

The M2PC will be the world's first fully connected end to end phenotyping platform from genetic diversity creation, to culturing, functional testing, and deep analyses of protein and metabolites allowing for autonomous biological experimentation when combined with AI approaches. The M2PC project will design and construct a new capability that will provide a range of 24,500–50,000 gross square feet (GSF) of instrumentation and support spaces conducive for highly autonomous operations, with a target of 34,500 GSF. In addition, the M2PC design will include acquisition of analytical instrumentation and microbial culturing and characterization capabilities that will be modular and expandable, self-contained, and operate in an automated pod configuration. Capabilities will include a suite of 5 to 10 microbial culturing pods, 3 to 5 biological and functional assay pods, and 4 to 5 analytical phenotyping workflow pods. This new capability will position BER to take a global lead in answering the most pressing challenge in biology—generating molecular phenotypic data at a pace that matches the rapid developments in high throughput genome sequencing and synthesis. Applicability of this capability to BER interests in bioproducts, critical elements, nutrient cycling, and other DOE-relevant bioenergy applications, and will create a knowledge ecosystem that would provide data to amplify BER's genome engineering and biosystems design efforts, as well as mechanistic hydro-biogeochemistry modeling capabilities. In the FY 2026 Request, the TEC funding of $10,000,000 will be used to begin construction of the conventional facility, and initiate procurement of the first phase of the high throughput phenotyping equipment.

Activities and Explanation of Changes

(dollars in thousands)

FY 2025 Enacted	FY 2026 Request	Explanation of Changes FY 2026 Request vs FY 2025 Enacted
Construction $19,000	**$10,000**	**-$9,000**
24-SC-31, Microbial Molecular Phenotyping Capability (M2PC), PNNL $19,000	$10,000	-$9,000
Funding supports the M2PC project at PNNL.	Funding will support the M2PC project at PNNL.	Funding will continue to support the M2PC project at PNNL.

Biological and Environmental Research
Capital Summary

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Capital Operating Expenses						
Capital Equipment	N/A	N/A	14,500	3,000	2,071	-929
Minor Construction Activities						
General Plant Projects	N/A	N/A	5,000	–	–	–
Total, Capital Operating Expenses	**N/A**	**N/A**	**19,500**	**3,000**	**2,071**	**-929**

Capital Equipment

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Capital Equipment						
Major Items of Equipment						
Earth and Environmental Systems Sciences						
Atmospheric Radiation Measurement (ARM) Aerial Observation Capability (Air-ARM)	33,186	27,186	6,000	–	–	–
Total, MIEs	N/A	N/A	6,000	–	–	–
Total, Non-MIE Capital Equipment	N/A	N/A	8,500	3,000	2,071	-929
Total, Capital Equipment	**N/A**	**N/A**	**14,500**	**3,000**	**2,071**	**-929**

Note:

- *The Capital Equipment table includes MIEs with a Total Estimated Cost (TEC) > $10M.*

Minor Construction Activities

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
General Plant Projects (GPP)						
GPPs (greater than $5M and $34M or less)						
Project 3 - Relocations (3020EMSL Remodel to Unpack and Relocate), PNNL	5,000	–	5,000	–	–	–
Total GPPs (greater than $5M and $34M or less)	N/A	N/A	5,000	–	–	–
Total, General Plant Projects (GPP)	**N/A**	**N/A**	**5,000**	**–**	**–**	**–**
Total, Minor Construction Activities	**N/A**	**N/A**	**5,000**	**–**	**–**	**–**

Note:

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

Biological and Environmental Research
Construction Projects Summary

(dollars in thousands)

	Total	Prior Years	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
24-SC-31, Microbial Molecular Phenotyping Capability (M2PC), PNNL						
Total Estimated Cost (TEC)	117,000	-	10,000	19,000	10,000	-9,000
Other Project Cost (OPC)	5,000	250	950	-	-	-
Total Project Cost (TPC)	**122,000**	**250**	**10,950**	**19,000**	**10,000**	**-9,000**
Total, Construction						
Total Estimated Cost (TEC)	**N/A**	**N/A**	**10,000**	**19,000**	**10,000**	**-9,000**
Other Project Cost (OPC)	**N/A**	**N/A**	**950**	**-**	**-**	**-**
Total Project Cost (TPC)	**N/A**	**N/A**	**10,950**	**19,000**	**10,000**	**-9,000**

Biological and Environmental Research
Scientific User Facility Operations

The treatment of user facilities is distinguished between two types: TYPE A facilities that offer users resources dependent on a single, large-scale machine; TYPE B facilities that offer users a suite of resources that is not dependent on a single, large-scale machine.

(dollars in thousands)

	FY 2024 Enacted	FY 2024 Current	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Scientific User Facilities - Type B					
Environmental Molecular Sciences Laboratory	**55,250**	**54,973**	**57,729**	**57,841**	**+112**
Number of Users	715	720	753	754	+1
Joint Genome Institute	**92,250**	**91,757**	**95,127**	**93,596**	**-1,531**
Number of Users	2,375	2,456	2,491	2,428	-63
Atmospheric Radiation Measurement User Facility	**81,500**	**81,075**	**83,757**	**–**	**-83,757**
Number of Users	1,215	1,062	1,073	–	-1,073
Total, Facilities	**229,000**	**227,805**	**236,613**	**151,437**	**-85,176**
Number of Users	4,305	4,238	4,317	3,182	-1,135

Note:

- *Percent optimal operations defines what is achieved at this funding level. This includes staffing, up-to-date equipment and software, operations and maintenance, and appropriate investments to maintain world leadership.*

Biological and Environmental Research
Scientific Employment

	FY 2024 Enacted	FY 2025 Enacted	FY 2026 Request	FY 2026 Request vs FY 2025 Enacted
Number of Permanent Ph.Ds (FTEs)	1,795	1,740	795	-945
Number of Postdoctoral Associates (FTEs)	420	405	200	-205
Number of Graduate Students (FTEs)	650	630	305	-325
Number of Other Scientific Employment (FTEs)	415	405	205	-200
Total Scientific Employment (FTEs)	**3,280**	**3,180**	**1,505**	**-1,675**

Note:
- *Other Scientific Employment (FTEs) includes technicians, engineers, computer professionals, and other support staff.*

24-SC-31, Microbial Molecular Phenotyping Capability (M2PC), PNNL
Pacific Northwest National Laboratory, PNNL
Project is for Design and Construction

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

Summary

The FY 2026 Request for the Microbial Molecular Phenotyping Capability (M2PC) project is$10,000,000 of Total Estimated Cost (TEC) funding. The project will design and construct a new research capability that will be broadly available to the scientific community as part of an Office of Science User Facility. DOE approved Critical Decision (CD)-0 on April 28, 2021, and CD-1 on February 15, 2024. The current total project cost (TPC) range is $100,000,000 to $167,000,000. The point estimate TPC for this project is $122,000,000.

Significant Changes

DOE conducted both an Independent Project Review (IPR) and an Independent Cost Review (ICR) of the project in June 2023, as pre-requisites for a CD-1 decision. Through the development of the CD-1 materials and in response to comments from the IPR and ICR reviews, the project scope, schedule, and cost range have been further defined, as reflected in the tables below. The updated project TPC range is $100,000,000 to $167,000,000, and the CD-4 range is FY 2029 to FY 2032. The project achieved CD-1, Approve Alternative Selection and Cost Range on February 15, 2024. The project is pursuing a tailoring strategy to combine CD-2 and CD-3.

FY 2024 funding supported the project's advanced conceptual planning and the refinement of estimates based on initial ideas and plans. In addition, the project developed request for proposal (RFP) documentation for both the high throughput (HTP) capabilities and construction of the facility. The FY 2025 Enacted funding allows the project to solicit vendor proposals for the HTP capabilities and the facility. In addition, the project will refine project artifacts to support an ICR review, in preparation to achieve CD-2/3 approval in early fiscal year 2026. The performance baselines for scope (Key Performance Parameters), schedule, and cost will then be set. The FY 2026 Request will support awards for both the HTP and facility contracts. Design-Build activities for the facility construction will commence and procurement and fabrication of the initial HTP phenotyping equipment components will begin.

Critical Milestone History

Fiscal Year	CD-0	Conceptual Design Complete	CD-1	CD-2	Final Design Complete	CD-3	CD-4
FY 2026	4/28/21	6/30/22	2/15/24	1Q FY 2026	4Q FY 2026	1Q FY 2026	1Q 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

Project Cost History

(dollars in thousands)

Fiscal Year	TEC, Design	TEC, Construction	TEC, Total	OPC, Except D&D	OPC, Total	TPC
FY 2025	29,000	88,000	117,000	5,000	5,000	122,000
FY 2026	29,000	88,000	117,000	5,000	5,000	122,000

2. Project Scope and Justification

Scope

The M2PC project will design and construct a new capability that will provide approximately 34,500 gross square feet (GSF) of instrumentation and support spaces conducive for highly autonomous operations. In addition, the M2PC design will include acquisition of analytical instrumentation and microbial culturing and characterization capabilities that will be modular and expandable, self-contained, and operate in an automated pod configuration. Capabilities will include a suite of 5 to 10 microbial culturing pods, 3 to 5 biological and functional assay pods, and 4 to 5 analytical phenotyping workflow pods.

Justification

Within the Biological and Environmental Research (BER) program, basic research to gain a predictive understanding of biological systems provides the foundation for harnessing and integrating the latest biosystems design techniques with data science and multi-scale modeling approaches. This effort will advance a burgeoning bioeconomy and provide transformative science and technology solutions to enable DOE to meet its energy and environmental challenges. Toward systems-level understanding, BER-supported research has increasingly embraced the integration of multi-omics analyses together with phenotypic characterization of microbial isolates and communities to determine the function of expressed genes and pathways.

While the number of microbial isolates and chassis microbes interrogated is expanding rapidly along with advances in next generation genome sequencing and synthesis, incomplete and constrained genome annotation limits the ability to understand and model the range of activities and functions of individual microbes, engineered microbial consortia with bio-industrial potential or ecological relevance, and microbial communities from natural soil environments. Specifically, there is a significant gap in the ability of the scientific community to identify proteins and biochemical pathways of unknown function in microbes at the single-cell to microbial-community scales, in part because the phenotypes of microbes change rapidly due to environmental factors and perturbations. To address this gap, BER proposes a research capability for a Microbial Molecular Phenotyping Capability that would be broadly available to the scientific community as part of a DOE Office of Science User Facility.

An emphasis on coupled high-throughput autonomous experimental and multimodal analytical capabilities would be the primary components of the instrumentation part of the M2PC. These capabilities would be integrated with, and amplify, existing BER data platforms within the DOE JGI, the NMDC, and the KBase to speed the discovery of new protein functions and metabolic pathways in microbial systems, including fungi, algae, bacteria, protists, archaea, and viruses.

This new capability will position BER to take a global lead in answering the most pressing challenge in biology—generating molecular phenotypic data at a pace that matches the rapid developments in high throughput genome sequencing and synthesis, and it will advance the DOE mission to ensure America's security and prosperity by addressing energy and environmental challenges through transformative science and technology solutions. Applicability of this capability to BER interests in bioproducts, critical elements, nutrient cycling, and other DOE-relevant bioenergy applications, will create a knowledge ecosystem that would provide data to

amplify BER's genome engineering and biosystems design efforts, as well as mechanistic hydro-biogeochemistry modeling capabilities.

The project is being conducted in accordance with DOE's project management requirements.

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 achievement of the Threshold KPPs will be a prerequisite for approval of CD-4, Project Completion. The Objective KPPs represent the desired project performance.

Performance Measure	Threshold	Objective
Demonstrate high-throughput (HTP) Culturing	Capacity to operate with 500 Experiments/Week*	Capacity to operate with 2,000 Experiments/Week*
Demonstrate HTP Microbiome Culturing	Capacity to operate with 100 Microbiome Experiments/Week	Capacity to operate with 500 Microbiome Experiments/Week
Demonstrate HTP Assaying and Phenotyping	Capacity to obtain 1,000,000 Multi-Modal Analytical Measurements/Month	Capacity to obtain 3,000,000 Multi-Modal Analytical Measurements/Month
Remote Capability to Access Operations	Demonstrate that remote users can run pre-defined EMSL protocols to be executed autonomously within M2PC across culturing, assaying, and analyses**	Demonstrate remote users can perform dynamic experimental intervention with help from EMSL staff by modifying an executed protocol during the experimental timeframe**
Total Building Size (GSF)	24,500 sq. ft.	50,000 sq. ft.
*A microbiome start is an experiment consisting of a mix of 2-8 microbial species cultured under a defined set of conditions. **Protocol settings will have built-in acceptable safe operating ranges for selection within established instrument specifications from vendors, EMSL protocol best-practices, and PNNL EH&S safe research operating windows.		

3. Financial Schedule

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
Design (TEC)			
FY 2024	10,000	10,000	10,000
FY 2025	19,000	19,000	19,000
Total, Design (TEC)	**29,000**	**29,000**	**29,000**
Construction (TEC)			
FY 2026	10,000	10,000	10,000
Outyears	78,000	73,875	78,000
Total, Construction (TEC)	**88,000**	**83,875**	**88,000**
Total Estimated Cost (TEC)			

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Estimated Cost (TEC)			
FY 2024	10,000	10,000	10,000
FY 2025	19,000	19,000	19,000
FY 2026	10,000	10,000	10,000
Outyears	78,000	73,875	78,000
Total, Total Estimated Cost (TEC)	**117,000**	**112,875**	**117,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Other Project Cost (OPC)			
Prior Years	250	250	250
FY 2024	950	950	950
Outyears	3,800	3,800	3,800
Total, Other Project Cost (OPC)	**5,000**	**5,000**	**5,000**

(dollars in thousands)

	Budget Authority (Appropriations)	Obligations	Costs
Total Project Cost (TPC)			
Prior Years	250	250	250
FY 2024	10,950	10,950	10,950
FY 2025	19,000	19,000	19,000
FY 2026	10,000	10,000	10,000
Outyears	81,800	77,675	81,800
Total, TPC	**122,000**	**117,875**	**122,000**

4. Details of Project Cost Estimate

(dollars in thousands)

	Current Total Estimate	Previous Total Estimate	Original Validated Baseline
Total Estimated Cost (TEC)			
Design	N/A	20,500	N/A
Design - Contingency	N/A	8,500	N/A
Total, Design (TEC)	**N/A**	**29,000**	**N/A**
Construction	N/A	66,000	N/A
Construction - Contingency	N/A	22,000	N/A
Total, Construction (TEC)	**N/A**	**88,000**	**N/A**
Total, TEC	**N/A**	**117,000**	**N/A**
Contingency, TEC	***N/A***	*30,500*	***N/A***
Other Project Cost (OPC)			
OPC, Except D&D	N/A	3,900	N/A
Conceptual Design	N/A	1,100	N/A
Total, Except D&D (OPC)	**N/A**	**5,000**	**N/A**
Total, OPC	**N/A**	**5,000**	**N/A**
Contingency, OPC	***N/A***	*N/A*	***N/A***
Total, TPC	**N/A**	**122,000**	**N/A**
Total, Contingency (TEC+OPC)	***N/A***	***30,500***	***N/A***

5. Schedule of Appropriations Requests

(dollars in thousands)

Fiscal Year	Type	Prior Years	FY 2024	FY 2025	FY 2026	Outyears	Total
FY 2025	TEC	—	10,000	19,000	—	88,000	117,000
	OPC	250	950	—	—	3,800	5,000
	TPC	250	10,950	19,000	—	91,800	122,000
FY 2026	TEC	—	10,000	19,000	10,000	78,000	117,000
	OPC	250	950	—	—	3,800	5,000
	TPC	250	10,950	19,000	10,000	81,800	122,000

6. Related Operations and Maintenance Funding Requirements

Start of Operation or Beneficial Occupancy	1Q FY 2032
Expected Useful Life	50 years
Expected Future Start of D&D of this capital asset	1Q 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	223	N/A	11,150
Utilities	N/A	145	N/A	7,250
Maintenance and Repair	N/A	331	N/A	16,550
Total, Operations and Maintenance	N/A	699	N/A	34,950

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 PNNL	34,500
Area of D&D in this project at PNNL	—
Area at PNNL to be transferred, sold, and/or D&D outside the project, including area previously "banked"	—
Area of D&D in this project at other sites	—
Area at other sites to be transferred, sold, and/or D&D outside the project, including area previously "banked"	—
Total area eliminated	—

8. Acquisition Approach

The Acquisition Strategy for the M2PC project was reviewed and approved as part of CD-1. It will include two major acquisitions: the research equipment vendor and facility contract. Both acquisitions will be best value source selections. The research equipment vendor will provide a turn-key solution (design, procurement, installation, fabrication, assembly, testing, KPP verification, training, etc.) for the high-throughput microbial molecular phenotyping capability needed to meet the research-related KPPs. PNNL will procure the facility via a design-build strategy. It will house and provide utilities to operate the research equipment and will meet the facility space KPP. PNNL will competitively bid and award all necessary subcontracts based on best value to the government. SC will evaluate the M&O contractor's performance through the annual laboratory performance appraisal process.

SC and the M&O will draw from lessons learned from other SC projects and other similar facilities in planning and executing the M2PC project.