



U.S. DEPARTMENT
of **ENERGY**

Office of
Science

Early Career Research Program (ECRP)

Notice of Funding Opportunity (NOFO) Number:
DE-FOA-0003602

NOFO Type: Initial
Assistance Listing: 81.049

NOFO Issue Date:	March 3, 2026
Submission Deadline for Pre-Applications:	March 24, 2026, at 5:00 PM ET A Pre-Application is required. Pre-Applications must be submitted by an authorized institutional representative.
Pre-Application Response Date:	April 21, 2026, at 5:00 PM ET
Submission Deadline for Applications:	June 2, 2026, at 11:59 PM ET

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I. Basic Information

U.S. Department of Energy (DOE)
Office of Science (SC)

Executive Summary

DOE SC hereby invites applications for support under the ECRP in the following program areas: Advanced Scientific Computing Research (ASCR); Basic Energy Sciences (BES); Biological and Environmental Research (BER); Fusion Energy Sciences (FES); High Energy Physics (HEP); Nuclear Physics (NP); Isotope Research and Development and Production (DOE IP). The purpose of this program is to support the development of individual research programs of outstanding scientists early in their careers and to stimulate research careers in the areas supported by SC.

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

SC accomplishes its mission and advances national goals by supporting:

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

Funding Details

Expected total available funding	\$145 million total, including \$79 million in FY 2026 funding and \$66 million in outyear funding, subject to the availability of future year appropriations
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Expected number of awards	100
Expected total dollar amount of individual awards ¹	\$875,000 for an Institution of Higher Education \$2,750,000 for a DOE/NNSA National Laboratory \$2,750,000 for an SC Scientific User Facility
Expected award project period	5 years

Key Facts

NOFO Title	Early Career Research Program (ECRP)
NOFO Number	DE-FOA-0003602
Announcement Type	Initial
Assistance Listing	81.049
Statutory Authority	The programmatic authorizing statutes are: Section 646 of Public Law 95-91, U.S. Department of Energy Organization Act Section 901, et seq. of Public Law 109-58, Energy Policy Act of 2005
Governing Regulations	Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 CFR 200 U.S. Department of Energy Financial Assistance Rules, codified at 2 CFR 910 U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR 605

Key Dates

Key dates are printed on the cover of this NOFO.

Agency Contact Information

Grants.gov Customer Support	800-518-4726 (toll-free) support@Grants.gov
PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 sc.pams-helpdesk@science.doe.gov
Technical/Scientific Program Contact	Questions regarding the specific program areas/technical requirements can be directed to the program managers/technical contacts listed for each program within the NOFO.
Administrative Contact (questions about budgets and eligibility)	SC.Early@science.doe.gov

Recommendation

SC encourages you to register in all systems as soon as possible. You are also encouraged to submit pre-applications and applications well before the deadline.

II. Eligibility

A. Eligible Applicants

In accordance with 2 CFR 910.126, Competition, eligibility for award is restricted to U.S. Institutions of Higher Education, DOE/NNSA National Laboratories (listed at <https://www.energy.gov/national-laboratories>), and institutions operating SC Scientific User Facilities (listed at <https://science.osti.gov/User-Facilities>).

This eligibility restriction is intended to create an opportunity for scientists who are (a) early in their careers, (b) in positions with sufficient permanence to support independent research efforts, and (c) for investigators not at DOE-affiliated institutions, in positions that require working with the students who will become the scientific workforce of the future.

1. DOE/NNSA National Laboratories

DOE/NNSA National Laboratories are eligible to submit applications under this NOFO. If recommended for funding as a lead applicant, funding will be provided through the DOE Field-Work Proposal System and work will be conducted under the laboratory's contract with DOE. If recommended for funding as a proposed subawardee, the value of the proposed subaward will be removed from the prime applicant's award and will be provided to the laboratory through the DOE Field-Work Proposal System. No administrative provisions of this NOFO will apply to the laboratory or any laboratory subcontractor. Additional instructions for securing authorization from the cognizant Contracting Officer are found in [Section IX](#) of this NOFO.

Submission of a pre-application (in PAMS) or an application (in Grants.gov) by an authorized institutional representative is a confirmation that the proposed research idea fits within the scope of SC-funded programs at the national laboratory. Proposing research that falls within this category ensures that investigators have the opportunity to belong to or join, at the laboratory's discretion, funded research groups. Applications from DOE National Laboratories should not: (a) attempt to revive previously terminated research areas within the laboratory, or (b) topically isolate investigators.

Investigators funded under this program are encouraged to charge at least 50% of their time to the award, allowing time to develop or maintain funded collaborations within the lab over the course of the award. Amounts less than 50% should be as close to 50% as possible. Making sure that investigators have potential connections with SC funded programs encourages the laboratory to actively plan to address funding transition issues that may arise when an award ends.

Eligibility exemptions will not be granted.

2. SC Scientific User Facilities not at a DOE/NNSA National Laboratory

Institutions operating SC Scientific User Facilities are eligible to submit applications under this NOFO. If recommended for funding as a lead applicant, funding will be provided as a financial assistance award to the non-Governmental entity operating the User Facility.

Submission of a pre-application (in PAMS) or an application (in Grants.gov) by an authorized institutional representative is a confirmation that the proposed research idea fits within the scope of SC-funded programs at the User Facility. Proposing research that falls within this category ensures that investigators have the opportunity to belong to or join, at the facility's discretion, funded research groups. Applications from SC Scientific User Facilities should not (a) attempt to revive previously terminated research areas within the facility or (b) topically isolate investigators.

Investigators funded under this program are encouraged to charge at least 50% of their time to the award, allowing time to develop or maintain funded collaborations within the facility over the course of the award. Amounts less than 50% should be as close to 50% as possible. Making sure that investigators have potential connections with SC funded programs encourages the facility to actively plan to address funding transition issues that may arise when an award ends.

Eligibility exemptions will not be granted.

3. Non-DOE/NNSA FFRDCs

Non-DOE/NNSA FFRDCs are neither eligible to submit applications under this NOFO nor to be proposed as subrecipients under another organization's application.

4. Other Federal Agencies

Other Federal Agencies are neither eligible to submit applications under this NOFO nor to be proposed as subrecipients under another organization's application.

Notes for applicants of all types:

Eligibility is restricted to the above entities due to the requirement for an applicant institution to have already made a career commitment to individuals as exemplified by putting them on the tenure track or in a permanent position at a national laboratory or an SC Scientific User Facility. Non-tenure-track positions and fellowships lack the expected permanence required by the ECRP. Outside of DOE/NNSA National Laboratories and SC Scientific User Facilities, tenure track faculty positions at academic institutions involve a long-standing growth and evaluation process committed to by the institution. Achieving

tenure is a uniquely academic pursuit: No equivalent positions exist in industry or non-profit organizations.

This NOFO seeks to support basic research to advance understanding rather than to address commercial opportunities. Applications that propose research related to current commercial activity or current customer needs may be declined without merit review.

B. Cost Sharing

Cost sharing for basic and fundamental research is not required pursuant to an exclusion from the requirements of Section 988 of the Energy Policy Act of 2005.

Cost sharing is not required of DOE/NNSA National Laboratories or their subcontractors at any tier. DOE/NNSA National Laboratories may impose cost-sharing requirements on their contractors subject to their policies and procedures.

Cost sharing will not be considered as a factor during merit review or award selection.

C. Eligible Individuals

Individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Principal Investigator (PI) are invited to work with their organizations to develop an application.

SC does not require that individuals be U.S. citizens or permanent residents to be proposed as a PI or in any other role under an award, but all personnel working or proposed to work under an award must have the legal right to perform such work in the jurisdiction where the work will be performed.

Awards under the Early Career Research Program must be under the sole and indivisible leadership of the PI. Other senior or key personnel may be proposed provided their efforts in the research are clearly and unambiguously under the direction and supervision of the PI. Other senior or key personnel must commit less time and effort and request less support than the PI. SC's intent is to support the PI's development of an independent research career. The presence of a co-PI – or substantial support for other senior or key personnel – is incompatible with this intent. There can be no co-PIs. Applications including co-PIs may be declined without review. A Co-PI is an individual designated by the applicant as sharing, or being delegated, a significant aspect of the PI's authority and responsibility for the proposed project as a whole. Not all PIs on subawards or collaborative proposal submissions are necessarily co-PIs on the project as a whole.

PIs who have received awards previously under the SC ECRP are not eligible. PIs of early career awards funded by other agencies or entities are eligible, but the proposed research must have a scope different from that already funded by the other organization.

No more than 10 years can have passed between the year the PI's Ph.D. was awarded and the calendar year at the start of the Federal fiscal year in which this NOFO is released. For the present competition, those who received doctorates on or after January 1, 2015, are eligible. If a PI has multiple doctorates, the discipline of the one they have earned within the 10-year eligibility window must be relevant to the proposed research.

Extensions to eligibility due to major life events (three months or longer) must be validated by a letter from the university dean, research vice president, laboratory division director, or equivalent official. The letter must be included in the pre-application.

PIs from Institutions of Higher Education, DOE/NNSA National Laboratories, and SC Scientific User Facilities must adhere to the respective eligibility standards below.

The eligibility requirements improve the quality of applications submitted and encourage those who are strong candidates to submit applications to the program.

1. PIs from Institution of Higher Education

The PI must be an untenured Assistant Professor on the tenure track or an untenured Associate Professor on the tenure track at a U.S. academic institution where the application is originating from and as of the deadline for the application. The PI must be employed in the eligible position as of the closing date for this NOFO. If a PI has multiple doctorates, the discipline of the one they have earned within the 10-year eligibility window should be relevant to the proposed research.

2. PIs from DOE/NNSA National Laboratories

The PI must be a full-time, permanent, non-postdoctoral national laboratory employee as of the deadline for the application. If a PI has multiple doctorates, the discipline of the one they have earned within the 10-year eligibility window should be relevant to the proposed research.

3. PIs from SC Scientific User Facilities not at a DOE/NNSA National Laboratory

The PI must be a full-time, permanent, non-postdoctoral user facility employee as of the deadline for the application. If a PI has multiple doctorates, the discipline of the one they have earned within the 10-year eligibility window should be relevant to the proposed research.

D. Limitations on Submissions

While there is no limit on the number of pre-applications from a DOE/NNSA National Laboratory or an SC Scientific User Facility in a given year, each laboratory or user facility is responsible for ensuring that the research ideas submitted in its pre-applications fit within the scope of SC-funded programs at the national laboratory or the user facility.

LIMITATIONS ON PI

Only one pre-application on behalf of a PI may be submitted in any given SC ECRP competition. A PI may not submit an application in more than three SC ECRP competitions. Participation in the competition is defined as submission of a full application that completed the review/decision process. In rare cases, it is necessary to withdraw an application; an application withdrawn prior to it being officially declined will not count as a submission. Likewise, an application declined without merit review by the DOE SC will not count as a submission.

III. Program Description

A. Purpose

The DOE SC hereby invites applications for support under the ECRP in the following program areas: Advanced Scientific Computing Research (ASCR); Basic Energy Sciences (BES); Biological and Environmental Research (BER); Fusion Energy Sciences (FES); High Energy Physics (HEP); Nuclear Physics (NP); Isotope Research and Development and Production (DOE IP). The purpose of this program is to support the development of individual research programs of outstanding scientists early in their careers and to stimulate research careers in the areas supported by SC.

B. Program Goals, Objectives, and Priorities

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

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

SC is an established leader of the U.S. scientific discovery and innovation enterprise. Over the decades, SC investments and accomplishments in basic research and enabling research capabilities have provided the foundations for new technologies, businesses, and industries, making significant contributions to our nation's economy, national security, and quality of life.

ECRP opportunities exist in the following SC research programs. Additional details about each program, websites, and technical points of contact are provided in the materials that follow.

Advanced Scientific Computing Research (ASCR)

- (1) Extreme-Scale Applied Mathematics for Scientific Computing
- (2) Scalable Scientific Artificial Intelligence and Automation
- (3) Quantum Computing and Networking

Basic Energy Sciences (BES)

- (1) Materials Chemistry
- (2) Biomolecular Materials
- (3) Synthesis and Processing Science
- (4) Experimental Condensed Matter Physics
- (5) Theoretical Condensed Matter Physics
- (6) Physical Behavior of Materials
- (7) Mechanical Behavior and Radiation Effects
- (8) Quantum Information Science in Materials Sciences and Engineering (QIS-MSE)
- (9) X-ray Scattering
- (10) Neutron Scattering
- (11) Electron and Scanning Probe Microscopies
- (12) Atomic, Molecular, and Optical Sciences (AMOS)
- (13) Gas Phase Chemical Physics (GPCP)
- (14) Computational and Theoretical Chemistry
- (15) Condensed Phase and Interfacial Molecular Science (CPIMS)
- (16) Quantum Information Science Research in Chemical Sciences, Geosciences, and Biosciences (QIS-CSGB)
- (17) Catalysis Science
- (18) Separation Science (SEP)
- (19) Heavy Element Chemistry (HEC)
- (20) Geosciences (GEO)
- (21) Photochemistry and Radiation Chemistry
- (22) Photosynthetic Systems
- (23) Physical Biosciences
- (24) Accelerator and Detector Research
- (25) Instrumentation and Technique Development for BES User Facilities

Biological and Environmental Research (BER)

- (1) Systems Biology Research to Advance Bioenergy Crop Production
- (2) Energy, Land, and Human Interdependencies in Coastal-Urban or Coastal-Rural Systems within Earth and Environmental Systems Modeling (EESM)

Fusion Energy Sciences (FES)

- (1) Toroidal Long Pulse: Tokamak and Stellarator Research
- (2) Compact Toroidal Concepts Research
- (3) Magnetic Fusion Energy Science Theory and Simulation

- [\(4\) General Plasma Science Experiment and Theory](#)
- [\(5\) Fusion Nuclear Science](#)
- [\(6\) Materials Research for Fusion](#)
- [\(7\) Artificial Intelligence and Machine Learning for Fusion Energy Sciences](#)

[High Energy Physics \(HEP\)](#)

- [\(1\) Experimental Research at the Energy Frontier in High Energy Physics](#)
- [\(2\) Experimental Research at the Intensity Frontier in High Energy Physics](#)
- [\(3\) Experimental Research at the Cosmic Frontier in High Energy Physics](#)
- [\(4\) Theoretical Research in High Energy Physics](#)
- [\(5\) Accelerator Science and Technology Research & Development in High Energy Physics](#)
- [\(6\) Instrumentation and Detector R&D in High Energy Physics](#)
- [\(7\) Computational Research in High Energy Physics](#)
- [\(8\) Quantum Information Science in High Energy Physics \(HEP-QIS\)](#)
- [\(9\) Accelerator Stewardship and Accelerator Production](#)

[Nuclear Physics \(NP\)](#)

- [\(1\) Medium Energy Nuclear Physics](#)
- [\(2\) Heavy Ion Nuclear Physics](#)
- [\(3\) Nuclear Structure and Nuclear Astrophysics](#)
- [\(4\) Fundamental Symmetries](#)
- [\(5\) Nuclear Theory](#)
- [\(6\) Nuclear Theory Computing](#)
- [\(7\) Nuclear Data](#)
- [\(8\) Accelerator Research and Development for NP Facilities](#)
- [\(9\) Quantum Information Science for Nuclear Physics Research](#)

[Isotope R&D and Production \(DOE IP\)](#)

- [\(1\) Targetry and Isotope Production Research](#)
- [\(2\) Nuclear and Radiochemical Separation, Purification, and Radiochemical Synthesis](#)
- [\(3\) Biological Tracers, Imaging and Therapeutics](#)

Advanced Scientific Computing Research (ASCR)

Program Website: <https://www.energy.gov/science/ascr/advanced-scientific-computing-research> or <https://science.osti.gov/ascr>

The Advanced Scientific Computing Research (ASCR) program supports research in applied mathematics, computer science and networking, and artificial intelligence, including leveraging the latest quantum computing and networking approaches; delivers the most advanced computational scientific applications in partnership with disciplinary science; advances computing and networking capabilities; and develops future generations of computing hardware and tools for science, in partnership with the research community and U.S. industry. The program supports the development, maintenance, and operation of first-of-a-kind large-scale high-performance computing, network and data scientific user

facilities, including the Leadership Computing Facilities at Oak Ridge and Argonne National Laboratories, the National Energy Research Scientific Computing Center at Lawrence Berkeley National Laboratory, and the Energy Sciences Network; and future computing and networking technology testbeds for artificial intelligence, quantum, analog, and other computing.

Proposed research under ASCR for the ECRP must be responsive to one of the specific topic areas below. Pre-applications must clearly articulate the main scientific motivations and barriers to progress, the technical basis for overcoming those barriers, and the key insights or novel approaches for addressing the scientific and technical challenges.

The specific topic areas of interest are:

(1) Extreme-Scale Applied Mathematics for Scientific Computing

Technical Contact: David Rabson, david.rabson@science.doe.gov

The scientific computing research community faces a broad array of challenges in the development of high-performance algorithms and solvers for emerging computing architectures. Because algorithms, solvers, and decision support methods can dominate the overall execution time of computational and data science applications, research in developing efficient, robust, resilient, and portable techniques is essential for scientific advances over the next decade.

Research areas of interest include novel approaches for addressing grand challenges:

1. High computational and communication complexity and the development of efficient algorithms;
2. Better algorithm scalability for high-performance computing;
3. Reduced ill-conditioning and sensitivity for inverse problems; and
4. Improved algorithm reliability and robustness to noise on future architectures where extreme parallelism, data placement and movement, resilience, and extreme heterogeneity may be significant considerations.

Recent ASCR workshop reports on “Randomized Algorithms for Scientific Computing” [1] and “Inverse Methods for Complex Systems under Uncertainty” [2] describe some of the kinds of algorithms and research directions that are in scope for this topic area.

Pre-applications that are out of scope for sub-topic (1) include

- Research that does not address one or more of the four grand challenges described above;
- Research that does not address creating a body of knowledge and understanding that will inform future advances in extreme-scale science;
- Proposed research that does not clearly articulate the main scientific motivations and barriers to progress, the technical basis for overcoming those barriers, and the key insights or novel approaches for addressing the scientific and technical challenges; and

- Research in cryptography algorithms.
- Research into AI or its scientific applications, which should be submitted instead under topic (2) below;
- Research into quantum computing, quantum networking, or their applications in science, which should instead be submitted under topic (3) below.

References:

1. A. Buluc et al., Randomized Algorithms for Scientific Computing (2021), <https://doi.org/10.2172/1807223>.
2. J. Donatelli et al., Basic Research Needs for Inverse Methods of Complex Systems under Uncertainty (2025), <https://doi.org/10.2172/2583339>.

(2) Scalable Scientific Artificial Intelligence and Automation

Technical Contact: Ravinder Kapoor, Ravinder.Kapoor@science.doe.gov

This topic focuses on the research and development of scientific artificial intelligence (AI) in two different scenarios: models and analysis 1) for large-scale distributed data sets that occur without moving the data (static), and 2) in real-time, streaming environments (dynamic). As the scientific process is increasingly accelerated by AI, scientific AI innovation is needed not only on HPC systems but also at the edge and in automated systems; and digital twins of scientific edge systems, instrumentation, and even entire laboratories might play an important role in enabling future AI development. The design, build, and training of physical AI systems for advancing and accelerating scientific discovery introduces a new era of AI/ML. The topic encompasses

- The rigorous mathematical and computationally efficient approaches are needed for analyzing and extracting information and insight from large-scale data relevant to the DOE missions (see PRD #4 from the Scientific Machine Learning workshop [2]);
- Hardware/software co-design, which is a method for designing and/or adapting both hardware and software design as part of a holistic process, for efficiently executing scientific AI algorithms; and
- Advancing the science of autonomous and semi-autonomous robotic systems tightly integrated with advanced AI/ML, high-performance computing (HPC), and real-time sensor data fusion to accelerate scientific discovery.

Research areas that are out of scope for this topic include:

- Approaches that apply scientific AI to a new application, rather than advancing fundamental aspects of scientific AI and/or automation.
- Biomedical, agricultural, warehouse, or consumer robotics use-cases unrelated to DOE missions.
- Hardware refresh, commercial deployment, or routine engineering lacking new scientific insight.
- Pure teleoperation without a pathway to scalable autonomy.

- Work whose main deliverable is a product or service rather than fundamental knowledge.
- Cyber-physical security or facility-management projects without experiment-centric autonomy goals.
- Research into quantum computing, quantum networking, or their applications in science, which should instead be submitted under topic (3) below.

References:

1. Basic Research Needs for Scientific Machine Learning: Core Technologies for Artificial Intelligence, <https://www.osti.gov/servlets/purl/1478744/>
2. Report for the 2022 Workshop Series “Advanced Research Directions on AI for Science, Energy and Security,” <https://www.anl.gov/sites/www/files/2023-06/AI4SESReport-2023-v6.pdf>
3. James Ahrens, Amber Boehnlein, Rich Carlson, Joshua Elliot, Kjersten Fagnan, Nicola Ferrier, Ian Foster, Lee Gimpel, John Shalf, Dan Ratner. “Envisioning Science in 2050”. United States Department of Energy, Advanced Scientific Computing Research, 2022. doi:10.2172/1871683 (<https://www.osti.gov/servlets/purl/1871683>)
4. ASCR Integrated Research Infrastructure Task Force. Toward a Seamless Integration of Computing, Experimental, and Observational Science Facilities: A Blueprint to Accelerate Discovery. USDOE Office of Science (SC), Washington, DC (United States). Advanced Scientific Computing Research (ASCR), 2021. (<https://www.osti.gov/servlets/purl/1863562>)

(3) Quantum Computing and Networking

Technical Contact: Marco Fornari, Marco.Fornari@science.doe.gov, Pavel Lougovski, Pavel.Lougovski@science.doe.gov

This topic involves innovative research in the area of quantum technologies --computing or/and networking-- that integrate computer science and applied mathematics concepts to address obstacles hindering the demonstration of quantum utility and the application of quantum technology to advance the DOE and ASCR mission. Possible areas include the development of modules of end-to-end software toolchains aimed to program and control quantum computing systems at scale, or/and the understanding of utility and new applications of quantum networking concepts, systems, and protocols. Research should be backed by rigorous theory and should delineate a path to success with clear metric and milestones. Engagement with quantum computing and quantum networking ASCR testbeds is encouraged.

Topics that are out of scope include:

- Pre-applications and applications that do not address the specific topics described above,
- Development of new candidate physical qubit systems and improvements to physical qubits,
- Quantum key distribution,

- Cryptography and cryptanalysis,
- Projects that are duplicative of or competitive with industry.

References:

1. “Report for the ASCR Workshop on Basic Research Needs in Quantum Computing and Networking,” <https://doi.org/10.2172/2001045>, July 2023.

Basic Energy Sciences (BES)

Program Website: <https://www.energy.gov/science/bes/basic-energy-sciences> or <https://science.osti.gov/bes/>

BES’s mission is to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels in order to provide the foundations for new energy technologies and to support DOE missions in energy, environment, and national security. The portfolio supports work in the natural sciences by emphasizing fundamental research in materials sciences, chemistry, geosciences, and biosciences. BES- supported scientific facilities provide specialized instrumentation and expertise that enable scientists to carry out experiments not possible at individual laboratories.

More detailed information about BES sponsored research can be found at the BES website listed above. There you will find BES-sponsored workshop reports that address the current status and possible future directions of some important research areas. Also, PI Meetings Reports contain abstracts of recent BES-supported research in each topical area. Finally, the websites of individual BES Divisions may also be helpful.

The following web pages are listed for convenience:

- a. BES Workshop Reports: <https://science.osti.gov/bes/community-resources/reports/>
- b. Materials Sciences and Engineering Division PI Meetings: <https://science.osti.gov/bes/mse/principal-investigators-meetings/>
- c. Chemical Sciences, Geosciences, & Biosciences Division PI Meetings: <https://science.osti.gov/bes/csgb/principal-investigators-meetings/>
- d. Scientific User Facilities Division web page: <https://science.osti.gov/bes/suf/>

Proposed research must be responsive to a supported topic in one of the core research areas listed below. Many of the core research areas limit early career Applications to a subset of topics within their regular research activities. In those cases, the intention is to rotate topics on an annual basis.

(1) Materials Chemistry

Technical Contact: Christopher Chervin, Christopher.Chervin@science.doe.gov (Select Christopher Chervin in PAMS) and Craig Henderson, Craig.Henderson@science.doe.gov

This program supports scientific research on materials with a focus on the *chemical synthesis, chemical control, and chemical dynamics* of composition and structure and a view to elucidating chemical aspects of materials' structure-property relationships and resulting functionality. The major programmatic focus is on the discovery, design and synthesis of novel, energy-relevant materials that span length scales beyond molecular, from which the consequent materials properties and functionalities emerge. The desired outcome is fundamental knowledge of the chemistry of materials, which may be widely applied to the development of next-generation materials to provide the foundations for new energy technologies.

Applications MUST pose scientific questions and propose hypothesis-driven research leading to scientific understanding of chemical phenomena observed to play a role in the synthesis, function, or degradation of energy-relevant materials. Applications will be evaluated based on their ability to formulate and address 'why' questions related to materials chemistry phenomena, prioritizing causal explanations over correlative observations. Further, to be considered for this year's ECRP, applications must propose basic research in one of these three (3) topical areas:

- Applied Materials Theory – New theoretical approaches to predict chemistry-related materials synthesis, properties, and/or functionality
- Materials Chemistry Dynamics – Understand the evolution and control of the composition, structure, and/or chemistry-related properties of materials in operating environments
- Chemical Synthetic Methodology – New synthetic methodology for energy-relevant materials that transform materials synthesis beyond incremental improvements of established methods.

For any of these topics, applications that propose materials chemistry research aimed primarily at electrochemical energy storage technologies, including ion transport properties of soft matter, will not be supported this year. The Materials Chemistry program does NOT support research on heterogeneous catalysis or otherwise on the molecular-scale mechanism of electrocatalysis. Additionally, the Materials Chemistry program does NOT support applications aimed primarily at improvement, optimization, or tuning of material properties for any application or as the basis for generating predictive design rules. For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at that laboratory.

(2) Biomolecular Materials

Technical Contact: Aura Gimm, Aura.Gimm@science.doe.gov

This activity supports fundamental materials science research in the discovery, design and synthesis of functional synthetic materials and complex structures based on principles and concepts of biology. Biology provides a blueprint for translating atomic and nanoscale phenomena into mesoscale materials that display complex yet well-coordinated collective

behavior. The major programmatic direction is on the science-driven creation of resilient materials and multiscale systems that exhibit well-coordinated functionality and information content approaching that of biological materials but capable of functioning under harsher, non-biological environments.

Biomolecular Materials research activity seeks innovative fundamental science approaches for co-design and scalable synthesis of materials that coherently and actively manage multiple complex, and simultaneous functions and tolerate abuse through autonomous repair and regrowth. New synthesis approaches and unconventional assembly pathways are sought to accelerate discovery/design of materials with transformative impacts on advanced manufacturing, and energy transfer and storage technologies. An area of emphasis will be activities to understand and control assembly mechanisms to seamlessly integrate capabilities developed over one length scale across multiple length scales as the material is constructed. Included is the development of predictive models and AI/ML for data-driven science that accelerate materials discovery and support fundamental science to direct energy efficient scalable synthesis with real-time adaptive control. Applications **MUST** propose hypothesis-driven research with clear connections to biological principles.

Two separate topics (A and B shown below) are planned for alternate fiscal years in pursuit of these goals. Science-driven coupling of theory and experiment to achieve Topic objectives are encouraged. For this announcement, only applications focused on Topic B will be considered.

- Topic A (Alternate years): The specific focus will be on fundamental materials science underpinning design of next-generation materials and systems that incorporate low-energy mechanisms found in biology for electrical and thermal energy transformation and/or ion transport with programmable selectivity based on biophysical gating.
- Topic B (This year): The focus will be on control of fundamental mechanisms for precise synthesis and assembly, including self-replication approaches for multiscale materials and systems that self-regulate structure repair, based on biological principles. Hierarchical materials assembly strategies and effective temporal/spatial control of biomolecular building blocks will be emphasized.

For both topics, bio-centric research will not be supported, including activities focused on understanding underlying biological mechanisms, creation of bio-hybrid materials, or use of living cells as materials or as molecular factory. The program will not support projects that lack a clear focus on fundamental materials science or are aimed at optimization of materials properties for any applications including device fabrication, sensor development, or tissue engineering. The program will not support biological or biomedical research.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(3) Synthesis and Processing Science

Technical Contact: Shawn Chen, shawn.chen@science.doe.gov

This program supports basic scientific research on materials to understand the physical principles that underpin materials synthesis and processing including diffusion, nucleation, and phase transitions and diagrams, often using *in situ* diagnostics and new techniques. An important element of this activity is the use of real-time monitoring tools that probe the dynamic environment and the progression of structure and properties as a material is formed. This information is essential to the physical understanding of the underlying mechanisms that help gain atomic level control in materials synthesis and processing. Recent BES Basic Research Needs (and other) workshops and reports, particularly the reports on [Synthesis Science](#) and [Transformative Manufacturing](#), have identified the needs and challenges in the science of synthesis and processing that are relevant to energy materials and technologies.

For this year's ECRP, proposed research must focus on hypothesis driven research that pursues new fundamental understanding and creative approaches that underpin the scientific foundation for the science of synthesis and processing. This year, applications must focus on the prediction of phase diagrams and the ability to change such phase spaces in real-time via applied external fields for metastable energy relevant materials. Additionally, applications in this program are encouraged to include complementary in-situ characterization and modeling techniques to achieve a detailed understanding of the onset of crystal growth, with the potential to expand fundamental nucleation and growth theory for multicomponent materials. The focus of the research should be on materials discovery and design by physical means, which is complementary to the BES Materials Chemistry and Biomolecular Materials research activities, where chemical and bio-inspired approaches are emphasized.

Applications focusing on the following areas will not be supported this year:

- Remote epitaxy or van der Waals epitaxy.
- 2D Membranes.
- Wafer scale deposition.

Additionally, the program does not support applications that involve biological materials or applications aimed at optimization of material properties for specific applications. The program will not support applications with a primary goal of engineering development, device fabrication, nanoparticle synthesis, tribology, fluid dynamics, or projects using advanced manufacturing techniques without emphasizing the potential advances in fundamental science.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(4) Experimental Condensed Matter Physics

Technical Contact: Claudia Cantoni, claudia.cantoni@science.doe.gov

The Experimental Condensed Matter Physics (ECMP) program supports research that will advance our fundamental understanding of the relationships between intrinsic electronic structure and the properties of complex materials.

This year the Early Career NOFO in ECMP will focus on quantum materials in the form of low-dimensional systems like 2D materials and heterostructures, wherein fundamental electronic, lattice, spin, and valley degree of freedom are investigated and controlled to add functionality. Examples of material forms of interest are deposited or exfoliated monolayers, heterostructures comprising few-layer systems, nanowires, nanodots, and their combination with 2D structures. Systems requiring the use of a bulk substrate for deposition or assembly but addressing 2D physics are considered responsive.

To be considered responsive, applications must propose fundamental research in one of the following topics:

1. emergent fractional quasiparticles as realized in topological superconductors, fractional Chern insulators, and chiral spin liquid candidates;
2. flat band systems and unconventional superconductivity;
3. hybrid quasiparticles for energy transfer and transduction;
4. 2D topological quantum magnets;
5. ferroelectric and multiferroic 2D materials;
6. organic-inorganic hybrid materials, including interfacial spin transfer effects and 2D material functionalization via molecular adsorption or intercalation.

For any of the topics encouraged, ECMP welcomes the incorporation of computational tools and domain aware scientific machine learning algorithms to aid the interpretation of experiments and/or predictions of material properties.

The ECMP Program does not support applications on electrochemistry, or photovoltaic materials; nor does it support projects aimed at materials and/or device optimization, or metrology. In addition, the ECMP Early Career Program will NOT accept applications on topics in the following areas: conventional semiconductors, heavy fermion (non-topological) superconductivity, quantum Hall physics in conventional semiconductor materials, cuprate superconductivity, and cold atom physics. Bulk materials and single crystals, including layered and van der Waals 3D materials will NOT be considered responsive to this year's call but are anticipated to be the focus of next year's call.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(5) Theoretical Condensed Matter Physics

Technical Contacts: Matthias Graf, Matthias.Graf@science.doe.gov and Claudia Mewes, Claudia.Mewes@science.doe.gov (Select Claudia Mewes in PAMS)

This program supports research in theoretical condensed matter physics developing quantum methods and techniques for quantum materials, materials discovery and design, out-of-equilibrium quantum dynamics, materials theory related to energy efficient technologies, and materials design of alternates to critical materials/minerals. Research spans from analytical to computational approaches, including data-driven and physics-guided AI/ML, with a strong emphasis on theory, methods, and technique development, as well as prediction and interpretation of novel quantum phenomena. Physics-guided AI/ML approaches must combine both AI/ML models and physics-based models.

For the ECRP, two separate topics (A and B shown below) are planned for alternate fiscal years. For this announcement, only applications focused on Topic B will be considered. Applications on Topic A will NOT be considered responsive to this year's NOFO.

- Topic A (alternate years): Computational discovery and design of functional materials with unique physical properties, including methods and algorithms development.
- Topic B (this year): Development of theories and methods to understand (i) materials with emergent and ordered magnetic, ferroelectric, and/or superconducting properties, including their dynamics, or (ii) the role critical materials/minerals (e.g., rare earth elements) play in functional materials.

Exclusions: Applications focusing solely on high-throughput calculations, the application of existing AI/ML tools, the creation of a database, classical transport, classical molecular dynamics, optimization of physical properties, quantum phase transitions, and/or fractional quantum Hall effect are excluded. Excluded are applications on molecules, cold atoms, ionic liquids, electrolytes, batteries, catalysts, soft matter, polymers, glasses, structural materials, and granular materials.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(6) Physical Behavior of Materials

Technical Contact: Tim Mewes, tim.mewes@science.doe.gov

The Physical Behavior of Materials (PBM) Program supports hypothesis-driven basic research that aims to advance understanding of fundamental processes that take place in materials and in response to external stimuli, such as temperature, pressure, electromagnetic fields, chemical dopants and disorder, strain, and the proximity effects of surfaces and interfaces. The program supports diverse research including two-dimensional (2D) materials and heterostructures, spintronics and magnetic, plasmonics, nanophotonics, and other complex and disordered systems.

This year, applications to the program must focus on basic research in opto-spintronics that combines spintronics and optoelectronics. Of particular interest are light-matter interactions on magnetically ordered semiconducting van der Waals materials that are sensitive to external stimuli, which have potential for use as atomically thin opto-spintronic device architectures. Research on the interplay between optical and exciton-magnon interactions should have a strong spin- and charge-based characterization component and may include fabrication and theory. Applications solely focused on materials synthesis, theory and software development, and optimization of materials/properties for device applications (neuromorphic computing and non-volatile memory, high-frequency devices) are excluded.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(7) Mechanical Behavior and Radiation Effects

Technical Contact: John Vetrano, John.Vetrano@science.doe.gov

This activity supports hypothesis-driven basic research to understand defects in materials and their effects on the properties of strength, structure, deformation, and failure. Defect formation, growth, migration, and propagation are examined by coordinated experimental and modeling efforts over a wide range of spatial and temporal scales. Topics include fundamental studies of deformation in nanostructured materials, and intelligent microstructural design for understanding mechanisms dictating strength, formability, and fracture in energy relevant materials. The goals are to develop scientific underpinnings for predictive design of materials having superior mechanical properties.

This year the emphasis is on mechanical behavior of interfaces in materials, with the plan to alternate this topic with radiation effects annually. Within the area of mechanical behavior, applications must include a scientific hypothesis and focus on research opportunities in one of the following two areas:

- Fundamental understanding of mechanical behavior related to the general area of interface behavior under extreme environments (temperature, stress, strain, corrosion) of structural materials. Radiation damage is excluded.

- Fundamental understanding of novel mechanisms of deformation and failure at interfaces of other materials used in energy systems (e.g., polymers, membranes, coating materials, electrodes).

Applications taking advantage of advanced synthesis methods to create tailored structures to better isolate mechanisms, utilizing AI/ML to uncover novel mechanisms, and taking advantage of advanced characterization techniques, are of particular interest.

The topics of wear, bio-inspired materials, and high-strain rate deformation will not be explored in this program at this time. Applications emphasizing mechanics of materials and simple structure-property correlations, rather than fundamental materials science mechanisms, will not be considered responsive.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(8) Quantum Information Science in Materials Sciences and Engineering (QIS-MSE)

Technical Contact: Athena Sefat, Athena.Sefat@science.doe.gov

This activity supports research in Materials Sciences and Engineering (MSE) to advance fundamental understanding of quantum materials relevant for quantum information science (QIS) in support of crosscutting [MSE Division research areas](#) (Materials Discovery, Design, and Synthesis; Condensed Matter and Materials Physics; Scattering and Instrumentation Sciences) within the Office of Basic Energy Sciences (BES).

This program encompasses QIS topics as noted in the [Basic Energy Sciences Roundtable: Opportunities for Basic Research for Next-Generation Quantum Systems](#) and [Basic Energy Sciences Roundtable on Opportunities for Quantum Computing in Chemical and Materials Sciences](#) reports. The program also supports characterization of QIS-relevant materials, and use or development of cutting-edge techniques to measure quantum phenomena, with the goal of advancing QIS.

Applications must propose fundamental research, based on a specific QIS-inspired research topic, with a potential transformative technological impact. Early Career applications must state specifically which (one or more) of the eight Priority Research Opportunities identified in the two BES Roundtable Reports mentioned above are targeted. Theory/simulation centric proposals must articulate how they advance the understanding of specific properties or quantum dynamics of materials relevant to QIS in MSE.

This program will not fund applications that are solely based on engineering, manufacturing of prototypes/devices, or optimization of hardware/software.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(9) X-ray Scattering

Technical Contact: Helen Kerch, Helen.Kerch@science.doe.gov

This activity supports basic research on the fundamental interactions of photons with matter to achieve an understanding of atomic, electronic, and magnetic structures and excitations and their relationships to materials properties. The main emphasis is on x-ray scattering, spectroscopy, and imaging research, primarily at major BES-supported user facilities. Instrumentation development and experimental research directed at the study of ultrafast physical phenomena in materials is an integral part of the portfolio. Based on programmatic priorities, this activity will not support ultra-fast source development but will focus on the application of ultra-fast probe interactions with materials and the resulting connection to materials dynamics.

Advances in x-ray scattering and ultrafast sciences will continue to be driven by scientific opportunities presented by improved source performance and optimized instrumentation. The x-ray scattering activity will continue to fully develop and extend the capabilities at the DOE facilities by providing support for novel instrumentation, techniques, and research. For example, research is sought that will take advantage of unprecedented levels of coherent brightness and of controlled timing structures at upgraded light source facilities.

New investments in ultrafast science will also focus on research that uses radiation sources associated with BES facilities and beam lines. New pump schemes to manipulate dynamic states of quantum materials will be supported, especially those which can be adapted to x-ray free electron laser (XFEL) and ultrafast electron diffraction (UED) probe environments. Additionally, new approaches to improve the collection, processing and analysis of large data sets obtained with high repetition- rate pulsed sources or with fast multi-mega-pixel detector arrays are encouraged under the cross-cutting emerging domain of Data Sciences.

Novel x-ray techniques are sought that enable detailed investigations of the fundamental dynamic mechanisms of energy conversion systems and their active material components. This involves the interaction of complexity at atomic to mesoscopic length scales and requires the development of multimodal experimental techniques that examine the same active sample positions, in place and under operational boundary conditions. Of particular emphasis for new energy saving quantum computational devices is the in-place study of the evolution of quantum coherence and evolving transient quantum phase transitions at the shortest relevant time scales.

The program will not support research considered “mature use” of existing x-ray or ultrafast techniques. Typically, the emphasis on new techniques enables new access to inhomogeneous and dynamic systems and therefore the program will de-emphasize steady-state research of bulk and equilibrium systems.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(10) Neutron Scattering

Technical Contact: Helen Kerch, Helen.Kerch@science.doe.gov

This activity supports hypothesis-guided research on the fundamental interactions of neutrons with matter to achieve an understanding of the atomic, magnetic or hierarchical structures and excitations of (hard or soft) materials and their relationship to macroscopic properties. The program’s emphasis is transformative research on materials and phenomena using neutron beams, accompanied by advancement of neutron scattering techniques primarily at the BES user facilities. A continuing theme of this program is that integration of neutron scattering measurements on high quality samples with theory and data science is vital for an in-depth understanding of the relationship between structure, dynamics, and macroscopic properties.

Fundamental research on materials that exhibit novel emergent phenomena or unique properties resulting from out-of-equilibrium conditions or structural inhomogeneity is encouraged. Characterizing and controlling such emergent behavior are keys to optimizing and exploiting a wide range of materials’ performance and functionality. *In situ* and *operando* characterizations can measure structure and dynamics of materials in the appropriate environment and at realistic conditions, yielding data for comparison to predictions. The program encourages development of novel measurement and/or analysis techniques that exploit the unique aspects of neutron scattering to facilitate the proposed materials research. Of particular interest is observation and interpretation of three-dimensional inhomogeneous structures over decades of length scales using novel approaches, e.g., gratings, neutron ptychography, neutron tomography, etc.

The program will de-emphasize research resulting in incremental advances of understanding of materials, such as conventional and high-temperature (cuprate) superconductivity and magnetic systems in quiescent conditions.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(11) Electron and Scanning Probe Microscopies

Technical Contact: Jane Zhu, Jane.Zhu@science.doe.gov

This activity supports basic research in materials sciences using microscopy and spectroscopy techniques. The research includes experiments and theory to understand the atomic, electronic, and magnetic structures and properties of materials. This activity also supports the development of new methodologies, including ultrafast diffraction and imaging techniques, to advance basic science and materials characterizations for energy applications. The goal is to develop a fundamental understanding of materials through advanced microscopy and spectroscopy.

For this NOFO, applications must include a scientific hypothesis and focus on the fundamental understanding of quantum materials and phenomena using innovative electron and scanning probe microscopy approaches. New methods and approaches could provide an array of opportunities for groundbreaking science that will accelerate discovery and technological deployment of advanced materials. These include understanding and controlling quantum systems, nano- or meso-scale inhomogeneity, and the interplay between charge, orbital, spin and lattice degrees of freedom. Research opportunities also include functionality imaging and spectroscopy of nanostructures; integrating multimodal imaging for functional studies of quantum materials and behaviors; and utilizing advanced computational methods, including artificial intelligence and machine learning, for integrating complex datasets from multimodal imaging and faster and more accurate data reconstruction and analysis.

Based on programmatic priorities, projects aimed at technique development without science goals will not be considered.

For DOE national laboratory applicants, the proposed research must fit within the BES Materials Sciences and Engineering (MSE) Division funded programs at the laboratory of the applicant.

(12) Atomic, Molecular, and Optical Sciences (AMOS)

Technical Contact: Patrick El Khoury, patrick.el-khoury@science.doe.gov

The BES AMOS program supports fundamental experimental and theoretical research in ultrafast chemical sciences. The aim of this program is to develop accurate quantum chemical descriptions of photophysical and photochemical processes to establish the foundational knowledge required to control ultrafast (coherent) electronic and vibrational dynamics. The program currently supports efforts to develop and use novel probes of ultrafast phenomena, to understand the dynamics of molecules in intense electromagnetic fields, and to observe and control quantum (de)coherence on increasingly faster timescales.

The program supports ultrafast, strong-field, short-wavelength science, and studies of correlated dynamics in molecular systems. Examples include ultrafast x-ray science at the Linac Coherent Light Source (LCLS-II) and the use of high-harmonic generation and its variants for probing ultrafast dynamics. Applications of these light sources include ultrafast imaging of chemical reactions, inner-shell photoionization of molecules, and probing and controlling non-adiabatic dynamics. The program encourages research exploiting next-generation capabilities of x-ray free electron lasers and modern data science approaches, including tools of artificial intelligence, to provide new insights into electronic and molecular dynamics on the attosecond-to-femtosecond time scale. Coherent control of nonlinear optical processes and tailoring of wavefunctions with lasers continues to be of interest, particularly in the context of non-adiabatic photochemistry.

In addition to core programmatic emphases, the AMOS program is currently seeking proposals for research at the interface of ultrafast chemical and quantum information sciences. Research topics that potentially fall within this growing area of the AMOS portfolio include tailoring both classical and quantum light sources to control electronic/vibrational wave packets in molecular systems as well as quasiparticle dynamics (excitons and phonons) in low dimensional quantum systems. ECRP proposals aimed at taking advantage of quantum phenomena to enhance classical approaches to probing chemical dynamics, ultimately in real space-time (femto-nano scale), are strongly encouraged. Overall, proposals in this area must include elements of quantum information sciences research (quantum light, quantum materials, quantum metrology) and AMOS, with an aim of gaining a deeper fundamental understanding of ultrafast phenomena.

The AMOS program is not currently accepting ECRP applications in the areas of plasma physics and the physics of atomic and ultracold systems. Projects involving theoretical, computational, and instrument development must include well-integrated scientific research focused on ultrafast chemical sciences.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(13) Gas Phase Chemical Physics (GPCP)

Technical Contact: Tom Settersten, Thomas.Settersten@science.doe.gov

This program supports research on fundamental gas-phase chemical processes. Research in this program explores chemical reactivity, kinetics and dynamics in the gas phase at the level of electrons, atoms, molecules and nanoparticles. A continuing goal of this program is to understand energy flow and reaction mechanisms in complex, nonequilibrium, gas-phase environments. A crosscutting theme for the GPCP program concerns systems chemistry, in which complex molecular behavior emerges from ensembles of molecules or large reaction networks in the gas phase. The GPCP program seeks to understand, model, and ultimately

control this emergent molecular complexity. Of particular interest are gas phase and/or gas/surface chemical systems in which emergent behavior manifests as a significant and possibly precipitous change in chemical reaction rates, branching ratios, particle growth, and/or product energy distributions with changes in conditions, e.g. temperature, pressure, ion concentration (plasma) and reactions included in a reaction network.

The major focus of research in this area is in four thrust areas: *Light-Matter Interactions*, *Chemical Reactivity*, *Gas-Particle Interconversion*, and *Gas-Surface Chemical Physics*. Research applications will be accepted from only a subset of the selected five research thrusts in response to each year's NOFO, with the remaining thrusts offered in alternate years. For this NOFO, only applications focused on thrusts 1 and 2 will be considered (designated as OPEN). Research applications for thrusts 3 and 4 will not be considered this year (designated as CLOSED) but considered in alternate years.

1. *Light-Matter Interactions* includes research in the development and application of innovative tools for probing the nuclear and electronic structure and dynamics of gas-phase molecules in complex environments. Proposed technical developments must yield new insights on processes such as energy flow, nuclear rearrangements, and loss of coherence and entanglement. Applications are encouraged that develop automated methods based on AI/ML to facilitate the analysis of complex molecular spectra or provide critical new insights on quantum phenomena in systems that could be used for quantum information science. (OPEN)
2. *Chemical Reactivity* comprises research in chemical kinetics and mechanisms, chemical dynamics, collisional energy transfer, and construction of, and calculations on, molecular potential energy surfaces to develop fundamental insight into energy flow and chemical reactions. Applications are encouraged that develop AI/ML methods for the construction of potential energy surfaces and optimization of chemical kinetic mechanisms. (OPEN)
3. *Gas-Particle Interconversions* comprises research on the chemistry of small gas-phase particles, including their interactions with gas-phase molecules and dynamic evolution to understand the molecular mechanisms of formation, growth and transformation (such as evaporation, phase transition, and reactive processing) of small particles. (CLOSED)
4. *Gas-Surface Chemical Physics* retains a strong emphasis on molecular-scale investigations of gas-phase chemical processes with the goal of gaining a better understanding of the cooperative effects of coupling gas phase chemistry with surface chemistry. Applications are encouraged that explore the cooperative effects of gas-surface coupling. (CLOSED)

The GPCP program does not support research in the following areas: non-reacting fluid dynamics and spray dynamics, reacting and non-reacting turbulent flow, data-sharing software development, end-use combustion device development, and characterization or optimization of end-use combustion devices.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(14) Computational and Theoretical Chemistry

Technical Contact: Aaron Holder, Aaron.Holder@science.doe.gov

Computational and Theoretical Chemistry (CTC) emphasizes sustained development¹, innovation and integration of theoretical and computational approaches for the accurate and efficient prediction of chemical processes and mechanisms relevant to the BES mission. Part of the focus is on simulation of dynamical processes that are so complex that efficient computational implementation must be accomplished in concert with development of new theories and algorithms. Efforts must be tightly integrated with the research and goals of BES and provide theories and computational approaches to advance the fundamental science of chemical transformations and energy and information transduction processes across multiple scales in complex environments and systems. Applications may include the development or improvement of modular computational tools that enhance interpretation and analysis of advanced experimental measurements, including those acquired at DOE user facilities, or efforts aimed at enhancing the accuracy, precision, applicability and scalability of quantum-mechanical simulation methods. Also included are development of spatial and temporal multiscale methodologies that allow for time-dependent simulations of relativistic, coherent, entangled, and dissipative processes as well as rare events. Development of novel theories and simulation capabilities for the theory-guided control of externally driven electronic and spin-dependent processes in real environments is encouraged.

The CTC focus for this year's Early Career NOFO is on the innovation of predictive mechanistic theories and practical, systematically improvable and hierarchical methods for describing and simulating dynamical processes occurring in complex molecular ensembles and environments. Topics of interest within this focus include the development and integration of quantum chemical approaches for the accurate simulation and prescriptive design of (i) systems-level behaviors and other emergent functionalities and phenomena for manipulating information and energy transduction, with specific emphasis on dynamical chemical systems that exploit coordinated effects of chirality, topology, and magnetoelectric interactions to achieve novel functionalities, (ii) non-biological cooperative reaction networks and mechanisms leading to programmable matter, chemical artificial intelligence and/or molecular cybernetic functionalities, or (iii) correlated multi-electron, multi-photon, and/or interacting quasiparticle governed chemical transformation and energy transduction processes, including those that may require consideration of symmetry violations or non-Hermitian or non-memoryless dynamical approaches to describe, in field-driven complex open quantum systems.

CTC does not support projects based on (i) the “mature use” of presently available implementations of computational and theoretical chemistry methods and/or approaches, (ii) the development of phenomenological models and empirical parameterization of models, (iii) methods for, or applications to, systems that do not explicitly consider rearrangements of quantum-mechanical degrees of freedom, or (iv) the development of density functional theory approximations or machine-learned potentials. AI/ML focused efforts in CTC must develop run-time compute intensive algorithms and methods, such as those that require reasoning and/or inference modelling to be performed during their execution, to advance the current state-of-the-art in exascale, quantum hardware-based, or other novel computing paradigm-based simulations of chemical systems and processes for fundamental knowledge discovery.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

1. A Perspective on Sustainable Computational Chemistry Software Development and Integration, R. Di Felice et al., J. Chem. Theory Comput. 2023, 19, 7056.

(15) Condensed Phase and Interfacial Molecular Science (CPIMS)

Technical Contact: Gregory Fiechtner, Gregory.Fiechtner@science.doe.gov

The CPIMS program emphasizes basic research at the boundary of chemistry and physics, pursuing a molecular-level understanding of chemical and physical processes in liquids and at interfaces. With its foundation in chemical physics, the impact of this crosscutting program is far reaching, providing understanding and scientific foundations underpinning a variety of areas of importance to the DOE, including energy, quantum information science, chemical synthesis and manufacturing, and microelectronics. The CPIMS program also supports efforts related to research priorities such as artificial Intelligence and machine learning that can form the basis for new approaches to understanding science questions of interest to the CPIMS program.

Experimental and theoretical investigations in the gas phase, condensed phase, and at interfaces aim at elucidating the molecular-scale chemical and physical properties and interactions that govern chemical reactivity, solute/solvent structure, and transport. Studies of reaction dynamics at well-characterized surfaces and clusters lead to the development of theories on the molecular origins of surface-mediated catalysis and heterogeneous chemistry. Studies of model condensed-phase systems target first-principles understanding of molecular reactivity and dynamical processes in solution and at interfaces. The transition from molecular-scale chemistry to collective phenomena in complex systems is also of interest, allowing knowledge gained at the molecular level to be exploited through the dynamics and kinetics of collective interactions. In this manner, the desired evolution is the understanding of molecular-scale interactions as well as their role in complex, collective

behavior at larger scales. A molecular level understanding of complex molecular systems is sought, capturing the essence of chemical behavior, knowledge of the main molecular-level driving forces behind the behavior, and discovery of universal principles that can be applied more widely.

The CPIMS program also seeks new projects in the chemistry of dissipative, nonequilibrium molecular systems, looking to understand how interacting molecular networks can lead to emergent reactive behavior. Examples include reaction-diffusion systems, positional information, compartmentalized reaction networks, substrate-induced reactive systems, chemical replication, self-organized biomimetic chemical reaction networks, and the dynamics of nonequilibrium catalysis. The CPIMS program seeks additional new projects on chemistry at the boundaries of condensed matter physics, including topics where unexpected emergent behavior has been identified. For example, recent CPIMS-supported projects include 1) a study of how chemical reactions might be supported at the surface of topological materials, 2) a study of the impact of Moiré effects on electrochemistry, 3) a study that explores theories of topological physics to change the way chemical reactions are understood and manipulated, and 4) studies at the intersection of cavitronics and chemistry.

The CPIMS program does not fund research in mechanics or dynamics of bulk fluids, technological applications, or device development.

A more extensive description of program evolution can be found at the link: <https://science.osti.gov/bes/csgb/Research-Areas/Condensed-Phase-and-Interfacial-Molecular-Sciences>.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(16) Quantum Information Science Research in Chemical Sciences, Geosciences, and Biosciences (QIS-CSGB)

Technical Contact: Marat Valiev, Marat.Valiev@science.doe.gov

The Quantum Information Science (QIS) program in CSGB supports fundamental research at the intersection of chemistry, quantum physics, and the theory of computation to provide a foundational understanding of quantum information processing in complex molecular systems.

The program adopts an integrated approach that combines foundational QIS research, the fundamental understanding of quantum processes underlying quantum technologies, and the translation of QIS advances into applications central to the BES mission.

Applicable research areas include:

Fundamental understanding of complex chemical systems from QIS-centric perspective, including

- Development of physically grounded measures of non-classical correlations in molecular systems, using quantum resource theory to investigate their generation, manipulation, and interconversion under physically motivated constraints.
- Development of algebraic and geometric methods, such as operator algebras, quantum space geometry, and noncommutative frameworks, to identify general principles that connect molecular structure and dynamics to the evolution of quantum information in high-dimensional and strongly interacting molecular systems.
- Investigation of quantum information scrambling and chaotic dynamics in molecular systems to uncover how complex interactions and many-body effects govern the flow, delocalization, and irreversibility of quantum information.

Molecular design principles for quantum technology, targeting

- Use of dynamically modulated external fields and measurement-based feedback control to enable the generation, manipulation, and resiliency of quantum information resources.
- Investigation of high-dimensional quantum information encoding in molecular systems, including continuous-variable representations and qudit architectures, with opportunities for both theoretical and experimental research.
- Advancing the concept of the single-molecule quantum processor by developing strategies to isolate, control, and interconnect multiple quantum degrees of freedom within an individual molecular system, enabling compact and multifunctional on-chip molecular units suitable for quantum information encoding, processing, and transduction.
- Development of quantum thermodynamics approaches to uncover novel mechanisms of energy, entropy, and information flow at the quantum scale, with potential to enable new quantum technologies for energy conversion and storage.

Novel quantum computing paradigms aiming at the development of

- Alternative models of quantum computation for molecular systems that move beyond circuit-based approaches, drawing on paradigms such as measurement-based quantum computing, quantum cellular automata, and other spatially and structurally informed frameworks that take advantage of the inherent locality, symmetry, and dynamical structure of molecular processes.
- Universal mappings of molecular processes into abstract and controllable quantum surrogate models that not only support simulation on quantum hardware but also serve as standalone representations for exposing hidden structure and extracting fundamental physical insight for the underlying system.
- Interpretable quantum machine learning approaches to uncover physically meaningful structure within molecular quantum systems, including the extraction of patterns, universal representations, and resource features from trained models; the discovery of

underlying mechanisms and control principles; and the refinement of theoretical frameworks.

To be considered responsive, proposals must pursue high impact foundational research that incorporates one or more of the research topics listed above and clearly articulates its importance to the molecular systems relevant to the CSGB domain sciences.

Proposals will be nonresponsive if they focus on

- materials science, engineering, synthesis, device optimization, or designing/building quantum computers
- algorithmic translation of established quantum chemistry methods to quantum computers, without addressing foundational QIS questions
- computational simulation, including those based on AI/ML, without contributing to the understanding or advancement of foundational QIS principles

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(17) Catalysis Science

Technical Contacts: Viviane Schwartz, Viviane.Schwartz@science.doe.gov and Chris Bradley, Chris.Bradley@science.doe.gov

This program supports basic research pursuing novel catalyst design and quantum- and molecular-level control of chemical transformations applicable to energy and industrial processes. A central element of the program is the elucidation of *catalytic reaction mechanisms in diverse chemical environments* and *the structure-reactivity relationships of solid and molecular catalysts*. Applications and pre-applications MUST clearly identify the fundamental hypothesis to be tested and the reaction system to be studied, as well as their relevance to the development of structure-reactivity relationships.

Strategies and feedstocks emphasized this year are:

- New mechanisms and catalytic transformations mediated by Earth-abundant metals.
- Reducing the dependence on catalysts containing platinum group or other critical elements by advancing novel concepts to increase active site efficiency.
- Approaches that explore catalysts and mechanisms associated with transformations in multicomponent mixtures, multiple reactions, and integrated processes.
- Examination of the dynamics of catalyst and electronic structures occurring during catalytic cycles and deactivation via the development of novel spectroscopic techniques and structural probes for *in situ/operando* characterization of catalytic processes.
- Advanced theory, modeling, data-science and artificial intelligence/machine learning approaches to mechanism identification and catalyst discovery and development.

- Transformations involving light hydrocarbons or lignocellulosic-derived molecules towards chemicals and fuels.

The FY26 Early ECRP in Catalysis Science will exclude the following types of applications:

- The primary focus is new synthetic approaches of catalytic materials.
- The main objective is developing theoretical, computational, or characterization methods, while understanding the catalytic reaction mechanism is secondary.
- Applications with a focus primarily on battery chemistry.
- Transformations mediated by biocatalytic systems.
- Topics primarily focused on electrocatalytic reduction of CO₂.

This program does not support: (1) the study of transformations appropriate for pharmaceutical synthesis; (2) studies where the primary focus is photophysics or photochemistry; (3) non-catalytic stoichiometric reactions; (4) whole cell or organismal catalysis; (5) studies primarily focused on process or reactor design and optimization; or (6) device development or optimization.

Examples of research funded in catalysis can be found in Catalysis Science Program Meeting Reports on the ‘Chemical Sciences, Geosciences, & Biosciences Division PI Meetings’ webpage (<https://science.osti.gov/bes/csgb/Principal-Investigators-Meetings>). A 2017 BESAC-sponsored workshop, [Basic Research Needs for Catalysis Science](#), outlining the current challenges and needs in this field, can also be found on the ‘Basic Research Needs Reports’ webpage as well as a 2019 BES roundtable report on [Chemical Upcycling of Polymers](#), discussing the challenges of polymer deconstruction and redesign (<https://science.osti.gov/bes/Community-Resources/Reports>).

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(18) Separation Science (SEP)

Technical Contact: Amanda Haes, Amanda.Haes@science.doe.gov

This program supports hypothesis-driven experimental and computational fundamental research questions that seek to discover, understand, predict, and control de-mixing chemical and physical states. Goals should enable chemical separation mechanisms and paradigms that may become the basis for solutions to current and long-term energy and separation science challenges. Research questions that could enable the availability and separation of critical materials and minerals are of particular interest. Basic research in these areas relies on understanding chemical and physical properties at multiple scales, quantum through macroscopic, and molecular interactions and energy exchanges that determine the efficiency and sustainability of chemical separations.

The program supports emerging fundamental scientific areas within separation science that are in a nascent stage and would result in molecular understanding. Selected topics of interest include:

- discovering, understanding, and predicting mechanistic paradigms for removal of dilute constituents from a mixture, including but not limited to (a) reactive separations, (b) intermolecular interactions leading to formation of a new phase, and (c) emergent phenomena that result from correlation and amplification of individual atomic or molecular processes, such as aggregation and their effects on kinetics or transport properties;
- elucidating how dynamics and molecular criteria limit mass transfer at interfaces/interfacial regions;
- understanding non-thermal and other mechanisms that have the potential to drive efficient and selective energy-relevant separations, such as magnetic, mechanic, electromagnetic, electrochemical, magneto-reactive, bio-inspired, and other means to affect transport kinetics;
- elucidating how separation parameters and processes such as high selectivity, capacity, and throughput are impacted by emergent system properties;
- understanding and controlling temporal changes in separation systems, such as activation, degradation, self-repair, or solvation.

The above topics are agnostic to the separation system. Issues of selectivity, capacity, throughput, durability, and energy input are important for most separations, and should be of concern in separation science research although they may not be the singular focus. Pre-applications and proposals must explicitly identify the fundamental hypothesis to be tested and the separation science knowledge gap that will be addressed. Scientific research questions that utilize experimental, computational, or artificial intelligence/machine learning approaches are encouraged.

The Separation Science program will exclude the following topics:

- The primary focus is on engineering design, optimization, or scale-up.
- The primary goal is to develop narrowly defined processes or devices.
- The objective is to advance established desalination approaches, microfluidics technology, or sensors.
- The primary focus is on new synthetic approaches for materials or ligands rather than on advancing separation science.
- The main objective is developing databases, characterization methods, computational methods, or theoretical methods, rather than advancing separation science.

Research opportunities identified in recent reports from the National Academies of Sciences, Engineering, and Medicine and the Basic Energy Sciences Advisory Committee (BESAC) serve as references for some of the basic science topics outlined above: *A Research Agenda for Transforming Separation Science* (<https://www.nap.edu/catalog/25421/a-research-agenda-for-transforming-separation-science>). Applicants should also examine

relevant reports of Basic Energy Needs workshops and roundtables (<https://science.osti.gov/bes/Community-Resources>). These contain multiple chemical separation challenges that this program will help tackle over the next decades.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(19) Heavy Element Chemistry (HEC)

Technical Contact: Philip Wilk, Philip.Wilk@science.doe.gov

This program supports actinide and transactinide fundamental chemical research that underpins the DOE missions in energy, environment, and national security. The unique molecular bonding of these elements is explored using experiment and theory to elucidate electronic and molecular structure, reaction thermodynamics, as well as quantum phenomena, such as coherence and entanglement. Emphasis is placed on the chemical and physical properties of the transuranic elements to determine their bonding and reactivity, the fundamental transactinide chemical properties, and the overarching goal of resolving the *f*-electron challenge. The *f*-electron challenge refers to the inadequacy of current electronic structure methods to accurately describe the behavior of *f*-electrons, in particular strong correlation, spin-orbit coupling, multiplet complexity, and associated relativistic effects. Theoretical applications are considered, which integrate closely with experimental research or otherwise demonstrate impact outside the theory community. The HEC program does not fund code development.

The role of 5*f* electrons in bond formation remains the fundamental topic in actinide chemistry and is an overarching emphasis for this program. Theory and experiment show that 5*f* orbitals participate significantly in molecular actinide compounds. Resolving the role of the *f*-electrons is one of the three grand challenges identified in the [Basic Research Needs for Advanced Nuclear Energy Systems \(ANES\)](#) report of the Basic Energy Sciences Workshop (2006) and echoed in the report from the Basic Energy Sciences Advisory Committee: [Science for Energy Technology: Strengthening the Link between Basic Research and Industry](#) (2010). Applicants should also look at the priority research directions and opportunities discussed in the reports from the 2017 [Basic Research Needs for Future Nuclear Energy](#) workshop and the July 2022 [Foundational Science to Accelerate Nuclear Energy Innovation](#) roundtable.

Catalytic reactivity involving actinides is of current interest to this program, if the project yields insight into *f*-electron behavior and is not better aligned with the BES Catalysis Science program described in section (17). Exotic catalytic and redox behavior exhibited by actinides in extreme environments, such as the legacy nuclear waste tanks or molten salts, is also of particular interest to this program. Also of particular interest is the exploitation of the unique electronic properties of the *f*-elements for quantum information science (QIS)

purposes (e.g., actinide qubits or the synthesis and investigation of strongly correlated multidimensional lattices).

The inclusion of machine learning, artificial intelligence, and quantum computing methods are particularly desirable and aligned with current BES priorities. The HEC program will consider applications to understand how the unique electronic structure of rare earth elements, including the role of *f*-electrons, determines the physical and chemical properties of molecules and materials, with the goal of accelerating their design to reduce or eliminate the use of critical elements. Research that is focused primarily on separations and does not address the unique properties of the heavy elements would be better aligned with the BES Separation Science (SEP) program, which is described in section (18). More information about the Heavy Element Chemistry program can be found at <https://science.osti.gov/bes/csgb/Research-Areas/Heavy-Element-Chemistry>.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(20) Geosciences (GEO)

Technical Contact: Philip Wilk, Philip.Wilk@science.doe.gov

This program supports hypothesis-driven experimental and theoretical research in fundamental geochemistry and geophysics that have clear connections to energy production or recovery of critical elements. Geochemical research emphasizes fundamental understanding of the reaction mechanisms and rates associated with geochemical processes, focusing on molecular-mesoscale aspects of minerals and interfaces and on the molecular origins of critical element/isotope distributions and their influence on migration/separation/fractionation pathways in the earth, ranging from weathering environments to magmatic/hydrothermal systems. Geophysical research focuses on new approaches to understand subsurface processes that characterize the evolution of fractures in the upper crust, particularly when associated with enhanced geothermal systems and hydrocarbon prospecting & recovery.

Applicants should look at the geosciences-aligned priority research directions and opportunities discussed in the [BES workshop and roundtable reports](#). The reports that contain particularly topical geosciences topics include [Basic Research Needs for Geosciences: Facilitating 21st Century Energy Systems](#) (2007) and [Controlling Subsurface Fractures and Fluid Flow: A Basic Research Agenda](#) (2015).

The inclusion of machine learning, artificial intelligence, and quantum computing methods are particularly desirable and aligned with current BES priorities. While it is necessary that the work has a well-defined connection to energy or critical elements, priority in BES Geosciences is given to research that has strong potential for breakthrough science.

Applicants must make a strong case for (i) the relevance of the work to energy or critical elements and (ii) the fundamental science nature of the work (i.e., why the work belongs in the BES Geosciences program and not a more applied program). Preapplications that do not make a strong case for both will be discouraged. Research focused primarily on separation science and does not address subsurface science, would be better aligned with the BES Separation Science (SEP) program, which is described in section (18). Modeling-focused applications that do not clearly indicate and discuss direct engagement with novel and compelling data sets will also be discouraged. Applications that do not describe subsurface science (e.g. oceanography), will be discouraged. The Geosciences program does not fund code development, engineering design or scale-up, development of narrowly defined processes or devices, microfluidics, or sensors.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(21) Photochemistry and Radiation Chemistry

Technical Contacts: Jennifer Roizen, Jennifer.Roizen@science.doe.gov (Select Jennifer Roizen in PAMS) and Chris Fecko, Christopher.Fecko@science.doe.gov

This activity supports fundamental, molecular-level research on photochemistry and radiation chemistry in the condensed phase and at interfaces.

Photochemical processes initiated by the absorption of visible or near-infrared light may ultimately form the basis of reliable, secure energy technologies that generate electricity or energy-rich chemicals. Advances in these areas will require a thorough understanding of elementary processes such as light absorption, charge separation, and charge transport within a number of chemical systems, including those with significant nanostructured composition. Supported research areas include organic and inorganic photochemistry, light-driven electron and energy transfer in condensed phase and interfacial molecular systems, photocatalysis of fuel-relevant reactions, semiconductor photoelectrochemistry, light-driven generation or manipulation of quantum coherence in artificial molecular systems, and artificial assemblies that mimic natural photosynthetic systems. An enhanced theory and modeling effort is needed to improve current understanding of many photochemical phenomena.

To enable the light-driven production of fuels and other energy-rich chemicals, knowledge of photoinduced charge transfer needs to be closely coupled with the conversion of abundant, feedstocks like H₂O, CO₂, or N₂. Fundamental research to enable robust photochemical water oxidation continues to be a particularly challenging and important area of research. Basic science that could underpin light-driven cascade approaches to generate energy-rich chemicals from CO₂ and/or N₂ is a topic of increasing emphasis. More generally, considerable challenges remain in understanding degradation mechanisms to

enhance photochemical durability, designing catalytic microenvironments that promote selective reaction outcomes, exploiting direct coupling of light-driven phenomena and chemical processes to enhance performance, and tailoring interactions of complex phenomena to achieve integrated multicomponent assemblies for fuels production.

Another regime of interest is the chemistry initiated through the creation of high-energy states with ionizing radiation, as can be produced through electron pulse radiolysis, to investigate reaction dynamics, structure, and energetics of short-lived transient intermediates in the condensed phase. Basic research on radiation chemistry is needed to enable continued advances in nuclear energy production and environmental waste management. Supported topics include fundamental research to understand the radiation-induced speciation and redox chemistry of coolants and solvents being considered for next-generation nuclear energy systems, the degradation mechanisms and mitigation strategies of molecular reagents employed for separations processes in the nuclear cycle, and the radiation chemistry of solid-liquid interfaces encountered in nuclear waste processing and storage.

Photochemistry and Radiation Chemistry does support systems-level investigations, but it does not fund applied research on device development or optimization.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(22) Photosynthetic Systems

Technical Contact: Stephen Herbert, Stephen.Herbert@science.doe.gov

This activity supports basic research on the capture of light energy and its utilization by the photosynthetic systems of plants, algae, and photosynthetic microbes. General topics of study include light harvesting, electron transport, proton transport, conversion of carbon dioxide into useful organic compounds, and the self-assembly and self-repair of photosynthetic proteins, complexes, and membranes. The goal of the program is to foster greater knowledge of the useful biochemistry of photosynthesis. Examples include prolonged coherence of excitation energy transfers in photosystems, oxidation of water to provide electrons for synthesis of energy-rich carbon compounds, precise transfers of electrons through large and complex molecular systems, and the protein-protein interactions that assemble and repair photosynthetic membranes.

Photosynthetic Systems supports projects that seek to understand the chemical mechanisms of photosynthesis. The program does not fund: 1) development or optimization of devices or processes; 2) development or optimization of microbial strains or plant varieties for biofuel or biomass production; 3) phenotype analyses that do not test specific hypotheses relevant to the program; 4) genomic or other “omic” data acquisition that does not test specific

hypotheses relevant to the program; and 5) projects that are primarily computational in nature.

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(23) Physical Biosciences

Technical Contact: Katherine Brown, Katherine.Brown@science.doe.gov

This activity supports basic research into biochemistry, biophysics, and molecular biology to understand the fundamental principle of how plants and non-medical microbes move, manage, and transform energy. Fundamental research supported by the program includes:

- structure/function, mechanism, and electrochemical properties of enzymes that catalyze complex multielectron energy-relevant reactions (e.g. those involved in the interconversion of CO₂/CH₄, N₂/NH₃, C-H activation, C-C bond formation, etc.)
- complex metallo-cofactors and active site biosynthesis
- cofactor redox tuning by ligand coordination and local chemical environment that control overpotentials, manage electron transfer, and enable efficient catalysis
- mechanisms that enable electron bifurcation and/or catalytic bias electron flow over larger spatial and temporal scales, proton and electron tunneling, and other quantum phenomena in enzyme systems
- biosynthesis, structure, and biophysics of complex compounds and materials (e.g., plant cell walls, lipids, terpenes, etc.)

The fundamental research supported by this program provides foundational knowledge for affordable, reliable, and secure energy technologies and critical materials. A mechanistic understanding of the processes and unique structure-function relationships in biological systems can provide the basis for the design of highly selective and efficient bioinspired catalysts, enable control of electron flow to achieve desired metabolic outcomes, and provide an unprecedented architectural and mechanistic understanding of natural systems. Such insights can guide design of chemical pathways for affordable and reliable production of fuels, commodity chemicals and other products.

Submitted applications must clearly state how the proposed research will further our fundamental understanding of the ways biological systems capture, convert, and/or store energy. Projects must be hypothesis-driven. Physical Biosciences does not fund research in: 1) animal systems; 2) prokaryotic systems related to human/animal health or disease; 3) development and/or optimization of devices and/or processes; 4) development and/or optimization of microbial strains or plant varieties for biofuel/biomass production; 5) cell wall breakdown or deconstruction; 6) transcriptional or translational regulatory mechanisms and/or processes; 7) environmental remediation and/or identification of

environmental hazards; 8) genomic or other “omic” data acquisition that does not test specific hypotheses relevant to the program; and 9) computational projects that do not contain some experimental components (by PI or collaborator).

For DOE national laboratory applicants, the proposed research must fit within the BES Chemical Sciences, Geosciences, and Biosciences (CSGB) Division funded programs at the laboratory of the applicant.

(24) Accelerator and Detector Research

Technical Contact: Mikhail Zhernenkov mikhail.zhernenkov@science.doe.gov

This program supports research that advances the instruments, techniques, and capabilities of the existing and/or future BES Scientific User Facilities. The program will not support applications to establish new, unrelated types of facilities or to develop techniques that do not relate to the missions of the BES light source and neutron scattering user facilities

The program supports:

- research to understand the fundamentals of beam generation and to probe parameters’ behavior near or at their theoretical limits;
- research to explore scientific mechanisms that limit system performance and utilization;
- mechanisms to tailor and control beams with unprecedented precision and speed to probe complexity in matter;
- detectors concepts with higher computational capabilities per pixel, improved readout rates, radiation hardness, and better energy and temporal resolution;
- research leading to high atomic weight sensors to expand the range of experiments possible at synchrotrons and allow operando probes of diverse materials;
- co-design of optics in conjunction with detector leading to efficient optics that couple photons for complex detector systems (e.g., cryogenic detectors with limited collections areas); separate development of optics components will be given lower priority;
- research leading to ultrafast beam instrumentation capable of accurate measurement of femto- and atto-second bunch lengths;
- tight control of beam losses, and detectors designed for advanced neutron imaging with very high throughput for high-intensity H⁻ currents; and
- advances in probabilistic digital twins that incorporate errors present in physical systems and real-time integration to predict outcomes of specific experiments (with real-time parameter optimization) and facility operations.

References: Accelerator physics needs for light sources: Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, Volume 618, Issues 1-3. Opportunities for future neutron and photon detector development: [BES Workshop on Neutron and X-ray Detectors](#) report. AI/ML for User facilities: [Basic Energy Sciences Roundtable on Producing and Managing Large Scientific Data with Artificial Intelligence and Machine Learning](#) report. Opportunities for future

accelerator-based tool development: [Basic Research Needs for Accelerator-based Instrumentation](#) brochure (full report will be available soon).

For DOE national laboratory applicants, the proposed research must fit within and advance BES Scientific User Facilities Division funded programs at the laboratory of the applicant.

(25) Instrumentation and Technique Development for BES User Facilities

Technical Contacts: Dava Keavney, Dava.Keavney@science.doe.gov (select Dava Keavney in PAMS) and Misha Zhernenkov, Mikhail.Zhernenkov@science.doe.gov

The program is open to national laboratory applications only. University PIs interested in x-ray, neutron, or nanoscale instrumentation technique development should consider the topics discussed above under (9) X-ray Scattering, (10) Neutron Scattering, or (11) Electron and Scanning Probe Microscopy.

This program supports research that emphasizes the development of novel concepts that advance/contribute to the instrumentation, techniques, and capabilities of existing and/or future BES-supported light source, neutron, and nanoscale science research facilities. Applications are encouraged to include hypothesis-driven scientific research relevant to the instrumentation, technique, or capability being developed. Priorities include development of novel techniques to enable innovative discoveries in energy, transformational manufacturing processes, microelectronics, quantum materials, and biopreparedness. Research on new techniques or capabilities for BES user facilities may incorporate materials innovation, sample environments, optics, detectors, etc. Also of interest are novel, innovative AI/ML, data science, and analysis workflows that accelerate the realization of the full potential of current and next-generation user facilities. Research leading to incremental advances will not be supported.

This program will only support instrumentation/technique developments directly applicable to BES user facilities. While the program supports new, innovative technique development for existing instruments, it will not support research considered to be “mature use” of existing instruments. Also, applications focused primarily on development of neutron polarization techniques will be discouraged.

The proposed work must contribute to the user program at the applicant’s facility and fit within and advance the scientific capabilities of the BES Scientific User Facilities Division funded programs at the laboratory of the applicant.

Biological and Environmental Research (BER)

Program Website: <https://www.energy.gov/science/ber/biological-and-environmental-research> or <https://science.osti.gov/ber>

BER's mission is to support transformative science and scientific user facilities to achieve a predictive understanding of complex biological, earth, and environmental systems for energy and infrastructure security and resilience.

Biological Systems Science

The Biological Systems Science Division (BSSD) within BER supports fundamental systems biology and 'omics research to elucidate the complex networks and molecular mechanisms of bioenergy crop growth, development, and metabolism to drive broader efforts in plant biotechnology for producing fuels, chemicals and materials from plant biomass.

Understanding the interaction between bioenergy crops, their microbiome, and their environment at the ecosystem level presents a unique challenge, which is further complicated by dynamic nature of the abiotic stresses that crops are exposed to. The ability to predict plant and microbial species' coordinated responses to those variable stresses will be critical to understanding potential environmental impacts on feedstock productivity as well as for optimizing bioenergy crops.

BER is seeking Biological Systems Science research only in the following area:

(1) Systems Biology Research to Advance Bioenergy Crop Production

Technical Contact: Pablo Rabinowicz pablo.rabinowicz@science.doe.gov

Applications are requested for systems biology-driven, basic research on the fundamental principles of bioenergy crop production in relationship to their ecosystem context. Proposed projects should be hypothesis-driven and focus on understanding feedstock productivity and the effects of water and nutrient availability as well as abiotic stresses (e.g., drought, heat, flood, salt, light, etc.). A deep understanding of these processes and their integration into predictive modeling frameworks will enable the potential development of bioenergy crops as natural resources for a range of potential products that require less agronomic inputs, are tolerant to abiotic stressors, and are resilient and/or adaptable to changing conditions. Species of interest include, but are not limited to, candidate bioenergy crops such as sorghum, energy cane, *Miscanthus*, switchgrass, *Populus*, etc., as well as non-food oilseed crops such as members of the Brassicaceae family. Field research is highly encouraged and simplified laboratory environments are also of interest, as long as they result in knowledge that can be extrapolated to field settings.

Research that will advance our understanding of the molecular and physiological mechanisms that control bioenergy crop vigor and productivity, resource use efficiency, carbon allocation, nitrogen metabolism, resilience/adaptability to abiotic stress, and the interactions of plants with their surrounding environment is encouraged. Systems biology-enabled investigations into the roles of rhizosphere and endophytic microbiomes, including diazotrophs, endophytes, bacteria, archaea, fungi, and viruses on plant productivity, abiotic stress tolerance, adaptation, and resilience in changing conditions are also encouraged.

Applications are expected to propose omics-driven approaches to enable the development of resilient bioenergy feedstock systems in terrestrial environments within their ecosystem context, including state-of-the-art computational technologies (e.g., artificial intelligence and harnessing of big datasets) for integrative analyses and predictive modeling.

NOTE: BER encourages the submission of innovative "high-risk/high-reward" research applications that address critical knowledge gaps and have the potential for high impact. The probability of success and the risk-reward balance will be considered when making funding decisions.

The following topics are NOT within the scope of the BSSD research area: starch accumulation, digestion, and/or fermentation; soybean, food-grade canola or other food-grade oilseed crops; crops targeted for food, pharmaceutical, or cosmetic use; aquatic systems (e.g., algae, seagrass); plant-pathogen interactions; and life cycle analysis (LCA). Although the long-term vision of this research is to enable improvement of bioenergy feedstock crops, applications focused solely on breeding- or transgenic-based crop improvement will not be considered.

Research that would result in only incremental knowledge or technology advances or proposals solely focused on technology development are not encouraged.

Applications primarily focused on genomic or metagenomic sequencing are not encouraged and should instead be directed to the DOE Joint Genome Institute's Community Science Program: <https://jgi.doe.gov/work-with-us/proposals/CSP>.

DOE User Facilities and other specialized resources: Applicants are encouraged to consider the use of resources provided by DOE Scientific User Facilities and Community Resources. These include the DOE Systems Biology Knowledgebase (KBase; <http://www.kbase.us>), the National Microbiome Data Collaborative (NMDC; <https://microbiomedata.org/>), the DOE Environmental Molecular Sciences Laboratory (EMSL; <https://www.emsl.pnnl.gov/>), the National Energy Research Scientific Computing Center (NERSC; <http://www.nersc.gov>), the BER Structural Biology and Imaging Resources (<https://berstructuralbiportal.org>), and the DOE Joint Genome Institute (JGI; <http://jgi.doe.gov>). Awarded projects will receive prioritized consideration for use of JGI capabilities through the Biological and Environmental Research Support Science (BERSS) user program (<https://jgi.doe.gov/work-with-us/proposals/special-programs>). To determine the feasibility of the planned work to be done by JGI, applicants should contact JGI before submitting their application.

Annual Principal Investigator (PI) meeting: if an award is made, at least one project participant will be expected to attend an annual investigator meeting each year of funding. Reasonable travel expenses may be included as part of the project budget.

Earth and Environmental Systems Sciences

The Earth and Environmental Systems Sciences Division (EESD) within BER supports fundamental science and research capabilities that enable major scientific developments and enhanced predictability involving Earth system-relevant atmospheric, terrestrial, cryospheric, and human system process and modeling research in support of DOE's mission goals for transformative science for energy dominance and expansion, and national security. This includes observational, laboratory experiments, and modeling research on atmospheric components such as clouds, aerosols, precipitation, and turbulence interactions; experimental and modeling research involving terrestrial biogeochemistry, hydrology, ecology, coastal processes, and the energy-water dynamics of urban systems; and the nonlinear dynamics of multi-scale complex systems extending from hyper-resolution to regional and larger scales and from subseasonal to decadal scales. Novel uncertainty quantification methodologies and the use of AI/ML to enhance predictability are high priorities for all investments.

The goal of the Earth and Environmental Systems Modeling (EESM) portfolio within EESS research is to develop, demonstrate, and deploy technologically and scientifically advanced modeling and simulation capabilities to enhance the understanding and predictability of the Earth system over multiple temporal and spatial scales. Of particular interest is systems-level research that extends over a wide range of scales, in particular new science that demands hyper-resolution scales to understand how variabilities and extremes in the Earth system evolve in heterogeneous regions characterized by large spatial gradients. Modeling investments are designed to demonstrate the interdependence of the natural and human systems, with significant focus on impacts involving energy and related sectors. Some of the notable examples of EESM capabilities at different scales include:

- The Energy Exascale Earth System Model ([E3SM](#)) and the Global Change Analysis Model ([GCAM](#)), which can be effectively employed on DOE's advanced high performance computers for modeling the natural and human systems at global-to-regional and even local scales.
- A suite of regional modeling capabilities, including the variable resolution E3SM model components such as the new E3SM Atmosphere Model (i.e., [EAMxx/SCREAM](#)) and the emerging Energy Research and Forecasting ([ERF](#)) atmospheric model, several terrestrial system and land use models ([ELM](#): The E3SM Land Model, the MOSART river model, [DEMETER](#)) and several open-source energy system modeling tools developed by the Integrated Multisector Multiscale Modeling ([IM3](#)) project (e.g., grid operations/vulnerability, power plant siting, and energy/water demand). These models can be operated independently or through integrated approaches in specific regional contexts (e.g., [Mid-Atlantic](#), the [Great Lakes region](#), and the [Arctic region](#)) to simulate interactions between natural and human systems.
- Ultra-high resolution modeling capabilities such as the Advanced Terrestrial Simulator ([ATS](#)) watershed modeling capability, the urban development model (e.g., [MOSART-](#)

[Urban](#), [CHANCE-C](#)), and the [TORRENT](#) inundation model, and other tools that can represent processes with high spatiotemporal resolution and process fidelity.

- A variety of AI/ML capabilities, such as the use of Spherical Fourier Neural Operators (SFNOs) to create Huge ENsembles (HENS) for quantifying the risk of rare events such as Tropical Cyclones and Atmospheric Rivers, the Risk Analysis Framework for Tropical Cyclones (RAFT) - a hybrid model based on physics, statistics, and deep neural networks for modeling tropical cyclone characteristics and impacts such as flooding, storm surge, and electric power outage, the E3SM AI emulator (AI2) that complements the complex physics-based E3SM, the differentiable process-learning based hydrologic model from [HypeRFACETS](#) and novel model coupling capabilities developed under IM3.
- Modeling capabilities also include a rich ecosystem of tools to support modeling efforts and model analysis, including model initialization capabilities for modified forcing experiments, data analysis workflows and toolsets (e.g. [TempestExtremes](#)), and a comprehensive platform for computing metrics and diagnostics ([CMEC](#), [PMP](#), [ILAMB](#)).

Together, the foundational EESM research and strategically focused capabilities combine to provide the integrated modeling framework that enhances discovery, predictive understanding, and energy-sector relevant insights that constitute the broader EESM Hierarchical Modeling Framework. The vision for EESM is to provide DOE with the best possible science and related information about the evolving Earth system, in order to inform planning for more robust, affordable, and diversified energy assets and infrastructures that, in turn, supports DOE's ambition to assure US leadership in energy science and innovation.

BER is seeking Earth and Environmental Systems Sciences (EESS) research in the following area:

(2) Energy, Land, and Human Interdependencies in Coastal-Urban or Coastal-Rural Systems within Earth and Environmental Systems Modeling (EESM)

Technical Contact: Renu Joseph Renu.Joseph@science.doe.gov; Daniel Winkler

Daniel.Winkler@science.doe.gov

Within the context of EESM, BER is seeking modeling research applications that address science challenges that focus on high gradient and heterogeneous regional Coastal-Urban or Coastal-Rural systems where interactions between the natural and human-related processes are important. Here, human processes include, e.g., energy and related infrastructures, the built environment, economic activity, and land use activities. Research supported by this program must leverage the DOE modeling capabilities described in the Earth and Environmental Systems Sciences section of this NOFO.

Coastal systems are tightly interconnected built and natural environments along America's coastlines that often experience rapid transitions, driven in part by weather patterns of storminess (e.g., land falling storms), storm surge, sea level change, hydrologic shifts, concentrated economic activity and infrastructure, global trade and shipping, transport and distribution (including energy), land and resource pressures, population shifts, and more. With their often-unique natural boundaries, densely populated urban components within

coastal systems are of great national importance and heightened scientific interest. For purposes of this NOFO, the term “coastal” refers to coastlines of oceans and the Great Lakes, and the scope of coastal research in this context is not limited to the precise delineation of water and land boundaries but implies a geographic domain where broader interactions of terrestrial, atmospheric, and aquatic systems and processes can be felt tens of kilometers inland of the coastal boundary. Similarly, while urban regions are densely populated areas, and rural regions are less populated, both encompass interdependent atmospheric, terrestrial, hydrologic, environmental, ecological, infrastructure, and human process interactions. Of particular interest is how intense interactions in these domains evolve, e.g., in response to trends and perturbations involving temperature, precipitation, water supply, energy production, urbanization, and other attributes of the system. Understanding how high gradient heterogeneous coastal systems function over a variety of conditions is of great significance scientifically and societally.

Applications responding to this coastal topic must focus on enhancing Model Coupling, demonstration, and evaluation to further EESM’s ability to enhance a more flexible and integrative framework for studying natural-human systems in regions either dominated by or interacting with coastal-urban or coastal-rural interfaces, where physics-based modeling combined with AI/ML and advanced techniques play central roles. Research is expected to enhance the current modeling capabilities to build and/or expand the integrative methods for analysis and prediction. Such research requires highly sophisticated toolsets based on models, observations, and other data sources; and the scientific rationale and basis for flexible and extensible coupled modeling is necessary to capture the dynamic multiscale interactions among the natural system and the human system (energy, water, and land) in coastal-urban and coastal rural regions. While “Soft” coupling (information exchange that occurs outside of a direct software connection among models) that includes extensive use of AI/ML techniques is allowed, an enhanced workflow for coupling across a hierarchical framework is encouraged.

Applications are expected to involve both (1) Model Enhancement and (2) Testing and Evaluation components:

1. Model enhancement for coupling that could include at least one of the following:
 - The enhancement of the current capabilities of DOE supported atmospheric models (e.g., EAMxx/SCREAM, ERF), terrestrial models (e.g., ELM, ATS) at these regional scales to efficiently improve representation of coastal-urban or coastal-rural processes while improving coupling of two or more components to enable better connection with the existing multisectoral models in the energy and/or water sectors. A case should be made as to why the chosen scales and models are the most appropriate for studying the proposed research.
 - and/or
 - The enhancement of the current capabilities of multisectoral models of the energy, water, and land sectors to better couple with the regional atmospheric and terrestrial

components of the natural system (like those used in IM3, but with a focus on ELM for the land model, and ERF for regional weather model).

2. Testing and evaluation of the realism of the coupling techniques in addressing enhanced understanding of the interactions between the natural system and the energy-water-land sectors in the context of a highly heterogeneous coastal-urban and/or coastal-rural system. Features of the system for new research must involve all four of the following:
 - One or more case studies to demonstrate the integrative framework of the hierarchical coupling while examining the influence of, e.g., heat waves and/or high precipitation events such as those caused by tropical cyclones, atmospheric rivers, or mesoscale convective systems.
 - An emphasis on understanding how uncertainties at the larger scales propagate downward to hyper-resolution small scales and vice versa.
 - Implications of creating hierarchical multi-model ensembles of simulations to assess the uniqueness of the (hierarchical) framework of coupling.
 - Development of rigorous and defensible metrics to evaluate the veracity of the simulations.

Additionally, all applications in response to this Coastal topic area must:

- Focus on the United States to better understand the connectivity between natural and human system across a heterogeneous landscape characterized by high gradients; specifically, those found in coastal-urban or coastal-rural regions. The goal should be to conduct simulations that enhance understanding of the natural-human system interactions and feedbacks in these regions.
- Advance an integrated multiscale modeling approach that involves human-natural systems at global, regional, local, and finer hyper-resolution scales to enhance understanding of human-natural system interactions (e.g., energy-water-land). This applies to both the “model enhancement” and the “testing and evaluation” sub-topics.
- Prediction time scales governing the research should emphasize weekly to subseasonal to decadal scales
- Include an actionable plan for evaluation and assessment of the model development activities, based on existing observations. As metrics and diagnostics are being developed, they must be included into existing DOE packages; examples of DOE packages include PCMDI Metrics Package-PMP, International Land Model Benchmarking- ILAMB, Coupled Model Evaluation Capabilities- CMEC and the E3SM diagnostics tools.
- While the proposed modeling efforts can focus on a single region or location, the full application must include a plan for illustrating how the outcome is extensible to the rest of the United States and the global Earth system.
- Use modern and sustainable software practices and workflows.
- Applicants must clearly state how the proposed work contributes to enhanced resilience of water and energy systems, either regionally or on larger scales.

Out of Scope topics for applications include:

- Collecting new observations is out-of-scope. The use of appropriate pre-existing observations is allowed.
- Any focus only on the development/use of a single model component is out of scope.
- Emphasis on climate time scales, i.e., beyond decadal is out-of-scope. .

Useful resources:

- More information on BER’s Earth system development and analysis modeling activities can be found at the [modeling project website](#) and in the strategic plan for the Earth and Environmental Systems Sciences Division. BER encourages potential applicants to review this plan in order to familiarize themselves with the EESM activities and their strategic goals. More information on E3SM is available at <https://e3sm.org/>.
- For more information about EESSD’s interests in machine learning, please refer to <https://ai4esp.org/>.
- It is anticipated but not guaranteed that successful projects will obtain computing resources through proposals to the National Energy Research Scientific Computing (NERSC) <https://www.nersc.gov/>

Fusion Energy Sciences (FES)

Program Website: <https://science.osti.gov/fes>

The mission of the Fusion Energy Sciences (FES) program is to drive the scientific and technological foundation for a fusion energy source and support the development of a competitive U.S. fusion energy industry. This is accomplished through the study of plasma, the fourth state of matter, and how it interacts with its surroundings. Section 2008 of the Energy Act of 2020 (42 U.S.C. § 18645) expanded the scientific mission of FES to support “the development of a competitive fusion power industry in the U.S.”

FES invests in flexible U.S. experimental facilities of various scales, international partnerships leveraging U.S. expertise, large-scale numerical simulations based on experimentally validated theoretical models, development of advanced fusion-relevant materials, enabling R&D, future blanket concepts and tritium fuel cycle, research in inertial confinement fusion, and innovation in measurement techniques. FES supports partnerships with the private fusion sector to accelerate the development of commercial fusion energy by combining efforts to resolve common scientific and technological challenges and enable commercially relevant fusion pilot plant designs. In addition to its fusion energy mission, FES also supports discovery plasma science and technology, which is focused on research at the frontiers of basic and low temperature plasma science and high-energy-density laboratory plasmas. Finally, FES invests in several crosscutting initiatives, such as artificial intelligence and machine learning (AI/ML), microelectronics, and quantum information science (QIS), that have practical applications and the potential to accelerate progress in several mission areas.

Please note, only early career researchers that are not eligible for the ECRP are encouraged to submit pre-applications to the DOE Office of Science FY2026 Continuation of Solicitation for the Office of Science Financial Assistance Program. Before applying, it is also encouraged to communicate with the technical contact of the subtopic area that the research most closely aligns.

References

To achieve its mission, an alignment in the FES program toward the Long-Range Plan (LRP) Fusion Materials and Technology gaps is being implemented, which connects the three science drivers: Sustain a Burning Plasma, Engineer for Extreme Conditions, and Harness Fusion Energy. FES research is guided by the LRP “Powering the Future: Fusion and Plasmas” developed by the Fusion Energy Sciences Advisory Committee (FESAC): https://science.osti.gov/-/media/fes/fesac/pdf/2020/202012/FESAC_Report_2020_Powering_the_Future.pdf

Additional resources include:

- A series of community engagement workshops (<https://science.osti.gov/fes/Community-Resources/Workshop-Reports>)
- The FES [Building Bridges](#) vision for fusion energy science
- [The 2023 Fusion fuel cycles workshop summary](#)
- National Academies reports such as:
 - the 2018 report on a [Strategic Plan for U.S. Burning Plasma Research](#)
 - the 2018 report on [Opportunities in Intense Ultrafast Lasers](#)
 - the [2020 Decadal Assessment of Plasma Science](#) report
 - the 2021 report on [Bringing Fusion to the U.S. Grid](#)

The Fusion Energy Sciences program supports research on the specific topics below:

(1) Toroidal Long Pulse: Tokamak and Stellarator Research

Technical Contact: Matthew Lanctot, Matthew.Lanctot@science.doe.gov

The Toroidal Long Pulse (TLP) area addresses gaps in the physics and technology basis for the conventional tokamak and stellarator approaches to magnetic confinement fusion. The TLP Tokamak Research area includes research on the DIII-D National Fusion Facility in San Diego, CA, small-scale tokamak research conducted on university-scale devices, and research on international tokamak facilities accessible to U.S. staff under international bilateral agreements and multi-lateral frameworks. The TLP Stellarator Research area includes research on the Helically Symmetric Experiment (HSX) in Madison, Wisconsin, and the Wendelstein 7-X stellarator in Greifswald, Germany.

This area supports foundational science, early-stage technology development, and capability development in the following priority areas:

- 1) Sustaining Burning Plasmas, which includes managing plasma transport and instabilities from energetic particles, enhancing plasma confinement, accessing and maintaining burning plasma conditions, and optimizing plasma heating and current drive strategies.
- 2) Exhaust Handling, which includes understanding the physics of tokamak divertors, managing plasma exhaust, controlling particle inventories, and integrating plasma core and edge scenarios.
- 3) Plasma Material Interactions, which includes controlling the plasma edge, testing the survivability of materials, effects from impurities on materials and plasma performance, and wall conditioning for long pulse operation.
- 4) Control of Damaging Transients and Instabilities, which includes mitigating tokamak disruptions, avoiding and preventing off-normal events, and controlling instabilities (e.g., edge localized modes, resistive wall modes, tearing modes, etc.).
- 5) Theory and Model Validation, which includes scope in artificial intelligence and machine learning, simulation support for experimental efforts, integrated control modeling and pulse design, and model validation, including uncertainty quantification.
- 6) Other activities that are essential for the operation and exploitation of conventional tokamak and stellarator facilities not covered in the areas above.

Applicants are strongly encouraged to propose research on fusion science and technology R&D that addresses gaps common to both tokamak and stellarator concepts using methodologies that exploit the unique aspects of both configurations.

(2) Compact Toroidal Concepts Research

Technical Contact: Josh King, Josh.King@science.doe.gov

The Compact Toroidal Concepts (CTC) program supports S&T research necessary to develop a compact Fusion Pilot Plant (FPP) in a toroidal geometry. Two of the most promising concepts in the CTC program are the spherical tokamak (ST) and the high magnetic field conventional tokamak. These devices offer complementary strategies for achieving compactness: STs leverage enhanced plasma physics properties—such as energy confinement time—while high-field conventional tokamaks rely on advanced high-field magnets.

This year, only applications seeking to conduct collaborative research involving the MAST-U facility will be accepted. Applications must contain clear physics deliverables. Applications to this area may involve the exploitation of existing hardware, but may not involve the implementation of new diagnostic and/or hardware capabilities. A Record of Discussion with the MAST-U leadership is required.

Research applications should be relevant to the FES Long-Range Plan, Building Bridges Vision, and Roadmap.

(3) Magnetic Fusion Energy Science Theory and Simulation

Technical Contact: Michael Halfmoon, Michael.Halfmoon@science.doe.gov

The Magnetic Fusion Theory and Simulation program focuses on advancing the scientific understanding of the fundamental physical processes governing the behavior of magnetically confined plasmas and contributes to the FES goal of developing the predictive capability needed for a sustainable fusion energy source. Specific areas of interest include:

- Macroscopic stability and dynamics of fusion plasmas, with a strong focus on the prediction, avoidance, control, and mitigation of deleterious or performance-limiting instabilities, such as plasma disruptions and other transient or off-normal events;
- Understanding and control of the multiscale, collisional and turbulent physical mechanisms responsible for the loss of heat, momentum, and particles from the confining region;
- Interaction of externally launched radiofrequency waves designed to heat the plasma and drive current, with the background plasma and surrounding structures;
- Nonlinear interaction between background plasma, various instabilities, and energetic particle populations, including the alpha particles generated by the fusion reactions, and its impact on the confinement of these particles and the overall plasma performance; and,
- The effect of multiscale and multi-physics processes at the plasma boundary, including the pedestal and scrape-off layer regions, on the plasma performance and on the interaction and interface of the hot plasma boundary with the material walls.

The efforts supported by this program provide the foundations for integrated whole-device modeling simulations of fusion systems and range from analytical work to the development and application of advanced simulation codes capable of exploiting the potential of current and next-generation high performance computers. Applications focused on transformative approaches, such as fusion-relevant computing aspects of quantum information science (QIS), are also encouraged.

(4) General Plasma Science Experiment and Theory

Technical Contact: Nirmol Podder, Nirmol.Podder@science.doe.gov

The General Plasma Science (GPS) program supports research at the frontiers of basic plasma science including laboratory plasma astrophysics. This program aims to develop accurate descriptions of the complex behavior of the plasma state, to push it into new regimes that expand our concept of what constitutes a plasma, to design experiments and diagnostics to explore these states, and to validate theoretical models. The current objective is to support hypothesis-driven, frontier-level research to significantly increase our understanding of the plasma processes that are common to both plasma astrophysics and

fusion. Applicants are strongly encouraged to develop integrated research projects in frontier plasma astrophysics, leveraging existing laboratory-based collaborative research facilities, high-performance computing, and space observation data available through NASA and other space agencies. Specific areas of interest include: (i) multi-island or plasmoid-mediated magnetic reconnection (3-D, rate, onset, particle heating and acceleration, fast release of magnetic energy, cross-scale coupling in large systems, multi-scale research from laboratory to large astrophysical system such as magnetospheric or solar plasma); (ii) Waves and turbulence (energy cascade, relaxation, dissipation, heating, acceleration, and coherent structures); and (iii) dusty plasma (dust grain formation in strong magnetic field, nucleation, agglomeration, rate, charging, growth, breakup, and transport). For more information, see GPS science drivers (e.g., Understanding Plasma Universe) in the CPP Report: [A Community Plan for Fusion Energy and Discover Plasma Sciences](#), 2019-2020 and the Report of the [Workshop on Opportunities in Plasma Astrophysics](#), 2010.

(5) Fusion Nuclear Science

Technical Contact: Heather Jackson, <mailto:Heather.Jackson@science.doe.gov>

The Fusion Nuclear Science and Enabling R&D programs focus on component, subcomponent, plant systems and ancillary technologies required to support the safe operation and maintenance of an economically and environmentally practical integrated fusion energy system. In 2023, many grass-roots workshops, organized by the community, identified research objectives for many of the subtopics listed below. Utilizing these workshops reports and the FESAC LRP, it is encouraged that proposed research aligns with these reports. Focus R&D areas include:

Fusion Breeding Blanket R&D: R&D should focus on addressing complexities of the blanket in an integrated system including but not limited to materials compatibility, mechanical and thermal stress, fusion relevant irradiation, and cooling and structural penetrations.

1. Fusion Fuel Cycle R&D: R&D should focus on outstanding technology gaps that require innovation.
2. Fusion Nuclear Engineering Analysis R&D: R&D should focus on addressing data gaps, user friendly multi-physics methods and analysis techniques that couple to plasma and first wall models. Also, analysis to understand whole system environmental and waste impacts.
3. Advancing existing technology R&D: Technologies like plasma heating, current drive, fusion magnets, MFE pellet injection, and IFE target injection currently exist but require significant innovation to enable an integrated fusion energy system.

(6) Materials Research for Fusion

Technical Contact: John Echols, John.Echols@science.doe.gov

A fusion power plant is expected to produce heat, particle, and neutron fluxes that place significant demand on materials. New materials will be necessary, and existing materials must be developed and engineered for these extreme reactor conditions expected in fusion energy devices. This research topic focuses on fusion materials research opportunities to

enable a fusion power plant. This includes a focus on both experimental and theory/modeling efforts (including machine learning and artificial intelligence) that support advancing material readiness in the specific topical areas below:

- Plasma facing materials and plasma-material interaction
- Plasma facing components that require specialized materials
- Degradation of materials by irradiation
- Functional materials with needs dictated by specific fusion application
- Manufacturability and maintainability of fusion materials

For more information, please refer to the 2021 FESAC Long-Range Plan, the 2020 community plan, and the 2025 draft materials community roadmap.

- https://science.osti.gov/-/media/fes/fesac/pdf/2020/202012/FESAC_Report_2020_Powering_the_Future.pdf
- https://drive.google.com/file/d/1w0TKL_Jn0tKUBgUc8RC1s5fIOViH5pRK
- <https://www.epri.com/research/programs/065093/events/0b97781d-e3eb-470a-ab11-97800fb84638> (see “attachments” tab)

(7) Artificial Intelligence and Machine Learning for Fusion Energy Sciences
Technical Contact: Michael Halfmoon, Michael.Halfmoon@science.doe.gov

The objective of the FES Artificial Intelligence and Machine Learning (AI/ML) activity is to support research on the development and application of AI/ML techniques that can have a transformative impact on FES mission areas. Among the areas supported are prediction of key plasma phenomena and plant states; plasma optimization and active plasma control augmented by AI/ML; plasma diagnostics enhanced by AI/ML methods; extraction of models from experimental and simulation data; and extreme data algorithms able to handle the amount and rate of data generated by fusion simulations and experiments at both existing and planned fusion user facilities. Supported activities span the full range of other FES program areas. Applications submitted to this topic should seek to advance not only a specific FES area through the application of existing AI/ML techniques but should also further develop AI/ML techniques, so they are adequate for fusion energy applications. Activities include the development of fusion data resources and frameworks.

High Energy Physics (HEP)

Program Website: <https://www.energy.gov/science/hep/high-energy-physics> or <https://science.osti.gov/hep/>

The mission of the HEP program is to understand how the universe works at its most fundamental level, which is done by discovering the elementary constituents of matter and energy, probing the interactions between them, and exploring the basic nature of space and time.

The scientific objectives and priorities for the field recommended by the High Energy Physics Advisory Panel (HEPAP) are detailed in its recent long-range strategic Particle Physics Project Prioritization Plan (P5), available at: https://science.osti.gov/-/media/hep/hepap/pdf/Reports/2024/2023_P5_Report_Single_Pages.pdf.

The HEP program is divided into four core research programs covering three experimental scientific frontiers and theory:

- *The Energy Frontier*, where powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces using highly sensitive collider-based experimental detectors;
- *The Intensity Frontier*, where intense particle beams and highly sensitive detectors are used to pursue alternate pathways to investigate fundamental forces and particle interactions by studying events that occur rarely in nature, and to provide precision measurements of these phenomena;
- *The Cosmic Frontier*, where data from the universe are used to probe fundamental physics questions and offer new insight about the nature of dark matter, cosmic acceleration in the forms of dark energy and inflation in the early universe, neutrino properties, and other phenomena; and
- *Theoretical Particle Physics*, where the vision and mathematical framework for understanding and extending the knowledge of particles, forces, space-time, and the universe are developed.

Together, these interrelated and complementary discovery research areas offer the opportunity to answer some of the most basic questions about the world around us. Also integral to the mission of HEP are the following technology research areas that enable new scientific opportunities by developing the necessary tools and methods for discoveries:

- *Accelerator Science and Technology R&D*, where the technologies and basic science needed to design, build, and operate the accelerator facilities essential for making new discoveries are developed;
- *Instrumentation and Detector R&D*, where the basic science and technologies needed to design and build the High Energy Physics instrumentation essential for making new discoveries are developed;
- *AI/ML and Computational High Energy Physics*, where computational tools, data management and analytics, and simulation techniques are developed for advancing the HEP mission; this program also supports research that uses AI/ML to advance the HEP mission, use of HEP datasets and theory to learn about fundamental AI/ML techniques, and development of the HEP AI/ML ecosystem to broaden participation in HEP AI/ML research; and
- *Quantum Information Science for High Energy Physics Research*, an interdisciplinary research area where innovative solutions for scientific discovery techniques leveraging the unique capabilities of quantum information science and technology (e.g., in sensing,

computing, and theoretical advances) are developed through partnerships with the wider quantum information science community to advance the HEP science drivers, as identified by P5, the program mission of HEP, and the SC quantum information science initiative;

- *Accelerator Stewardship and Accelerator Production*, broadly supports the Office Science mission by facilitating development of next-generation particle accelerator science and technology to support scientific research while providing technology advances and industrial strength that position the U.S. to lead the world for decades to come.

The four core research areas and the five technology research areas are collectively the nine research subprograms supported by HEP. All applications should address specific research goals in one or more of the nine subprograms (as in the examples given below), explain how the proposed research or technology development supports the broad scientific objectives and mission of the HEP program, and aligns with its priorities. Applications where the investigator is proposing to conduct research across multiple HEP research subprograms during the project period will be considered, but PIs should note that in initial merit review of the applications, all applications are assigned to groups in one (and only one) subprogram area. In addition, applications that use modern data science approaches (e.g., artificial intelligence, machine learning, graph theory, uncertainty quantification, etc.) to accelerate scientific discovery of any of the HEP subprograms would be considered to be within the scope of that subprogram.

Additional information about the HEP research subprogram areas described above, and in areas

(1) through (9) given below, may be found at <https://science.osti.gov/hep/research/>. Each of the research frontiers is described with a list of currently supported experiments and facilities. PIs are encouraged to discuss their particular research interests, and how they relate to HEP's subprograms, with one of the technical contacts listed below.

Applications submitted to this NOFO for support of generic (i.e., broadly applicable) HEP detector R&D efforts should be directed to the Detector Research and Development subprogram research area described below. However, applicants proposing physics studies and/or R&D efforts directed towards a specific experiment or initiative within an experimental frontier should submit their application to the relevant HEP scientific frontier subprogram research area.

HEP Research Subprogram Areas:

(1) Experimental Research at the Energy Frontier in High Energy Physics
Technical Contact: Abid Patwa, Abid.Patwa@science.doe.gov

This research area seeks to support studies of fundamental particles and their interactions using particle beam collisions at the highest possible energies and/or luminosities. This is

accomplished through direct detection of new phenomena or through sensitive measurements that probe the Standard Model and new physics beyond it. In particular, applications are sought for physics research utilizing data being collected at the Large Hadron Collider (LHC) by the ATLAS (A Toroidal LHC Apparatus) and CMS (Compact Muon Solenoid) experiments. This research area also provides undergraduate, graduate and postdoctoral research training for the next generation of scientists, and equipment and computational support for physics research activities. Applications addressing physics studies, design, and pre-conceptual R&D directed towards specific future proposed Energy Frontier collider experiments are also accepted. Support for heavy-ion physics research is not provided under this research area.

(2) Experimental Research at the Intensity Frontier in High Energy Physics
Technical Contact: Brian Beckford, Brian.Beckford@science.doe.gov

This research area seeks to support precision studies that are sensitive to new physical processes at very high-energy scales, beyond what can be directly probed with energy frontier colliders, and that often require intense particle beams. This research area includes studies of the fundamental properties of neutrinos produced by a variety of sources, including accelerators and nuclear reactors; studies of rare processes or precision measurements probing new physics processes as described above, with either high intensity stored beams or beams incident on fixed targets; and studies of high intensity electron-positron collisions. Undergraduate, graduate, and postdoctoral research training for the next generation of scientists, and equipment and computational support for physics research activities are also provided. Applications addressing physics studies and pre-conceptual R&D directed towards specific future Intensity Frontier experiments are also accepted. Support for the Large Hadron Collider beauty experiment (LHCb) research or studies of neutrinoless double beta decay is not provided under this research area.

(3) Experimental Research at the Cosmic Frontier in High Energy Physics
Technical Contact: Bryan Field (Cosmology and Dark Energy),
Bryan.Field@science.doe.gov;
Manuel Bautista (Dark Matter), Manuel.Bautista@science.doe.gov;
Kathy Turner, Kathy.Turner@science.doe.gov

This research area seeks to support precision studies using observations of the cosmos and naturally occurring cosmic particles to understand the properties of fundamental particles and fields. Priorities include the study of cosmic acceleration by studying the nature of dark energy, planning the next-generation ground-based cosmic microwave background experiment to explore the inflationary epoch, and using direct-detection experiments to search for dark matter particles. Many of the experiments in the program also place constraints on neutrino masses.

Measurements using high-energy cosmic rays, gamma rays and other phenomena are included, but at a lower priority. Applications are sought for physics research efforts in support of current experiments in the Cosmic Frontier, as well as physics studies and pre-conceptual planning directed towards specific future experiments being considered for the program. This research area also provides undergraduate, graduate and postdoctoral research training for the next generation of scientists, and equipment and computational support for physics research activities.

Research efforts aimed at developing techniques or understanding experimental data within the context of theoretical models that are expressly for, or as part of, an experimental research collaboration are included in this area. General theoretical or computational research applications not specifically carried out as part of a particular Cosmic Frontier experimental collaboration should be directed to the Theoretical Research in High Energy Physics subprogram. Studies of gravitational physics (other than for cosmic acceleration), classical astrophysics phenomena, fundamental symmetries, or planning for future cosmic ray or gamma ray experiments are not included in this research area.

(4) Theoretical Research in High Energy Physics

Technical Contact: William Kilgore, William.Kilgore@science.doe.gov

This research area seeks to support theoretical activities that provide the vision and the mathematical framework for understanding and extending our knowledge of particles, forces, space-time, and the universe. Theoretical research is essential to support current experiments at the Energy, Intensity and Cosmic Frontiers, to identify new directions for High Energy Physics and to provide a deeper understanding of nature. Topics studied in theoretical high energy physics research include but are not limited to: phenomenological studies that seek to interpret experimental data, suggest searches for new physics at existing facilities and develop a research program for future facilities; precision calculations of experimental observables to test our current theories at the level of quantum corrections; the development of new models of physical interactions to describe unexplained phenomena or to unify seemingly distinct concepts; progress in quantum field theory, quantum gravity and other possible frameworks to develop a deeper understanding of nature; quantum information science to extend the reach of HEP theory; and the development of analytical and numerical techniques to facilitate studies in these areas. This research area also provides undergraduate, graduate and postdoctoral research training for the next generation of scientists and the computational resources needed for theoretical calculations. Activities that rely on experimental data, or are performed expressly for, or with, an experimental research collaboration, are not included in this research area.

(5) Accelerator Science and Technology Research & Development in High Energy Physics

Technical Contact: Derun Li, Derun.Li@science.doe.gov

The Accelerator Science and Technology R&D subprogram develops the next generation of particle accelerators and related technologies that are essential for discoveries in HEP. This research area supports world-leading research in the physics of charged particle beams and long-range, early-stage exploratory research aimed at developing new acceleration concepts. This subprogram also provides undergraduate, graduate and postdoctoral research training, equipment for experiments and related computational efforts.

Topics studied in the Accelerator Science and Technology R&D subprogram include, but are not limited to: accelerator and beam physics, including the development of analytic and computational techniques for modeling particle beams and simulation of accelerator systems; novel acceleration concepts; the science of high gradients in accelerating cavities and structures; high-power radio-frequency sources; high-power targets; high-brightness beam sources; and beam instrumentation and controls. Also of interest are superconducting materials and conductor development for high field magnets; innovative magnet design and development of high-field superconducting magnets; as well as associated testing and cryogenic systems. R&D applications which are focused on accelerator uses outside of high-energy physics continue to be coordinated through the Accelerator Stewardship program, see section (9) below.

(6) Instrumentation and Detector R&D in High Energy Physics

Technical Contact: Helmut Marsiske, Helmut.Marsiske@science.doe.gov

The Detector R&D subprogram develops the next generation of instrumentation for HEP and fosters the next generation of detector experts. It supports research leading to fundamental advances in the science of particle and radiation detection, and the development of new, HEP- relevant technologies and experimental techniques. This is typically long-term, “generic” R&D that is high-risk, but has the potential for wide applicability and/or high impact. Applications should broadly align with the priority research directions identified in the report of the FY 2020 HEP Detector R&D Basic Research Needs study. Moreover, applications for “Blue-Sky” scientific research on innovative technologies not already in contention for implementation in future HEP projects are strongly encouraged.

Topics studied in the Detector R&D research area include but are not limited to: low-mass, high channel density charged particle vertexing and tracking detectors; high resolution, fast-readout calorimeters and particle identification detectors; techniques for improving the radiation tolerance and fast-timing capabilities of particle detectors; detectors for photons from ultraviolet to infrared wavelengths; detectors for cosmic microwave background radiation; detectors and experimental techniques for low-mass dark matter and ultralow-background experiments, including those enabled by advances in QIS; and advanced front-end electronics and data acquisition systems, including those enabled by advances in 3D heterogeneous integration and real-time, edge AI/ML. Support for undergraduate, graduate, and postdoctoral research training, engineering and other technical efforts, and equipment

and computational efforts required for experimental detector R&D is included in this research area.

(7) Computational Research in High Energy Physics

Technical Contact: Jeremy Love, Jeremy.Love@science.doe.gov

This research area supports advanced computing research and development targeting challenges that are or have the capability of being broadly applicable to the increasingly complex HEP computing ecosystem. These challenges may include hardware-software co-design, development of collaborative software infrastructure, and research into high performance software and algorithms. These advanced computing techniques may include development of AI/ML techniques and novel applications that go well beyond current research standards, research that exploits unique aspects of HEP to learn about fundamental AI/ML techniques, and development that broadens participation in HEP AI/ML research. This subprogram also facilitates the effective use of DOE computing resources including, but not limited to, high-performance computing.

This program seeks applications into forward looking blue-sky research and the development needed to realize the benefit to the HEP community.

(8) Quantum Information Science in High Energy Physics (HEP-QIS)

Technical Contact: Zachary Goff-Eldredge, Zachary.Goff-Eldredge@science.doe.gov

The HEP QIS subprogram supports the “science first” approach of the National Quantum Strategy through National QIS Research Centers and individual research grants, applying HEP techniques to QIS and vice versa. The objectives are to support QIS research and technology development that extends the scientific reach of existing HEP programs well beyond what is currently achievable; or uses HEP experimental and theoretical techniques to improve the understanding of the theoretical and practical capabilities and limitations of complex quantum systems.

Applications are sought that are well aligned with the HEP program priorities. Research that advances the P5 science drivers, or development of new QIS-based technologies that have the potential to extend paths of investigation for HEP beyond what was considered in the P5 report, are encouraged. Applications of QIS techniques and technology that potentially benefit multiple HEP research areas are particularly sought; as are innovative approaches that can deliver significant advances to HEP or QIS experimental reach or theoretical understanding via interdisciplinary approaches. Research that exploits HEP theoretical understanding, experimental data, or simulations to provide important insights into general QIS methods and range of applicability are also encouraged. Topics include: implications of quantum entanglement for quantum gravity and other fundamental questions of HEP theory; quantum computing as applied to current research topics in HEP; quantum simulation for HEP theory and experiments; theoretical and experimental

development of quantum sensors for HEP science; and demonstration and integration of quantum information technology in HEP experiments.

This subprogram does not support general (that is, not HEP-specific) quantum computing research, algorithms, or hardware; or quantum communications or networking R&D. Similarly, research supported through this effort must make specific use of the tools of quantum information science and technology, including but not limited to entanglement, squeezing, state preparation, or quantum information processing.

(9) Accelerator Stewardship and Accelerator Production

Technical Contact: Eric R. Colby, Eric.Colby@science.doe.gov

The mission of the [Accelerator Stewardship and Accelerator Development](#) subprograms (“Accelerator Stewardship”) is to broadly support the Office of Science mission by facilitating development of next-generation particle accelerator science & technology to support scientific research while providing technology advances and industrial strength that position the U.S. to lead the world for decades to come. A key aspect of this mission is to develop a workforce with expertise in effective technology transfer of R&D and accelerator component engineering, including manufacturing risk reduction, cost reduction, and high-efficiency accelerator technologies.

Accelerator Stewardship Early Career Awards aim to develop scientists and engineers who are fully conversant in the motivation, methods, and outcomes of both academic and industrial research in particle accelerator technology. The successful applicant will collaborate with one or more domestic industrial partners to jointly perform basic R&D, technology transfer, and industrialization of accelerator technology. The chosen technology R&D must be identified as critical for multiple Office of Science programs and benefits to other federal agency missions, industrial, and/or medical applications will further strengthen the application.

Applications that seek to perform only basic R&D, lack robust industrial collaboration, and/or are aimed at one specific Office of Science program’s needs should not apply under this area.

Nuclear Physics (NP)

Program Websites: <https://www.energy.gov/science/np/nuclear-physics> or <https://science.osti.gov/np>

The mission of the Nuclear Physics (NP) program is to explore the nature of matter: its basic constituents and how they interact to form the elements and the properties we observe. The largest contribution by far to the mass of the matter we are familiar with comes from protons, neutrons, and heavier nuclei. Although the fundamental particles that compose nuclear matter—quarks and gluons—are themselves relatively well understood, exactly how

they interact and combine to form the different types of matter observed in the universe today and during its evolution remains largely unknown.

The priority areas for NP are described in [*A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science*](#) and include the following:

- Develop experiments, methods and techniques to accurately describe and predict the interactions between neutrons and protons that drive nuclear structure and nuclear reactions.
- Advance forefront nuclear physics to determine how quarks and gluons make up protons, neutrons, and atomic nuclei.
- Use atomic nuclei to uncover physics beyond the Standard Model.
- Connect multi-messenger and nuclear physics observables to characterize the nuclear processes that drive the birth, life, and death of stars.
- Conceive, construct, and operate national scientific user facilities and develop novel detector and accelerator instrumentation and technologies.

Within each of these priority areas, unique nuclear physics opportunities to advance or benefit from artificial intelligence (AI), machine learning (ML), new developments in microelectronics, and R&D integration which advance detector and imaging technologies are also of NP programmatic interest. Applicants are encouraged to contact the relevant subprogram manager.

To carry out its mission and address these priorities, the NP program addresses three boards, yet tightly interrelated, scientific thrusts: Quantum Chromodynamics (QCD); Nuclei and Nuclear Astrophysics; and Fundamental Symmetries and Neutrinos. NP supports basic research in seven subprograms or areas: Medium Energy, Heavy Ion, Nuclear Structure and Nuclear Astrophysics, Fundamental Symmetries, Nuclear Theory and Nuclear Theory Computing, and Nuclear Data (1 through 7). The program is also the steward of Accelerator Research and Development for NP Facilities (8). Quantum Information Science for Nuclear Physics Research (9) supports the QIS initiative and leverages opportunities for Nuclear Physics to benefit from advances in this topical area. Additional information about the NP research subprogram areas described above, and in areas (1) through (9) given below, may be found at <https://science.osti.gov/np/research/>.

The NP subprograms and their objectives follow:

(1) Medium Energy Nuclear Physics

Technical Contact: Gulshan Rai, Gulshan.Rai@science.doe.gov

The Medium Energy Nuclear Physics subprogram focuses primarily on understanding the structure of hadrons, how quarks move within a hadron and tests of the theory of the strong interaction, known as Quantum Chromodynamics (QCD). According to QCD, all observed

nuclear particles, collectively known as hadrons, arise from the strong interaction of quarks, antiquarks, and gluons. The protons and neutrons inside nuclei are the best-known examples of hadrons. QCD, although difficult to solve computationally, predicts what hadrons exist in nature, and how they interact and decay. Specific questions addressed include: *What is the internal landscape of the protons and neutrons (collectively known as nucleons)? What does QCD predict for the properties of strongly interacting matter? What governs the transition of quarks and gluons into pions (hadronic subatomic particle) and nucleons? What is the role of gluons and gluon self-interactions in nucleons and nuclei?* The objectives of this subprogram are to develop a comprehensive picture of the spatial, momentum and angular momentum structure of the nucleon, elucidate quark confinement and hadron excitations, and understand the strong interaction in nuclei. Various experimental approaches are used to determine the distribution of “up”, “down”, and “strange” quarks, their antiquarks, and gluons within protons and neutrons, as well as clarifying the role of gluons in confining the quarks and antiquarks within hadrons, and the origin of mass in mesons and baryons.

Polarized electron and proton beams are typically used to study the effects of the quark and gluon spins within nucleons, and the effect of the nuclear environment on the quarks and gluons. The subprogram also supports experimental searches for higher-mass “excited state” and exotic hadrons predicted by QCD, as well as studies of their various production mechanisms and decay properties. In pursuing these topics, the Medium Energy subprogram supports experimental research at the subprogram’s primary research facility, the Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF), and at other facilities, including the Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL), the High Intensity Gamma Source (HIGS) at the Triangle Universities Nuclear Laboratory (TUNL) and the future Electron-Ion Collider (EIC). Also of interest are R&D of concepts and emerging technologies in AI and ML that go beyond the simple use case for available software packages.

(2) Heavy Ion Nuclear Physics

Technical Contact: Spyridon (Spiros) Margetis, Spyridon.Margetis@science.doe.gov

The Heavy Ion Nuclear Physics subprogram focuses on studies of condensed quark-gluon matter at extremely high densities and temperatures characteristic of the infant Universe. Only two facilities in the world are capable of exploring the properties nuclear matter in these conditions, the U.S. Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory and the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN). The goal is to explore and understand unique manifestations of QCD in this many-body environment and their influence on the Universe’s evolution. Important avenues of investigation are directed at resolving properties of the quark gluon plasma at different length scales and learning more about its physical characteristics including its temperature, the energy loss mechanism for quarks and gluons traversing the plasma,

determining the speed of sound in the plasma, measuring the effect of the chiral magnetic force, understanding how quarks fragment and recombine to form hadronic matter (hadronization), and locating a possible critical point for the transition between the plasma and normal matter. Experimental research is carried out primarily using the RHIC facility, the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN) and the future Electron-Ion Collider (EIC). Also of interest are R&D of concepts and emerging technologies in AI and ML that go beyond the simple use case for available software packages.

(3) Nuclear Structure and Nuclear Astrophysics

Technical Contact: Spyridon (Spiros) Margetis, Spyridon.Margetis@science.doe.gov

The Nuclear Structure and Nuclear Astrophysics subprogram focuses on high-impact science with proton-rich and neutron-rich nuclei, searches for super-heavy elements as well as nuclear processes that inform our understanding of stellar nucleosynthesis, neutron stars, and Big Bang nucleosynthesis. Both frontiers are identified in [*A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science*](#).

The subfield of nuclear structure addresses the underlying nature of atomic nuclei and the limits of their existence. It also aims to describe dynamical processes such as nuclear reactions and fission. The goal is to develop a predictive understanding of nuclei and their interactions grounded in fundamental QCD and electroweak theory; furthermore, this understanding must be based on experimental data from a wide variety of nuclei.

Nuclear astrophysics addresses the role of nuclear physics in our universe. As a field at the interface of astrophysics and nuclear physics, it is concerned with the impact of nuclear processes on the evolution of the universe, the role of nuclear structure in influencing the evolution of the cosmos, and the cosmogenic origin of elements that are the building blocks of life. It is a broad discipline that can identify new observational signatures probing our universe. Nuclear astrophysics can identify the conditions at the very core of stars and provide a record of the violent history of the universe.

Major goals of this subprogram are to develop a comprehensive description of nuclei across the entire nuclear chart, to utilize rare isotope beams to reveal new nuclear phenomena and structures unlike those that are derived from studies using stable ion beams, and to measure the cross sections of nuclear reactions that power stars and spectacular stellar explosions and are responsible for the synthesis of the elements. Experimental research is currently carried out primarily at the Argonne Tandem Linac Accelerator System (ATLAS), the Facility for Rare Isotope Beams (FRIB) at Michigan State University, the 88-Inch Cyclotron at Lawrence Berkeley National Lab, the Texas A&M University Cyclotron Institute, and the Triangle Universities Nuclear Laboratory (TUNL) at Duke University.

(4) Fundamental Symmetries

Technical Contact: Paul Sorensen, Paul.Sorensen@science.doe.gov

This subprogram investigates aspects of the third thrust, Fundamental Symmetries and Neutrinos. Questions addressed in Fundamental Symmetries include: *What is the nature of the neutrinos, what are their masses, and how have they shaped the evolution of the universe? Why is there now more matter than antimatter in the universe? What are the unseen forces that were present at the dawn of the universe but disappeared from view as the universe evolved?* Specifically, the subprogram seeks to support: research to measure the neutrino mass and to determine if the neutrino is its own antiparticle; experiments with cold and ultra-cold neutrons to investigate the dominance of matter over antimatter in the universe, and to determine the lifetime of the neutron; experiments to illuminate the fundamental symmetries of nature through precise measurements of beta decay and searches for anomalous parity violation; research on other aspects of Fundamental Symmetries and Interactions involving nuclei. A major focus of this sub program is furthering progress towards a major priority of [A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science](#): the advancement of a neutrino-less double beta decay campaign to determine whether the neutrino is its own anti-particle.

(5) Nuclear Theory

Technical Contact: Astrid Morreale, Astrid.Morreale@science.doe.gov

The Theoretical Nuclear Physics subprogram provides the formal mathematical aspects of physics needed to explain the fundamental nature of the world around us. Theory research supports the interpretation of a wide range of data obtained from all the other Nuclear Physics subprograms and advances new ideas and hypotheses to stimulate experimental investigations. This subprogram addresses all scientific thrusts described in [A New Era of Discovery: The 2023 Long Range Plan for Nuclear Science](#). Theoretical research on QCD (the fundamental theory of quarks and gluons) addresses the questions of how the properties of the nuclei, hadrons, and nuclear matter observed experimentally arise from this theory, internal structure of nucleons and nuclei at sub-femtometer distance in terms of quarks and gluons and their dynamics, how the phenomenon of quark confinement arises, and what phases of nuclear matter occur at high densities and temperatures. In Nuclear Structure and Nuclear Astrophysics, theorists investigate a broad range of topics, including calculations of the properties of stable and unstable nuclear species, the limits of nuclear stability, the various types of nuclear transitions and decays, how nuclei arise from the forces between nucleons, and how nuclei are formed in cataclysmic astronomical events such as supernovae and neutron star mergers. In Fundamental Symmetries and Neutrinos, nucleons and nuclei are used to test the Standard Model, which describes the interactions of elementary particles at the most fundamental level. Theoretical research in this area is concerned with determining how various (beyond) Standard Model aspects can be explored through nuclear physics experiments, including the interactions of neutrinos, unusual nuclear transitions, rare decays, and high-precision studies of cold neutrons.

(6) Nuclear Theory Computing

Technical Contact: Astrid Morreale, Astrid.Morreale@science.doe.gov

The Nuclear Physics Computing subprogram supports research in nuclear physics that relies on large-scale, high-performance computing. The topical areas this subprogram supports include: 1) low energy nuclear physics; 2) the properties and structure of nuclei and nuclear interactions; 3) the internal structure of nucleons in terms of quarks and gluons; 4) hadron spectra and exotic states of QCD; 5) neutrino and electron interactions in nuclei and dense nuclear matter; 6) properties of quark-gluon plasma; and 7) nuclear astrophysics and nucleosynthesis. The Nuclear Physics Computing subprogram also supports the development of Lattice QCD computations and techniques that are critical to the understanding of nuclei, nuclear reactions, hadron structure, and the dynamics of strong interactions.

Of particular interest is the development of research software and advanced computing algorithms that are broadly applicable across the NP computing ecosystem, including the development of AI/ML techniques and novel applications unique to NP research.

(7) Nuclear Data

Technical Contact: Keith Jankowski, Keith.Jankowski@science.doe.gov

The mission of the United States Nuclear Data Program (USNDP) is to provide current, accurate, authoritative data for workers in pure and applied areas of nuclear science and engineering. This is accomplished primarily through the compilation, evaluation, dissemination, and archiving of extensive nuclear datasets. The USNDP also addresses gaps in the data, through targeted experimental studies and the use of theoretical models. An interagency program, led by NP, continues to address critical gaps in nuclear data and the modernization of nuclear data preservation and governance by incorporating new tools such as AI/ML. The USNDP involves the efforts of ~ 50 nuclear physicists at ~ 15 national labs, research centers, institutes and universities, and is an important resource for workers in a wide range of pure and applied topics in nuclear physics.

This research opportunity aims to dramatically improve the nuclear data pipeline (data collection, curation, evaluation, and dissemination) such that new evaluated data can reach the end users much faster. This will impact areas of basic nuclear science, as well as application areas such as non-proliferation, energy (fission and fusion), space exploration, and medicine. Specific nuclear data pipeline areas of interest include improvements to data compilation from literature (data collection), modernization of nuclear data libraries (data curation, formats, dissemination), accelerating evaluations, and approaches to open data, preservation, governance, and processing codes.

This research topic is interested in improvements to the nuclear data pipeline only. Submissions proposing to improve specific nuclear data will be considered out-of-scope.

(8) Accelerator Research and Development for NP Facilities

Technical Contact: Manouchehr Farkhondeh, Manouchehr.Farkhondeh@science.doe.gov

NP supports a broad range of activities aimed at research and development related to the science, engineering, and technology of heavy ion, electron, and proton accelerators and associated systems, as well as a suite of scientific instrumentation implemented at accelerator facilities around the world and also operating in standalone mode. The focus of accelerator research and development activities is at the four NP-supported, accelerator-based national user facilities <https://science.osti.gov/np/Facilities/User-Facilities/>. NP is also constructing the high energy, polarized Electron-Ion Collider (EIC) at BNL.

NP also supports research and development in emerging technologies in artificial intelligence (AI) and machine learning (ML) with focus on increasing operational efficiencies at the NP-supported, accelerator-based user facilities. The AI/ML research and development opportunities aim to improve beam availability, reduce the time needed to characterize scientific instrumentation, and enhance nuclear physics numerical modeling. The goal is to develop core competencies and transformative technologies that significantly advance state-of-the-art AI and data analytics capabilities in accelerator science and nuclear physics research.

(9) Quantum Information Science for Nuclear Physics Research

Technical Contact: Gulshan Rai, Gulshan.Rai@science.doe.gov

Quantum Horizons: QIS Research and Innovation for Nuclear Science is an initiative to identify, prioritize, and coordinate emerging opportunities in both fundamental research and applied challenges at the interface of Nuclear Physics and Quantum Information Science (QIS). QIS is a rapidly developing interdisciplinary field and has been identified as an important cross-cutting topic and where continued leadership is critically important to our nation's national security and economic competitiveness. Emerging priority areas in QIS provide new opportunities to address challenges of enormous interest and complexity in NP.

[NP's Quantum Horizons](#) emphasizes the science-first approach and supports research that could, in the long-term, have a transformative impact on the NP mission area and/or advance QIS development enabled by NP-supported science, technologies, and laboratory infrastructure.

Likewise, QIS technologies offer the ability to discover and probe the fundamental structure and behavior of Nature with unprecedented sensitivity and accuracy. Topics may include quantum computation, quantum simulations and simulators, quantum sensing, quantum-enhanced nuclear physics detectors, nuclear many-body problems, 'squeezed' quantum

states, nuclear qubits, quantum entanglement, and implementation of NP theories on quantum hardware, as well as other novel areas of basic research and technologies. Topics and subject areas which are outside the scope of NP's Quantum Horizons initiative are listed in a prior NOFO (DE-FOA-0002514), which may be accessed at: https://science.osti.gov/-/media/grants/pdf/foas/2021/SC_FOA_0002514.pdf.

This subprogram specifically encourages the exploitation of the interdisciplinary nature of Quantum Computing and QIS to expand the frontiers of the NP program and the national QIS enterprise through partnerships with Universities, National Laboratories and Industry. Prospective investigators are encouraged to contact the subprogram manager.

Isotope R&D and Production (DOE IP)

Program Website: <https://science.osti.gov/Isotope-Research-Development-and-Production>

The mission of the Office of Isotope R&D and Production (IRP) is to ensure American dominance in isotope production through a multi-faceted strategy that includes securing a reliable domestic supply, fortifying critical infrastructure, achieving U.S. science supremacy, and ensuring American isotope independence. Only the basic, fundamental, and use-inspired research portion of the IRP mission is supported by this NOFO. Isotopes are high-priority commodities of strategic importance for the Nation and are essential in medical diagnosis and treatment, discovery science, national security and preparedness, industrial processes and advanced manufacturing, space exploration and communications, biology, archaeology, quantum science, and other fields. Isotopes can directly enable emerging technology and contribute to the economic, technical and scientific strength of the United States.

The IRP relies on expertise across numerous technical disciplines to accomplish its mission, including nuclear and radiochemistry, nuclear physics, accelerator and reactor science, materials science and engineering, separations science, nuclear data, and others. The IRP utilizes domestic facilities and capabilities throughout the national laboratory complex and at domestic universities for the production and distribution of stable and radioactive isotopes to promote a reliable, domestic supply of isotopes to research, federal, and commercial entities. Facilities utilized by the IRP include particle accelerators, nuclear research reactors, enrichment technologies, and radiochemical processing capabilities throughout the national laboratory complex and at universities. Isotope production capabilities are located at Argonne National Laboratory, Brookhaven National Laboratory, Idaho National Laboratory, Los Alamos National Laboratory, Oak Ridge National Laboratory, Pacific Northwest National Laboratory, Savannah River National Laboratory, Michigan State University, Texas A&M University, University of Alabama-Birmingham, University of Missouri, University of Washington, and University of Wisconsin-Madison.

IRP supports world-leading R&D associated with creating innovative and more efficient isotope production and processing techniques. Core research competencies associated with

the IRP R&D portfolio include radio and nuclear chemistry, advanced targetry, artificial intelligence (AI) and machine learning (ML), robotics, automation and advanced manufacturing concepts. Research, development, and fabrication of equipment directed toward any IRP mission relevant topic may be proposed, but applications including extensive projects requiring detailed review of scope, budget, and schedule beyond the procedures for this announcement should first be socialized with the Program Office. Additionally, applications should not attempt to bolster the case for facilities or major items of equipment not currently approved for funding or not expected to be available during the proposed work.

While not an exhaustive list, three broad basic, fundamental, and use-inspired research topics of interest to the IRP R&D portfolio are listed below. The topics seek basic research supporting the development of advanced, cost-effective, and efficient technologies for producing, processing (including isotopic separations, and the development of biological tracers), extracting, recycling, and distributing isotopes in short supply as well as aspects related to stable isotopes. Workforce development is viewed as an essential component of the Program's R&D portfolio.

Excluded from this call are applications related to the production of Mo-99 and Pu-238, as these isotopes are under the purview of the National Nuclear Security Administration Office of Materials Management and Minimization and the DOE Office of Nuclear Energy, respectively. Additional information about the IRP may be found at: <https://science.osti.gov/Isotope-Research-Development-and-Production>.

(1) Targetry and Isotope Production Research

Technical Contact: Ethan Balkin, Ethan.Balkin@science.doe.gov and April Gillens, april.gillens@science.doe.gov

Applications to this topic should be focused on basic research supporting novel or improved capabilities for inducing transmutation of atoms in targets to create radioisotopes that strongly align with the DOE IPIRP mission space inclusive of any potential workforce development activities (e.g., travel bursaries for students and postdoctoral trainees to present results at scientific conferences). This includes aspects of targetry and target fabrication in a variety of form factors and batch sizes (e.g., milligrams to kilograms), low-loss advanced manufacturing techniques, as well as the development of innovative approaches, including integration of Artificial Intelligence and Machine Learning (AI and ML) techniques to model and predict the purity and processing of stable isotope products as well as the behavior of targets undergoing irradiation to optimize yield and minimize target failures during routine isotope production. It is understood that accelerator- and reactor-based isotope production have different considerations. Applications Submissions to this topic can address either production modality. Robotics and advanced manufacturing techniques, as they apply to isotope production and processing, may also be proposed. Studies aimed at the development of automated techniques to enhance the efficiency and

safety of materials processing are also encouraged. Uses of AI or ML might include, but are not limited to: multi-physics modeling, and advanced manufacturing. Note: All applications should first be discussed with the subprogram contacts listed above.

(2) Nuclear and Radiochemical Separation, Purification, and Radiochemical Synthesis

Technical Contacts: Ethan Balkin, Ethan.Balkin@science.doe.gov and April Gillens, April.Gillens@science.doe.gov

Work in this topic is broadly applicable to basic research supporting the improvement and/or development of novel chemical and physical processes to recover and purify radioisotopes from multiple sources activated targets or further refinement and purification of stable isotope feedstocks and final products. Applications proposing scopes of work dealing with isotopes resulting from activated targets along with those not necessarily resulting from direct transmutation of target material (e.g., the recovery and purification of radioisotopes from legacy materials, facility components, used nuclear fuel, or waste streams/effluents of other processing efforts) are also considered responsive. Scopes of work should be strongly aligned with the DOE IPIRP mission space inclusive of any potential workforce development activities (e.g., travel bursaries for students and postdoctoral trainees to present results at scientific conferences).

Additionally, basic research supporting the development or synthesis of chemical constructs or processes with physical or chemical properties that make them particularly useful in the isotope science landscape (e.g., the synthesis and development of novel chelating agents selective ion trapping ligands, chromatography resins, other novel separation technologies, or methods leading to increased fluoride to oxide conversion efficiencies for enriched solid or gaseous feedstocks) or other ligands) are programmatically very relevant. Development of automated production and processing techniques to enhance the efficiency and safety of radioisotope production and processing (including uses of AI or ML and advanced manufacturing) are also encouraged. It is important to note that the development of purification and separation techniques may, but do not have to, include the handling of radioactive materials or irradiation of targets (e.g., experiments based on surrogate material are acceptable). All applications should first be discussed with the subprogram contacts listed above.

(3) Biological Tracers, Imaging and Therapeutics

Technical Contact: Ethan Balkin, Ethan.Balkin@science.doe.gov

Work on this topic should be focused on the development of isotopes that might be useful as biological tracers, imaging and/or therapeutic agents. The development or modification of chemical constructs which have physical or chemical properties that make them particularly useful with the appropriate isotope(s) would also be considered responsive. Included in this topic are the modification of existing agents, synthesis and development of:

novel chelating agents or other ligands, pharmacokinetic modifying linkers, or other hydrodynamic volume altering compounds. Please note that the DOE IP funds only basic science R&D. Studies investigating the applications of isotopes will not be considered for funding.

Multi-Institutional Teams

SC uses two different mechanisms to support teams of multiple institutions.

COLLABORATIVE APPLICATIONS

Collaborative applications (in which each team member submits its own application with a common Project Narrative) will not be accepted under this NOFO.

SUBAWARDS¹

Multi-institutional teams must submit one application from a designated lead institution with all other institutions proposed as subrecipients.

DOE/National Nuclear Security Administration (NNSA) National Laboratories² may be proposed as subrecipients. DOE/NNSA National Laboratories are eligible to submit applications under this NOFO. If recommended for funding as a lead applicant, funding will be provided through the DOE Field Work Proposal System. If recommended for funding as a proposed subawardee, the value of the proposed subaward will be removed from the prime applicant's award and will be provided to the laboratory through the DOE Field-Work Proposal System.

Open Science

SC is dedicated to promoting the values of openness in Federally supported scientific research, including, but not limited to, ensuring that research may be reproduced and that the results of Federally supported research are made available to other researchers. These objectives may be met through any number of mechanisms including, but not limited to, data access plans, data sharing agreements, the use of archives and repositories, and the use of various licensing schemes.

¹Subawards are made to subrecipients. Both terms are defined in 2 CFR 200.1 (<https://www.ecfr.gov>)

²The phrase "National Laboratories" is used broadly to encompass DOE/NNSA laboratories and sites capable of performing the work described in this NOFO and capable of receiving funds through the DOE Field Work System.

The use of the phrase “open-source” does not refer to any particular licensing arrangement but is to be understood as encompassing any arrangement that furthers the objective of openness.

Export Control and Technology Transfer

All entities submitting applications to this NOFO must recognize the moral and legal obligations to comply with export controls and policies that limit the transfer of technologies with potential dual use. Applicants are reminded that international activities must comply with nonproliferation, sanction, and other protocols described at <https://www.trade.gov/us-export-controls>.

International activities related to special nuclear materials (SNM) are subject to additional requirements. Please see 10 CFR 810 for further information.

All work proposed under this NOFO must be for basic and fundamental research whose results may be published in scholarly literature. Do not submit applications containing restricted data or unclassified controlled nuclear information as defined in the Atomic Energy Act of 1954, as amended, 42 USC 2011, et seq., 10 CFR 1017, 10 CFR 1045.

C. Award Contribution to Goals and Objectives

Awards resulting from this NOFO are intended to increase the scientific community’s understanding of scientific phenomena.

D. Performance Goals

Investigators receiving an award will be expected to demonstrate progress toward increasing knowledge in periodic progress reports.

E. Substantial Involvement

Not applicable.

F. Program Unallowable Costs

You must apply the cost principles of 2 CFR 200, as supplemented by 2 CFR 910 and 10 CFR 605, to your application and any resulting award.

G. Citations to Statute and Regulations

The programmatic authorizing statute is:
Section 646 of Public Law 95-91, U.S. Department of Energy Organization Act

Section 901, et seq. of Public Law 109-58, Energy Policy Act of 2005

Applicable regulations are:

Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 CFR 200

U.S. Department of Energy Financial Assistance Rules, codified at 2 CFR 910

U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR 605

H. Program History

You can learn about SC's history at <https://science.osti.gov/About/History>. You can read about our achievements at <https://science.osti.gov/Science-Features/Science-Highlights>.

You can find information about all of our awards at

<https://pamspublic.science.energy.gov/WebPAMSEExternal/interface/awards/AwardSearchExternal.aspx>.

You can learn about the history of the ECRP program at <https://science.osti.gov/early-career>

I. Other Information

ANTICIPATED AWARD SIZE

DOE anticipates that, subject to the availability of future year appropriations, a total of \$145 million in current and future fiscal year funds will be used to support awards under this NOFO.

DOE expects the typical award size will be in a narrow range around \$875,000 over five years for an Institution of Higher Education and around \$2,750,000 over five years for a DOE/NNSA National Laboratory or SC User Facility.

Applications should adhere to the standard award size described below and present compelling justification for any request that deviates by more than 3%.

DOE is under no obligation to pay for any costs associated with preparation or submission of applications. DOE reserves the right to fund, in whole or in part, any, all, or none of the applications submitted in response to this NOFO.

The award size will depend on the number of meritorious applications and the availability of appropriated funds.

The ceiling and floor specified below are for total costs, both direct and indirect costs.

Ceiling

Historically, the average award under this program for both Institutions of Higher Education and DOE/NNSA National Laboratories has been close to the floor for each institutional type as described below. Requests for budget amounts larger than the historical average are possible with appropriate justification. Awards supporting PIs at SC User Facilities not at DOE/NNSA National Laboratories will be treated the same as DOE/NNSA National Laboratories for the purposes of this NOFO.

Floor

The minimum request for awards to an Institution of Higher Education is approximately \$875,000 over five years and the minimum request for awards to a DOE/NNSA National Laboratory is approximately \$2,750,000 over five years. DOE/NNSA National Laboratories awards are encouraged to cover at least 50% of the PI salary. Amounts less than 50% should be as close to 50% as possible. Awards supporting PIs at SC User Facilities that do not fall under these two broad categories must use the floor for the DOE/NNSA National Laboratories.

PERIOD OF PERFORMANCE

DOE anticipates making awards with a project period of 5 years.

Continuation funding (funding for the second and subsequent budget periods) is contingent on: (1) availability of funds appropriated by Congress and future year budget authority; (2) progress towards meeting the objectives of the approved application; (3) submission of required reports; and (4) compliance with the terms and conditions of the award.

IV. Application Contents and Format

A. Preliminary Submissions

1. Letter of Intent (LOI)

Not applicable.

2. Pre-application

PRE-APPLICATION DUE DATE

The pre-application due date is printed on the cover of the NOFO.

ENCOURAGE/DISCOURAGE DATE

The pre-application response date is printed on the cover of the NOFO.

A pre-application is required and must be submitted by the date indicated on the cover of the NOFO.

Pre-applications will be reviewed for responsiveness of the proposed work to the research topics identified in this NOFO. DOE will send a response by email to each applicant encouraging or discouraging the submission of an application by the date indicated on the cover of the NOFO. Applicants who have not received a response regarding the status of their pre-application by this date are responsible for contacting the program to confirm this status.

Applications that have not been encouraged by DOE may be declined without merit review.

The pre-application must begin with a title page that will not count toward the pre-application page limitation. Include, at the top of the first page, the following information:

Title of Pre-application

Principal Investigator Name, Job Title

Institution

PI Phone Number, PI Email Address

Year Doctorate Awarded: XXXX

Number of Times Previously Applied†:

Multiple Program Scope: (Yes/No – see below**)

The research area(s), specified in [Section III](#), primarily addressed by the proposed work

Eligibility Extension Requested: (Yes/No – see below*)

NOFO Number: Include the NOFO Number indicated on the cover of this NOFO

† Indicate how many times the PI has previously submitted a full application in the SC ECRP. The program has been offered in 16 previous years, FY 2010 – FY 2025. Participation in the competition is defined as submission of a full, formal application that was not withdrawn prior to official declination of the application. A PI who has participated in three past SC ECRP competitions is not eligible.

* Extensions to eligibility due to major life events (three months or longer) must be validated by a letter from the university dean, research vice president, laboratory division director, or equivalent official. The letter must be included in the pre-application.

** Interdisciplinary research of interest to multiple SC programs should be noted.

The material listed here defines the acceptable information on a title page.

The title page must be followed by a clear and concise description of the objectives and technical approach of the proposed research. Not including the title page, the pre-application may not exceed three pages, when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font must not be smaller than 11 point. Figures and references, if included, must fit within the three-page limit.

In addition, the pre-application must include a listing of senior/key personnel and a listing of individuals who should not serve as merit reviewers of a subsequent application. Detailed instructions for how to craft the required listings are provided in [Section IX](#) of this NOFO. Note that the listing of individuals who should not serve as merit reviewers is rarely empty because the instructions contain mandatory inclusions requirements. This listing will not count toward the pre-application's page limit. The list of individuals must be included as an "Additional Attachment" to your pre-application in PAMS.

The pre-application must be machine-readable. Do not submit a scanned image of a printed document.

PRE-APPLICATION REVIEW

SC may evaluate all or some portion of pre-applications to determine their competitiveness within a scientific topic.

Any review will be based on the following criteria:

1. Responsiveness to the objectives of the NOFO as stated in Section I.
2. Scientific and technical merit.
3. Appropriateness of the proposed research approaches.
4. Likelihood of scientific impact.

The decision to encourage or discourage the submission of an application may also be influenced by the following factors:

- Relevance of the proposed activity to SC priorities
- Ensuring an appropriate balance of activities within SC programs

Any such review will be concurred in by no less than three SC-affiliated individuals chosen for their topical knowledge and diversity of perspective.

Reviews within a topical field will be a comparative review with priority given to scientifically innovative and forward-looking basic research with the highest likelihood of success as an application. The results of the review will be documented.

Applicants with the highest rated pre-applications will be encouraged to submit applications; others will be discouraged from submitting applications.

Written feedback about pre-applications will be provided after the deadline for the receipt of applications.

Topics with comparatively few pre-applications may not make use of such pre-application reviews. The ratio of encourage/discourage results will differ between topical subjects.

SC is committed to ensuring that a sufficient number of applicants will be encouraged to submit applications to foster a competitive merit review of the applications. SC's intent in discouraging submission of certain applications is to save the time and effort of applicants in preparing and submitting applications with a low likelihood of success.

The PI will be automatically notified when the pre-application is encouraged or discouraged. The DOE SC Portfolio Analysis and Management System (PAMS) will send an email to the PI from PAMS.Autoreply@science.doe.gov, and the status of the pre-application will be updated at the PAMS website <https://pamspublic.science.energy.gov/>. Notifications are sent as soon as the decisions to encourage or discourage are finalized.

PRE-APPLICATION SUBMISSION

Pre-applications are created in the software system of your choice and must be submitted electronically through the DOE SC Portfolio Analysis and Management System (PAMS) website <https://pamspublic.science.energy.gov/>. You cannot draft or edit a pre-application in PAMS. Do not submit a pre-application through [FedConnect](#) or [Grants.gov](#).

Pre-applications may only be submitted by a user at the PI's institution with the "Submit to DOE" privilege in PAMS. A PI may draft a pre-application but will only be able to submit the pre-application for institutional countersignature.

Detailed instructions about how to submit a pre-application are in [Section IX](#) of this NOFO.

In addition to the standard instructions about pre-applications, pre-applications to the ECRP require that two additional questions be answered in PAMS:

1. Is the PI eligible for the Presidential Early Career Award for Scientists and Engineers (PECASE)? [To be PECASE eligible, a PI must be a U.S. citizen, U.S. national or permanent resident as of the closing date of this NOFO and may not have received a PECASE previously through any agency.]

2. Year Doctorate Awarded:

This information will be used to assist SC in assembling a preliminary list of potentially PECASE eligible investigators.

B. Application

Applications in response to this NOFO must be submitted through Grants.gov. Detailed instructions for registering in and using Grants.gov are in [Section IX](#) of this NOFO.

C. Component Pieces of the Application

LETTERS OF COLLABORATION OR ACCESS

Letters of recommendation and department chair letters are not allowed. Applications that include recommendations or department chair letters will be subject to elimination from consideration during DOE's initial review.

Letters from collaborators or from institutions providing access to data, models, software, equipment and/or facilities may be appended to your Project Narrative and are not considered part of the Project Narrative's page limit. Please ensure that letters from collaborators or from institutions providing access to data, models, software, equipment and/or facilities only describe the nature of the collaboration or the access to data, models, software, equipment and/or facilities.

All letters may be addressed "To Whom It May Concern:".

Letters of collaboration or access should be placed in Appendix 7 (Other Attachments). Letters of collaboration or access must not be written as recommendation or endorsement letters. Each letter of collaboration or access may contain two and only two sentences and must use the following format:

Dear <Principal Investigator Name>:

If your application entitled, “<Application Name>,” is selected for funding under the NOFO Name, it is my intent to collaborate in this research by <Complete Sentence With a Very Short Description of What the Collaborator Offers to Do or Provide>.

Thank you for the opportunity to participate.

Sincerely,
<Collaborator’s Name and Signature Block>

SCIENTIFIC USER FACILITIES

Documentation from any SC scientific user facility (<https://science.osti.gov/User-Facilities>) may be provided with other letters of collaboration or access in Appendix 7.

If the proposed research includes activities at the DIII-D National Fusion Facility, a U.S. DOE Office of Science user facility, then a Record of Discussion from the facility must be included in the submission. The Record of Discussion documents potential resources required by the facility to support the proposed research scope. Information on the Record of Discussion process at DIII-D is available at <https://d3dfusion.org/become-a-user/> under the “Records of Discussion” header. A Record of Discussion form is available for download from that site.

1. SF-424 (R&R)

Complete this form first to populate data in other forms. Complete all the required fields in accordance with the pop-up instructions on the form. The list of certifications and assurances referenced in Field 17 is available on the DOE Financial Assistance Forms Page at <https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Certifications and Assurances³. Applicants are bound by their representations and certifications in SAM.gov.

TYPE OF SUBMISSION (FIELD 1)

Select the checkbox for “Application” for an initial submission. Select the checkbox for “Changed/Corrected Application” if submitting an updated version of an application. Do not submit pre-applications via Grants.gov: Do not select the checkbox for “Pre-application.”

³ No separate form or submission is required for the Certifications and Assurances.

IDENTIFYING NUMBERS (FIELD 4)

For renewals and supplemental funding, enter the DOE award number in Field 4a. Do not enter any other number in Field 4a. Do not enter anything in Field 4b. If submitting an updated version of an application, you may enter the previous Grants.gov Tracking ID in Field 4c, though this is not required.

UEI AND EIN NUMBERS (FIELDS 5 AND 6)

The Uniform Entity Identifier (UEI) and Employer Identification Number (EIN) fields on the SF-424 (R&R) form are used in PAMS to confirm the identity of the individual or organization submitting an application.

- Enter the UEI as a 12-digit alpha-numerical sequence.
- Enter the EIN as a nine-digit number.
- Do not use hyphens or dashes.
- SC does not use the 12-digit EIN format required by some other agencies.
- Applications will not be rejected if an applicant's system-to-system service uses a 12-digit EIN format or inserts hyphens or dashes in an EIN.

TYPE OF APPLICATION (FIELD 8)

A new application is one in which DOE support for the proposed research is being requested for the first time. Only new applications will be considered under this NOFO.

Please answer "yes" to the question "Is this application being submitted to other agencies?" if substantially similar, identical, or closely related research objectives are being submitted to another Federal agency. Indicate the agency or agencies to which the similar objectives have been submitted.

Do not attach pre-applications to Field 20 of the SF-424(R&R) form or letters of intent to Field 21 of the SF-424(R&R) form.

Applications for the renewal of or of a supplement to an existing award will not be accepted.

2. Research and Related Other Project Information

Complete questions in fields 1 through 6 of the SF-424 Research and Related Other Project Information form.

Note regarding question 4.a. and 4.b.:

If any environmental impact, positive or negative, is anticipated, indicate "yes" in response to question 4.a., "potential impact – positive or negative - on

the environment.” Disclosure of the impact should be provided in response to question 4.b. First, indicate whether the impact is positive or negative and then identify the area of concern (e.g., air, water, exposure to radiation, impacts to endangered species or historic properties, etc.).

For actions that could have adverse impacts to the environment or have any possibility for adverse impacts to human health (e.g., use of human subjects, Biosafety Level 3-4 laboratory construction/operation, manufacture or use of certain nanoscale materials which are known to impact human health, or any activities involving transuranic or high level radioactive waste, or use of or exposure to any radioactive materials beyond de minimis levels), applicants should indicate a “negative” impact on the environment.

Lastly, based on requirements and guidance in 10 CFR 1021.102 and DOE’s NEPA Implementing Procedures, to find that a proposal is covered by a categorical exclusion (CX), DOE will determine: (1) the proposal fits within one or more classes of actions for which CXs are permissible, (2) there are no extraordinary circumstances related to the proposal that may affect the significance of the environmental effects of the proposal (DOE or an applicant may modify the proposal to avoid reasonably foreseeable adverse significant effects such that the CX would apply), and (3) the proposal has not been segmented to meet the definition of a CX.

The bulk of your application will consist of files attached to the Research and Related Other Project Information form. The files must comply with the following instructions:

PROJECT SUMMARY/ABSTRACT (FIELD 7 ON THE FORM)

The project summary/abstract is a summary of the proposed activity suitable for distribution to the public and sufficient to permit potential reviewers to identify conflicts of interest. It must be a self-contained document. The project summary/abstract must comprise:

- The project title, the PI name and the PI’s institutional affiliation, and any coinvestigators and their institutional affiliations. This information, and the information described below, must fit within the one-page abstract.
- This information must be followed by a statement of the project’s objectives, a description of the project, including methods to be employed, and the potential impact of the project (i.e., benefits, outcomes).
- The description of the proposed research may not exceed one page (excluding Project Title and list of investigators) when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font must not be smaller than 11 point. Figures and references, if included, must fit within the one-page limit.

A sample is provided below:

<p>Project Title</p> <p>A. Smith, Lead Institution (Principal Investigator) A. Brown, Institution 2 (Co-Investigator) A. Jones, Institution 3 (Co-Investigator)</p> <p>Text of abstract (no more than one page, excluding Project Title and list of investigators)</p>
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If an application is recommended for award, the project summary will be used in preparing a public abstract about the award. Award abstracts and titles form a Government document that describes the project and justifies the expenditure of Federal funds in light of the DOE and SC mission statements at <https://energy.gov/mission> and <https://science.osti.gov/about/>.

- Do not include any proprietary or sensitive business information.
- DOE may use the abstract to prepare public reports about supported research.

DOE TITLE PAGE

(PART OF PROJECT NARRATIVE ATTACHED TO FIELD 8 ON THE FORM)

The application narrative must begin with a title page that will not count toward the Project Narrative page limitation. The title page must include the following items:

- The project title:
- Applicant/Institution:
- Street Address/City/State/ZIP:
- Postal Address:
- Lead PI name, telephone number, email:
- Administrative Point of Contact name, telephone number, email:
- NOFO Number: Include the NOFO number printed on the cover of this NOFO.
- DOE/SC Program Office (ASCR, BER, BES, FES, HEP, NP, DOE IP):
- Research area or areas as identified in [Section III](#) of this NOFO*:
- DOE/SC Program Office Technical Contact:
- Year Doctorate Awarded:
- If at a University, is the PI in a tenure-track appointment? (yes or no)
- Does the PI have tenure: (Yes or No)?
- Number of Times Previously Applied†:
- PAMS Pre-application tracking number:
- Application Contains Data Management Plan in Appendix 4: (Yes or No)?

* For example, the topic area might be Synthesis and Processing Science or Magnetic Fusion Energy Science Theory and Simulation.

†Indicate how many times the PI has previously submitted a full application in the SC ECRP. The program has been offered in 16 previous years, FY 2010 - FY 2025. Participation in the competition is defined as submission of a full, formal application with two exceptions: applications withdrawn from consideration prior to official declination of the application do not count as a submission, and applications declined without merit review by the DOE SC do not count as a submission. A PI who has participated in three past SC ECRP competitions is not eligible.

** Presidential Early Career Award for Scientists and Engineers (PECASE): PECASE is the highest honor bestowed by the U.S. Government to outstanding scientists and engineers who are beginning their independent research careers and who show exceptional promise for leadership in science and technology. To be PECASE-eligible, a PI must be a U.S. citizen, U.S. national or permanent resident as of the closing date of this NOFO and may not have received a PECASE previously through any agency. PECASE eligibility is not required for an award under this NOFO. PECASE Awards are coordinated by the White House Office of Science and Technology Policy (OSTP) within the Executive Office of the President. Each year, OSTP may ask federal agencies, including DOE, to nominate candidates for PECASE. As part of the DOE nominations process, SC nominates investigators from among the PECASE-eligible awardees of the SC ECRP. OSTP makes the final selection and announcement of awardees from candidates submitted by participating Federal Agencies. Additional information can be found online <https://science.osti.gov/About/Honors-and-Awards/PECASE>.

The material listed here defines the required content of a title page. Additional material is not allowed.

Important Instructions to the Sponsored Research Office of Submitting Institutions: SC requires that you create one single machine-readable PDF file that contains the DOE Title Page, Project Narrative, all required appendices, and other attachments. This single PDF file may not be scanned from a printed document and must be attached in Field 8 on the Grants.gov form. This must be a plain PDF file consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not use PDF portfolios or binders. The Project Narrative will be read by SC staff using the full version of Adobe Acrobat: Please ensure that the narrative is readable in Acrobat. If combining multiple files into one Project Narrative, ensure that a PDF portfolio or binder is not created. If creating PDF files using any software other than Adobe Acrobat, please use a “Print to PDF” or equivalent process to ensure that all content is visible in the Project Narrative. Once a Project Narrative has been assembled, please submit the combined Project Narrative file through a “Print to PDF” or equivalent process to ensure that all content is visible in one

PDF file that can be viewed in Adobe Acrobat. Do not attach any of the appendices listed in this paragraph separately in any other field in Grants.gov. If you do, these additional attachments will not become part of the application in PAMS.

PROJECT NARRATIVE (FIELD 8 ON THE FORM)

The Project Narrative must not exceed a page limit of 15 pages of technical information, including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). The body text font of all main text must not be smaller than 11 point. Merit reviewers will only consider the number of pages specified in the first sentence of this paragraph. This page limit does not apply to the Title Page, Budget Page(s), Budget Justification, biographical material, publications and references, appendices, and an optional table of content, each of which may have its own page limit defined later in this NOFO.

Do not include any websites (URLs) that provide supplementary or additional information that constitutes a part of the application. Merit reviewers are not required to access websites; however, Internet publications in a list of references will be treated identically to print publications. See [Section IX](#) of this NOFO for instructions on how to mark proprietary application information. To attach a Project Narrative, click “Add Attachment.”

The Project Narrative comprises the research plan for the project. It should contain enough background material in the Introduction, including a brief review of the relevant literature and any prior research in this area, to demonstrate sufficient knowledge of the state of the science. The major part of the narrative should be devoted to a description and justification of the proposed project, including details of the methods to be used. It should also include a timeline for the major activities of the proposed project and should indicate which project personnel will be responsible for which activities. There should be no ambiguity about which personnel will perform particular parts of the project, and the time at which these activities will take place.

The following organization of the Project Narrative is suggested:

- **Background/Introduction:** Explanation of the importance and relevance of the proposed work as well as a review of the relevant literature.
- **Project Objectives:** This section should provide a clear, concise statement of the specific objectives/aims of the proposed project.
- **Proposed Research and Methods:** Identify the hypotheses to be tested (if any) and details of the methods to be used including the integration of experiments with theoretical and computational research efforts.

Buy America Preference for Infrastructure Projects

Awards funded through this NOFO that are for, or contain, construction, alteration, maintenance, or repair of public infrastructure in the United States undertaken by applicable recipient types, require that:

- All iron, steel, and manufactured products used in the infrastructure project are produced in the United States; and
- All construction materials used in the infrastructure project are manufactured in the United States.

Applicants should consult 2 CFR 184 and [Section IX](#) of this NOFO to determine whether the Buy America Preference applies and if they should consider the application of the Buy America Preference in the proposed project's budget and/or schedule.

Within the first two (2) pages of the Project Narrative, include a short statement on whether the project will involve the construction, alteration, maintenance and/or repair of public infrastructure in the United States. See [Section IX](#) of this NOFO for applicable definitions and other information regarding Infrastructure Projects and the Buy America Preference.

The Project Narrative is considered the intellectual work of the proposed researchers. Concurrent submission of the same or substantially similar narratives attributed to different researchers may constitute academic dishonesty or research misconduct. Submission of a Project Narrative that is not the work of the proposed researchers, including machine-generated Project Narratives, may constitute academic dishonesty or research misconduct.

Do not attach any of the requested appendices described below as files for Fields 9, 10, 11, and 12 on the SF-424 Research and Related Other Project Information form in Grants.gov. Follow the instructions below to include the information as appendices in the single Project Narrative file.

Biographical sketches and current and pending support may no longer be provided as attachments to a Project Narrative. These documents must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

APPENDIX 1: BIBLIOGRAPHY & REFERENCES CITED

Provide a bibliography of any references cited in the Project Narrative. Each reference must include the names of all authors (in the same sequence in which they appear in the publication), the article and journal title, book title, volume number, page numbers, and year of publication. For research areas where there are routinely more than 10 coauthors of archival publications, you may use an abbreviated style such as the *Physical Review Letters* (PRL) convention for citations (listing only the first author). For example, your paper may

be listed as, “A Really Important New Result,” A. Aardvark et. al. (MONGO Collaboration), PRL 999. Include only bibliographic citations. Applicants should be especially careful to follow scholarly practices in providing citations for source materials relied upon when preparing any section of the application. Provide the Bibliography and References Cited information as an appendix to your Project Narrative.

- This appendix will not count in the Project Narrative page limitation.
- Do not attach a bibliography to Field 9 of the Research and Related Other Project Information form.

APPENDIX 2: FACILITIES & OTHER RESOURCES

This information is used to assess the capability of the organizational resources, including subrecipient resources, available to perform the effort proposed. Identify the facilities to be used (Laboratory, Animal, Computer, Office, Clinical and Other). If appropriate, indicate their capacities, pertinent capabilities, relative proximity, and extent of availability to the project. Describe only those resources that are directly applicable to the proposed work. Describe other resources available to the project (e.g., machine shop, electronic shop) and the extent to which they would be available to the project. For proposed investigations requiring access to experimental user facilities maintained by institutions other than the applicant, please provide a document from the facility manager confirming that the researchers will have access to the facility. Such documents, provided that they do not become letters of support or recommendation, may be printed on any letterhead. Please provide the Facility and Other Resource information as an appendix to your Project Narrative.

- This appendix will not count in the Project Narrative page limitation.
- Do not attach a facilities and other resources statement to Field 10 of the Research and Related Other Project Information form.

APPENDIX 3: EQUIPMENT

List major items of equipment already available for this project and, if appropriate, identify location and pertinent capabilities. Provide the Equipment information as an appendix to your Project Narrative.

- This appendix will not count in the Project Narrative page limitation.
- Do not attach an equipment statement to Field 11 of the Research and Related Other Project Information form.

APPENDIX 4: DATA MANAGEMENT AND SHARING PLAN

Provide a Data Management and Sharing Plan (DMSP) as an appendix to the Project Narrative. DMSPs are not required for applications that only request support for a conference, workshop, or scientific meeting. Subject to the applicable cost principles, applications may request costs necessary for implementing the DMSP.

- This appendix should not exceed a page limit of 2 pages including charts, graphs, maps, photographs, and other pictorial presentations, when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right)
- Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.
- This appendix will not count in the Project Narrative page limitation.

The standard requirements for a DMP may be found in [Section IX](#) of this NOFO.

In addition, the DMSP should specifically address:

- How FAIR (Findable, Accessible, Interoperable, and Reusable)⁴ principles will apply to the anticipated data sets, software⁵, and models⁶ to be developed.
- What developed software, data sets, and models will be made available using an “opensource” licensing arrangement, noting the Software Package Data Exchange (SPDX) identifier(s) (<https://spdx.org/licenses/>) when possible, and where deviation in this arrangement is expected from The Open Source Initiative’s “Open Source Definition” (<https://opensource.org/osd>), a specific justification must be provided.
- How best practices in scientific software development will be applied to any development activities. For more information on best practices, see Better Scientific Software (<https://bssw.io/>).

APPENDIX 5: SYNERGISTIC ACTIVITIES (OPTIONAL)

In addition to biographical sketches in the Common Format, each senior/key person may provide a one-page list of no more than five distinct examples of synergistic activities that demonstrate the individual’s professional and scholarly activities that focus on the integration, transfer, and creation of knowledge as related to the application.

- Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.
- This appendix may not exceed a limit of the same number of pages as senior/key personnel when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-

⁴ Wilkinson, M. D. et al. The FAIR Guiding Principles for Scientific Data Management and Stewardship. *Sci. Data*

3:160018, 2016. <https://doi.org/10.1038/sdata.2016.18>

⁵ Chue Hong, N. P., Katz, D. S., Barker, M., Lamprecht, A-L, Martinez, C., Psomopoulos, F. E., Harrow, J., Castro, L. J., Gruenpeter, M., Martinez, P. A., Honeyman, T., et al. (2022). FAIR Principles for Research Software version 1.0. (FAIR4RS Principles v1.0). Research Data Alliance. DOI:

<https://doi.org/10.15497/RDA00068>

⁶ Ravi, N., Chaturvedi, P., Huerta, E.A. et al. FAIR principles for AI models with a practical application for accelerated high energy diffraction microscopy. *Sci Data* 9, 657 (2022). <https://doi.org/10.1038/s41597-022-01712-9>

inch margins (top, bottom, left, and right). This appendix will not count in the Project Narrative page limitation.

APPENDIX 6: TRANSPARENCY OF FOREIGN CONNECTIONS

As an appendix to your Project Narrative, applicants must provide the following information as it relates to the proposed recipient and subrecipient(s). Include a separate disclosure for the applicant and each proposed subrecipient.

Disclosure exceptions by entity type:

- U.S. National Laboratories and domestic government entities are not required to respond to the Transparency of Foreign Connections disclosure.
- Institutions of higher education and non-profit research organizations are only required to respond to items with an asterisk symbol (*).

Applicants, regardless of entity type, must provide complete responses for all proposed subrecipients that are not U.S. National Laboratories, domestic government entities, or institutions of higher education.

Disclosure Format: For the convenience of the entity providing the disclosure and certification a template is available at [Transparency of Foreign Connections | Department of Energy](#), however, the entity is not required to use this specific format. If another format is used, the signatory must include the same substantive information, a signature, date, and the certification statement provided at [Transparency of Foreign Connections | Department of Energy](#).

Questions: Contact rtesinfo@hq.doe.gov

DOE reserves the right to request additional or clarifying information based on the information submitted.

APPENDIX 7: OTHER ATTACHMENTS

If you need to elaborate on your responses to questions 1-6 on the “Other Project Information” document, please provide the Other Attachment information as an appendix to your Project Narrative. Information not easily accessible to a reviewer may be included in this appendix, but do not use this appendix to circumvent the page limitations of the application. Reviewers are not required to consider information in this appendix.

- Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.
- This appendix will not count in the Project Narrative page limitation.

REMINDERS REGARDING ALL APPENDICES

- Follow the above instructions to include the information as appendices to the Project Narrative file.
- These appendices will not count toward the Project Narrative's page limitation.
- Do not attach any appendices to Fields 9, 10, 11, or 12.

3. Research and Related Senior/Key Person Profile (Expanded)

Complete the Research and Related Senior/Key Person Profile (Expanded) form in accordance with the instructions on the form and the following instructions. Complete this form before the Budget form to populate data on the Budget form.

You must submit this information for the PI and all senior/key personnel who will be identified by name in Section A of the application's budget. List all other personnel who contribute in a substantive, meaningful way to the scientific development or execution of the project, whether or not salaries are requested. Consultants should be included in this "Senior/Key Person Profile (Expanded)" Form if they meet this definition. List individuals that meet the definition of senior/key regardless of what organization they work for. Senior/key personnel must be aware that they are included in the application and must agree to perform the work if awarded. The form will pre-populate with the PI identified on the SF-424(R&R) form. For each senior/key person:

- Complete the required sections in their profile.
- In the "credential" field, enter the person's PAMS username, if known.
- Attach the person's biographical sketch, following the instructions in [Section IX](#) of this NOFO for crafting a biographical sketch.
- Attach the person's current and pending support, following the instructions in [Section IX](#) of this NOFO for crafting current and pending support.

The Senior/Key Person Profile (Expanded) form will support the PI and up to 99 additional senior/key personnel. On the addition of the 99th senior/key person, you will be presented with an option to upload an additional file with the required information for all other senior/key personnel.

4. Research And Related Budget

Complete the Research and Related Budget form in accordance with the instructions on the form (Activate Help Mode to see instructions) and the following instructions. You must complete a separate budget for each year of support requested. The form will generate a cumulative budget for the total project period. You must complete all the mandatory information on the form before the NEXT PERIOD button is activated. All fields with a red border are required, but you may enter a zero "0" in any field in which funds are not being requested. You may request funds under any of the categories listed as long as the item and amount are necessary to perform the proposed work, meet all the criteria for allowability

under the applicable Federal cost principles, and are not prohibited by the funding restrictions in this NOFO.

Funding under this NOFO can be used to support the principal investigator to engage in international collaborations.

Applicants may propose non-domestic entities as subrecipients in their applications. Applicants are advised that successful applications that propose non-domestic entities as subrecipients include a detailed demonstration of how the proposed non-domestic subrecipients possess skills, resources, and abilities that do not exist among potential domestic subrecipients.

Additional information is found in [Section IX](#) of this NOFO.

BUDGET JUSTIFICATION (FIELD L ON THE FORM)

Provide a justification that explains all costs proposed in the budget. The following items of advice are offered to assist you in developing a justification.

- Organize the justification by listing items in the same order as presented on the budget.
- Ensure that the narrative matches the budget in dollar amounts and language.
- Explain the line items. If costs are estimated, provide a basis for the estimate. Explain if costs are based on prior experience of similar activities. If a cost is based on the product of two numbers (such as a number of items at a per-item price), ensure that your math is correct.
- If including an inflationary factor for future budget periods, explain the basis for the inflationary factor.

Provide any other information you wish to submit to justify your budget request. Including items in the budget justification is not considered a form of cost-sharing: Provide the details of all personnel (key or other) who will be working on the award, regardless of their source(s) of compensation. Explain their source(s) of compensation if it is not from this award. Include the indirect cost rate agreement as a part of the budget justification.

Attach a single budget justification file for the entire project period in Field L. The file automatically carries over to each budget year.

5. R&R Subaward Budget Attachment(s) Form

Budgets for Subawards: You must provide a separate R&R budget and budget justification for each subrecipient. Download the R&R Budget Attachment from the R&R SUBAWARD BUDGET ATTACHMENT(S) FORM and either email it to each subrecipient that is required to submit a separate budget or use the collaborative features of Workspace. After the subrecipient has either emailed its completed budget back to you or completed it within Workspace, attach it to one of the blocks provided on the form. All fields with a red border

are required, but you may enter a zero “0” in any field in which funds are not being requested. Use up to 10 letters of the subrecipient’s name (plus.pdf) as the file name (e.g., ucla.pdf or energyres.pdf). Filenames must not exceed 50 characters.

If the project involves more subrecipients than there are places in the SUBAWARD BUDGET ATTACHMENT(S) FORM, the additional subaward budgets may be saved as PDF files and appended to the Budget Justification attached to Field L.

Applicants should consult their local information technology (“IT”) support resources for any necessary assistance in converting the forms downloaded from Grants.gov into plain PDF files that can be combined into one non-Portfolio PDF file (the Budget Justification).

Ensure that any files received from subrecipients are the PDF files extracted from the SUBAWARD BUDGET ATTACHMENT(S) FORM. Errors will be created if a subrecipient sends a prime applicant a budget form that was not extracted from the application package.

Note: The prime award budget request should include any subawards to a DOE/NNSA National Laboratory, a Federal agency, or another Federal agency’s FFRDC, and subaward budgets and budget justifications should be included in the application; the details of such proposed budgets are essential for understanding and analyzing the proposed research. If recommended for an award, a revised budget will be requested where the value of such proposed subawards is deducted from any resulting award: Those classes of organizations will be paid directly by SC.

The standard subaward budget form allows for a maximum of 10 subawards. If an application contains more than 10 subawards, please present the budgets for the eleventh and subsequent subawards in a tabular format, followed by the appropriate budget justification, as a part of the lead applicant’s budget justification.

6. Project/Performance Site Location(s)

Indicate the primary site where the work will be performed. If a portion of the project will be performed at any other site(s), identify the site location(s) in the blocks provided.

Note that the Project/Performance Site Congressional District is entered in the format of the 2 digit state code followed by a dash and a 3 digit Congressional district code, for example VA-001. Hover over this field for additional instructions.

Use the Next Site button to expand the form to add additional Project/Performance Site Locations.

7. Disclosure of Lobbying Activities (SF-LLL)

If any funds other than Federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the grant/cooperative agreement, you must complete and submit Standard Form - LLL, "Disclosure Form to Report Lobbying." Applicants that have never paid any person for influencing or attempting to influence an officer or employee of any agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress do not need to submit this form.

8. Identification of Merit Reviewer Conflicts

Provide a list of individuals who should not serve as merit reviewers of this application, following the instructions in [Section IX](#) of this NOFO. Attach this information to Field 12 of the Research and Related Other Project Information Form.

9. Summary of Required Forms/Files

Your application must include the following items:

Name of Document	Format	Attach to
SF 424 (R&R)	Form	N/A
RESEARCH AND RELATED Other Project Information	Form	N/A
Project Summary/Abstract	PDF	Field 7
Project Narrative, including required appendices	PDF	Field 8
Identification of Merit Review Conflicts	File	Field 12
RESEARCH & RELATED Senior/Key Person Profile (Expanded)	Form	N/A
RESEARCH & RELATED BUDGET	Form	N/A
Budget Justification	PDF	Field L
R&R SUBAWARD BUDGET ATTACHMENT(S) FORM (if applicable)	Form	N/A
Subaward Budget Justification (if applicable)	PDF	Field L of the subaward budget
PROJECT/PERFORMANCE SITE LOCATION(S)	Form	N/A
SF-LLL Disclosure of Lobbying Activities, if applicable	Form	N/A

D. Information that Must be Submitted After Application but Before Award

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary, including, but not limited to:

- Indirect cost information
- Other budget information
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5)
- Representation of Limited Rights Data and Restricted Software, if applicable
- Commitment Letter from Third Parties Contributing to Cost Sharing, if applicable
- Environmental Information
- Information required to resolve concerns about conflicts of interest, conflicts of commitment, potential duplication of support

If you are proposing indirect costs and do not already have an Indirect Cost Rate Agreement with your Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, it is recommended that you begin preparing an Indirect Cost Rate Proposal to be submitted, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

V. Submission Requirements and Deadlines

A. Address to Request Application Package

Application forms and instructions are available at Grants.gov. To access these materials, go to <https://www.Grants.gov>, select “Search Grants”, and then enter the Assistance Listings⁷ number (81.049) and/or the NOFO number shown on the cover of this NOFO. Select the “Apply” button to access the application package.

Applications submitted through <https://www.FedConnect.net> will not be accepted. Applications may not be submitted through PAMS at <https://pamspublic.science.energy.gov>.

Detailed instructions for registering in and using Grants.gov are in [Section VIII](#) of this NOFO.

B. Unique Entity Identifier (UEI) and System for Award Management (SAM.gov)

Applicants must complete a series of registrations and enrollments to submit applications in response to this NOFO. Applicants not currently registered with SAM and Grants.gov should allow at least four weeks to complete these requirements. Applicants refer to the legal entity submitting an application: This is usually a corporate entity, not an individual investigator.

You should start the process as soon as possible.

You may not be able to use your preferred Internet browser: Each system has its own requirements.

Applicants must register with SAM at <https://www.sam.gov/> and obtain a Unique Entity Identifier (UEI). Assistance is available at <https://sam.gov/content/help>.

Applicants must provide a Taxpayer Identification Number (TIN) to complete their registration in <https://www.sam.gov>. An applicant’s TIN is an EIN assigned by the Internal Revenue Service (IRS). You may obtain an EIN from the IRS at <https://www.irs.gov/businesses/small-businesses-self-employed/apply-for-an-employer-identification-number-ein-online>.

If entities have technical difficulties with the UEI validation or SAM registration process, they should utilize the HELP feature on SAM.gov. SAM.gov will work on entity service

⁷ The Assistance Listings were formerly known as the Catalog of Federal Domestic Assistance (CFDA).

tickets in the order in which they are received and asks that entities not create multiple service tickets for the same request or technical issue.

Do not use a SSN as a TIN.
Obtain a TIN from the IRS using the website listed above.

1. Requirement for System for Award Management

Unless exempt from this requirement under 2 CFR 25.110, the recipient must maintain a current and active registration in SAM.gov. The recipient's registration must always be current and active until the recipient submits all final reports required under this Federal award or receives the final payment, whichever is later. The recipient must review and update its information in SAM.gov at least annually from the date of its initial registration or any subsequent updates to ensure it is current, accurate, and complete. If applicable, this includes identifying the recipient's immediate and highest-level owner and subsidiaries and providing information about the recipient's predecessors that have received a Federal award or contract within the last three years.

2. Requirement for Unique Entity Identifier (UEI)

If the recipient is authorized to make subawards under this Federal award, the recipient:

- Must notify potential subrecipients that no entity may receive a subaward until the entity has provided its UEI to the recipient.
- Must not make a subaward to an entity unless the entity has provided its UEI to the recipient. Subrecipients are not required to complete full registration in SAM.gov to obtain a UEI.

C. Submission Instructions

Pre-applications must be submitted in PAMS at <https://pamspublic.science.energy.gov>. Detailed instructions for pre-applications are in [Section IX](#) of this NOFO.

Applications must be submitted in Grants.gov at <https://www.grants.gov>. Detailed instructions are in [Section IX](#) of this NOFO.

D. Submission Dates and Times

1. Letter of Intent Due Date

Not applicable.

2. Pre-application Due Date

The pre-application due date is printed on the cover of this NOFO.

You are encouraged to submit your pre-application well before the deadline. Pre-applications may be submitted at any time between the publication of this NOFO and the stated deadline.

3. Application Due Date

The application due date is printed on the cover of this NOFO.

You are encouraged to submit your application well before the deadline. Applications may be submitted at any time between the publication of this NOFO and the stated deadline.

4. Late Submissions

Delays in submitting pre-applications and applications may be unavoidable. DOE has accepted late submissions when applicants have been unable to make timely submissions because of widespread technological disruptions or significant natural disasters. DOE has made accommodations for incapacitating or life-threatening illnesses and for deaths of immediate family members. Other circumstances may or may not justify late submissions. Unacceptable justifications include the following:

- Failure to begin submission process early enough.
- Failure to provide sufficient time to complete the process.
- Failure to understand the submission process.
- Failure to understand the deadlines for submissions.
- Failure to satisfy prerequisite registrations.
- Unavailability of administrative personnel.

You are responsible for beginning the submission process in sufficient time to accommodate reasonably foreseeable incidents, contingencies, and disruptions.

Applicants must email SC.Early@science.doe.gov to discuss the option of a late submission. Contacting SC.Early@science.doe.gov after the deadline may reduce the likelihood that a request will be granted.

DOE notes that not all requests for late submission will be approved.

VI. Application Review Information

A. Responsiveness Review

Prior to a comprehensive merit evaluation, DOE will perform an initial review in accordance with 10 CFR 605.10(b) to determine that (1) the applicant is eligible for the award; (2) the information required by the NOFO, including pre-application, has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the NOFO; and (5) the proposed project is not duplicative of programmatic work. Applications that fail to pass the initial review will not be forwarded for merit review and will be eliminated from further consideration.

B. Review Criteria

Applications will be subjected to scientific merit review (peer review) and will be evaluated against the following criteria, listed in descending order of importance, as found in 10 CFR 605.10 (d), the Office of Science Financial Assistance Program Rule.

- Scientific and/or Technical Merit of the Project;
- Appropriateness of the Proposed Method or Approach;
- Competency of Applicant's Personnel and Adequacy of Proposed Resources;
- Reasonableness and Appropriateness of the Proposed Budget; and

Merit reviewers will be asked to evaluate two additional criteria of equal significance to the fourth criterion established by SC:

- Appropriateness of the Data Management and Sharing Plan
- Potential for leadership within the scientific community

Note that external peer reviewers are selected regarding both their scientific expertise and the absence of conflict-of-interest issues. Both Federal and non-Federal reviewers may be used, and submission of an application constitutes agreement that this is acceptable to the investigator(s) and the submitting institution.

The questions below are provided to the merit reviewers to elaborate the criteria established by regulation:

1. Scientific and/or Technical Merit of the Project

- What is the scientific innovation of the proposed research?
- What is the likelihood of achieving valuable results?
- How might the results of the proposed work impact the direction, progress, and thinking in relevant scientific fields of research?

- How does the proposed work compare with other efforts in its field, both in terms of scientific and/or technical merit and originality?
- Does the application specify at least one scientific hypothesis motivating the proposed work? Is the investigation of the specified hypothesis or hypotheses scientifically valuable?
- Is the Data Management Plan suitable for the proposed research? To what extent does it support the validation of research results? To what extent will research products, including data, be made available and reusable to advance the field of research?

2. Appropriateness of the Proposed Method or Approach

- How logical and feasible are the research approaches?
- Does the proposed research employ innovative concepts or methods?
- Can the approach proposed concretely contribute to our understanding of the validity of the specified scientific hypothesis or hypotheses?
- Are the conceptual framework, methods, and analyses well justified, adequately developed, and likely to lead to scientifically valid conclusions?
- Does the applicant recognize significant potential problems and consider alternative strategies?
- Is the proposed research aligned with the published priorities identified or incorporated by reference in [Section III](#) of this NOFO?

3. Competency of Applicant's Personnel and Adequacy of Proposed Resources

- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities adequate for performing the research?
- Does the proposed work take advantage of unique facilities and capabilities?

4. Reasonableness and Appropriateness of the Proposed Budget

- Are the proposed budget and staffing levels adequate to carry out the proposed research?
- Is the budget reasonable and appropriate for the scope?

5. Appropriateness of the Data Management and Sharing Plan

- To what extent does the Data Management and Sharing Plan (DMSP) enable data generated in the course of the research project to be publicly shared and preserved in a timely and fair manner that enables validation and replication of results?
- Does the DMSP adequately justify any limitations of data sharing?
- Are there any weaknesses in the DMSP that should be addressed prior to the start of the project?

6. Potential For Leadership Within the Scientific Community

- How does the proposed work contribute to the PI becoming a recognized authority or leader in their field? How has the PI demonstrated the potential for scientific leadership and creative vision?
- How has the PI been recognized as a leader in the scientific community?

C. Review and Selection Process

1. Merit Review

Applications that pass the initial review will be subjected to a formal merit review and will be evaluated based on the criteria codified at 10 CFR 605.10(d) in accordance with the guidance provided in the “Office of Science Merit Review System for Financial Assistance,” which is available at: <https://science.osti.gov/grants/policy-and-guidance/merit-review-system/>.

2. Program Policy Factors

The Selection Official may consider any of the following program policy factors in making the selection, listed in no order of significance:

- Availability of funds
- Relevance of the proposed activity to SC priorities
- Relevance to the mission of the specific program (e.g. ASCR, BER, BES, FES, HEP, NP, DOE IP) to which the application is submitted
- Ensuring an appropriate balance of activities within SC programs
- Performance under current awards
- Ensuring a distribution of supported researchers at various early career stages
- Training the next generation of researchers
- Ensuring opportunities to investigators not currently supported by DOE
- Quality of international collaboration
- Commitment to sharing the results of research
- Increasing participation of institutions historically underrepresented in the SC research portfolio

3. Selection

The Selection Official will consider the findings of the merit review and may consider any of the Program Policy Factors described above and/or the review of risk described below.

4. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed necessary, including but not limited to the following: (1) the budget is not appropriate or reasonable for the requirement; (2) only a portion of the application is selected for award; (3) the Government needs additional information to determine that the recipient is capable of complying with the requirements in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation); and/or (4) special terms and conditions are required. Failure to resolve satisfactorily the issues identified by the Government will preclude award to the applicant.

5. Risk Review

Pursuant to 2 CFR 200.206, DOE will conduct a review of any potential risks posed by the applicant. Such review of risk will include:

- Quality of the application,
- Reports and findings from audits performed under 2 CFR 200 and/or 2 CFR 910, and
- Systems maintained under 2 CFR 180.

DOE may make use of other publicly available information and the history of an applicant's performance under DOE or other Federal agency awards.

Applicants with no prior performance of DOE awards may be asked to provide information about their financial stability and or their ability to comply with the management standards of 2 CFR 200.

6. Due Diligence Review for Research, Technology, and Economic Security

All applications submitted to DOE are subject to a due diligence review.

As DOE invests in critical infrastructure and funds critical and emerging technology areas,⁸ DOE considers possible threats to United States research, technology, and economic security from undue foreign government influence when evaluating risk. As part of the research, technology, and economic security risk review, DOE may contact the applicant and/or proposed project team members for additional information to inform the review. This risk review is conducted separately from the technical merit review.

All project participants, which for purposes of this term includes individuals participating in the project, are subject to RTES due diligence reviews. The due diligence review of covered individuals includes but is not limited to the review of resumes/biosketches, disclosures, and certifications, as required in the NOFO. DOE reserves the right to require

⁸ See [Critical and Emerging Technologies List Update \(whitehouse.gov\)](https://www.whitehouse.gov/critical-emerging-technologies/).

resumes/biosketches, disclosures, and certifications for project participants not defined as covered individuals. The Applicant need not submit any additional information on non-covered individuals, unless requested by DOE. The volume and type of information collected may depend on various factors associated with the award.

Note this review is separate and distinct from DOE Order 142.3B “Unclassified Foreign National Access Program.”

In the event an RTES risk is identified, DOE may require risk mitigation measures, including but not limited to, requiring that an individual or entity not participate in the award. If significant risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

Consistent with section 4(e) of the Presidential Memorandum on United States Government-Supported Research and Development National Security Policy-33 (NSPM-33), DOE may share information regarding the risks identified as part of the RTES due diligence review process or monitoring with other Federal agencies.

DOE’s decision regarding a due diligence review is not appealable.

VII. Award Notices

A. Type of Award Instrument

DOE anticipates awarding grants and National Laboratory authorizations under this NOFO.

B. Anticipated Timeline for Notice of Selection for Award Negotiation

It is anticipated that the award selection will be completed by July 2026. It is expected that awards will be made in Fiscal Year 2026.

1. Notice of Selection for Award Negotiation

Applicants Selected for Award Negotiation Notification: DOE will notify applicants selected for award negotiation. This notice of selection for award negotiation is not an authorization for the applicant/recipient to begin performance.

Non-selected Notification: Organizations whose applications have not been selected will be advised as promptly as possible. This notice will explain why the application was not selected.

2. Notice of Award

An Assistance Agreement issued by the DOE Contracting Officer is the authorizing award document. It normally includes, either as an attachment or by reference, the following items: (1) Special Terms and Conditions, (2) Intellectual Property Provisions, (3) Federal Assistance Reporting Checklist and Instructions, (4) Budget Pages, (5) The Research Terms and Conditions, available at https://www.nsf.gov/pubs/policydocs/rtc/rtcoverlay_march17.pdf, and DOE Agency Specific Requirements, available at <https://www.nsf.gov/awards/managing/rtc.jsp>, (6) Applicable program regulations, 10 CFR 605 at <https://www.ecfr.gov/>, (7) DOE Assistance Regulations, 2 CFR 200 as amended by 2 CFR 910 at <https://www.ecfr.gov/>, (8) Application/proposal as approved by DOE, (9) National Policy Assurances to Be Incorporated as Award Terms in effect on date of award at <https://www.nsf.gov/awards/managing/rtc.jsp>.

TERMS AND CONDITIONS

Sample DOE Special Terms and Conditions for Use in Most Grants and Cooperative Agreements are located at <https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Terms.

The standard DOE financial assistance intellectual property provisions applicable to various types of recipients are located at:

<https://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards>

NATIONAL POLICY ASSURANCES

The National Policy Assurances To Be Incorporated As Award Terms are located at

<https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Terms.

VIII. Post-Award Requirements and Administration

A. Administrative and National Policy Requirements

Additional policy provisions applicable to this NOFO are included in the list below. Awards made under this NOFO are subject to the respective Administrative and National Policy Requirements. The full text of each provision is in [Section IX](#) of this NOFO and may be accessed by navigating to the hyperlinks below:

- [1. Administrative Requirements](#)
- [2. Availability of Funds](#)
- [3. Buy America Preference for Infrastructure Projects](#)
- [4. Conference Spending \(February 2015\)](#)
- [5. Commitment of Public Funds](#)
- [6. Corporate Felony Conviction and Federal Tax Liability Representations \(March 2014\)](#)
- [7. Covered Individual Definition, Designation, and Responsibility](#)
- [8. Digital Persistent Identifier \(PID\)](#)
- [9. Environmental, Safety and Health \(ES&H\) Performance of Work at DOE Facilities](#)
- [10. Evaluation and Administration by Non-Federal Personnel](#)
- [11. Federal, State, and Local Requirements](#)
- [12 Foreign Travel](#)
- [13. Framework for Nucleic Acid Synthesis Screening Requirement](#)
- [14. Funding Restrictions](#)
- [15. Government Right to Reject or Negotiate](#)
- [16. Implementation of Presidential Memorandum Simplifying the Funding of Energy Infrastructure and Critical Mineral and Material Projects](#)
- [17. Intergovernmental Review](#)
- [18. Logos and Wordmarks](#)
- [19. Modifications](#)
- [20. National Environmental Policy Act \(NEPA\) Compliance](#)
- [21. Nondisclosure and Confidentiality Agreements Representations \(June 2015\)](#)
- [22. Notice Regarding Eligible/Ineligible Activities](#)
- [23. Portable Document Format \(PDF\) Generation](#)
- [24. Prohibition on the Use of Funds for Activities Related to FASC-Prohibited Unmanned Aircraft Systems](#)
- [25. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment](#)
- [26. Prohibition on Discrimination and Harassment](#)
- [27. Prohibition on Entities of Concern](#)
- [28. Prohibition on Lobbying Activity](#)
- [29. Prohibition Related to Malign Foreign Talent Recruitment Programs](#)
- [30. Proprietary Application Information](#)
- [31. Publications](#)
- [32. Registration Requirements](#)
- [33. Research Misconduct](#)

- [34. Research Security Training Requirement](#)
- [35. Rights in Technical Data](#)
- [36. Statement of Federal Stewardship](#)
- [37. Subaward and Executive Reporting](#)
- [38. Title to Subject Inventions](#)
- [39. Trafficking in Persons](#)
- [40. U.S. Competitiveness](#)
- [41. Updating Your Portfolio Analysis and Management System \(PAMS\) Profile](#)

B. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, DOE F 4600.2, attached to the award agreement. The standard checklist is available at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms> under Award Forms: Individual awards may impose additional requirements.

C. Reporting of Matters Related to Recipient Integrity and Performance (December 2015)

DOE, prior to making a Federal award with a total amount of Federal share greater than the simplified acquisition threshold, is required to review and consider any information about the applicant that is in the designated integrity and performance system accessible through SAM(see 41 USC 2313).

The applicant, at its option, may review information in the designated integrity and performance systems accessible through SAM and comment on any information about itself that a Federal awarding agency previously entered and is currently in the designated integrity and performance system accessible through SAM.

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under Federal awards when completing the review of risk posed by applicants as described in 2 CFR 200.206 Federal awarding agency review of risk posed by applicants.

D. Interim Conflict of Interest Policy for Financial Assistance

1. Policy

[The DOE interim Conflict of Interest Policy for Financial Assistance](#) (COI Policy) is applicable to all recipients or subrecipients applying for, or that receive, DOE funding by means of a financial assistance award (e.g., a grant or cooperative agreement) and, through

the implementation of this policy by the entity, to each Investigator who is planning to participate in, or is participating in, the project funded wholly or in part under the DOE financial assistance award. The term “Investigator” means the PI and any other person, regardless of title or position, who is responsible for the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. Recipients must flow down the requirements of the interim COI Policy to any subrecipient. Further, for DOE funded projects, the recipient must include all financial conflicts of interest (FCOI) (i.e., managed and unmanaged/unmanageable) in its initial and ongoing FCOI reports.

It is understood that recipients or subrecipients receiving DOE financial assistance awards will need sufficient time to come into full compliance with DOE’s interim COI Policy. To provide some flexibility, DOE allows for a staggered implementation. Specifically, prior to award, applicants selected for award negotiations must: ensure all Investigators complete their significant financial disclosures; review the disclosures; determine whether a FCOI exists; develop and implement a management plan for FCOIs; and provide DOE with an initial FCOI report that includes all FCOIs (i.e., managed and unmanaged/unmanageable). Recipients will have 180 days from the date of the award to come into full compliance with the other requirements set forth in DOE’s interim COI Policy. Prior to award, the applicant must certify that it is, or will be within 180 days of the award, compliant with all requirements in the COI Policy.

2. SC Implementation

SC only requires that unmanaged or unmanageable financial conflicts of interest be included in the financial conflict of interest (FCOI) report.

IX. Other Information

A. Checklist for Avoiding Common Errors

Note that not all items in this checklist will apply to every submission under every NOFO.

Item	Issue
Applications	Submitted in Grants.gov. Do not submit applications in PAMS or FedConnect.
Grants.gov Submission	<p>Ensure that applications are submitted under the correct Opportunity Number.</p> <p>Standard Form (SF)-424 Research and Related (R&R):</p> <ul style="list-style-type: none"> - Attach nothing to Field 20 - Attach nothing to Field 21 <p>SF-424 Research and Related Other Project Information form:</p> <ul style="list-style-type: none"> - Attach the abstract to Field 7 - Attach the Project Narrative, with all appendices, to Field 8 - Attach nothing to Field 9 - Attach nothing to Field 10 - Attach nothing to Field 11 - Attach the list of individuals who should not serve as merit reviewers (Collaborator Template) to Field 12 - Do not attach other files to Field 12 - NOTE: Files attached to Field 12 will not be shared with merit reviewers.
Letters of Intent (LOIs)	<ul style="list-style-type: none"> - Submit your LOI in PAMS. - Do not submit your LOI in Grants.gov. - Do not attach your LOI to the SF-424 Research and Related (R&R) form. - Follow the instructions in Section IV for the preparation of an LOI.
Pre-Applications	<ul style="list-style-type: none"> - Submit your pre-application in PAMS. - Do not submit your pre-application in Grants.gov. - Do not attach your pre-application to the SF-424 Research and Related (R&R) form.

Item	Issue
	- Follow the instructions in Section IV for the preparation of a pre-application.
Page Limits	Strictly followed throughout application, including particular attention to: <ul style="list-style-type: none"> - Project Narrative and appendices - Biographical sketches - Data Management and Sharing Plans (DMSPs) - Letter(s) of Collaboration or Access, if any
Personally Identifiable Information	None present in the application
Project Narrative	Composed of one PDF file including all appendices (bibliography, facilities, equipment, DMSP)
Project Summary / Abstract	Name of PI, PI's institutional affiliation(s), Co-Investigator(s), Co-Investigator's institutional affiliation(s)
DOE Title Page	Follow instructions closely
Budget	Use current negotiated indirect cost and fringe benefit rates
Budget Justification (attached to budget)	Justify all requested costs
Biographical Sketches	Follow page limits strictly and do not include list of collaborators. Attach the biographical sketch to the Senior/Key Person Profile (Expanded) Form.
Current and Pending Support	Ensure complete listing of all activities, regardless of source of funding. Attach the current and pending support to the Senior/Key Person Profile (Expanded) Form.
List of Individuals who Should not Serve as Merit Reviews	Attach to Field 12 of the SF-424 Research and Related Other Project Information form.
Data Management and Sharing Plans (DMSP)	<ul style="list-style-type: none"> - If referring to an experiment's DMSP, describe the relationship to the proposed research. - Include a DMSP even if no experimental data is expected.
Institutions capable of being funded through the DOE Field Work System	If National Laboratories and/or DOE sites are permitted to submit under this NOFO:

Item	Issue
	<ul style="list-style-type: none"> - Do not create new institutions in the PAMS website. - Submit applications in Grants.gov using the name of the laboratory or site in Field 5 of the SF-424(R&R) application form, not the contractor operating the laboratory or site. <p>Submissions under this NOFO will be evaluated for technical merit, but any resulting funding, work, or awards will be made under the laboratory or site’s contract with DOE. No separate financial assistance awards will be made. No administrative provisions of this NOFO will apply to the laboratory or any laboratory subcontractor.</p>

B. How-To Guides

The how-to guides provided in this section are intended as general guidance about SC. Not all parts will be applicable to every NOFO, every application, or every institution.

1. How to Distinguish Between a New and Renewal Application

New Application: An application must be submitted as “new” in the following circumstances:

- When applying for funding to create a new research award that has not previously received DOE funding, including any funding for the current year,
- When applying for funding to support continued research from the same applicant institution as the current grant but with a significant change in fundamental nature of the research, or
- When applying for funding to support continued research supported by an existing DOE award but at a new applicant institution.

Renewal Application: A renewal application is appropriate when funds are requested for an award from the same recipient/applicant institution that has no significant changes in the following items:

- The award’s senior leadership, and
- The fundamental nature of the award.

A change in an award’s PI does not necessarily require submission as a new application: The change in personnel must be considered in light of other changes.

Renewal applications compete for funds with all other peer-reviewed applications and must be developed as fully as though the applicant were applying for the first time. Renewal applications must be submitted by the same sponsoring institution as that holding the current award for which renewal funding is requested, and the proposed research topic must be logical scientific extensions of the research that has been performed in the current award.

2. How Federally Affiliated Organizations May Participate and Be Funded

VALUE/FUNDING FOR DOE/NNSA NATIONAL LABORATORIES AND NON-DOE/NNSA FFRDCS

For grant awards, the value of, and funding for, a DOE/NNSA National Laboratory contractor, a non-DOE/NNSA Federally Funded Research and Development Center (FFRDC) contractor, or another Federal agency's portion of the work will not be included in the award to the successful applicant. DOE will fund a DOE/NNSA National Laboratory contractor through the DOE field work authorization system or other appropriate process and may fund non-DOE/NNSA FFRDC contractors and other Federal agencies through an interagency agreement in accordance with the Economy Act, 31 USC 1535, or other statutory authority.

RESPONSIBILITY

The successful prime applicant/recipient (lead organization) will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues, including but not limited to, disputes and claims arising out of any agreement between the applicant and any team member, and/or subrecipient.

If an award is made to a DOE/NNSA National Laboratory, all Disputes and Claims will be resolved in accordance with the terms and conditions of the DOE/NNSA National Laboratory's management and operating (M&O) contract, as applicable, in consultation between DOE and the prime recipient.

If an award is made to another Federal agency or its FFRDC contractor, all Disputes and Claims will be resolved in accordance with the terms and conditions of the interagency agreement in consultation between DOE and the prime recipient.

3. How Federally Affiliated Organizations May Apply

DOE SC NATIONAL LABORATORIES

DOE Office of Science (SC) National Laboratories (Ames National Laboratory, Argonne National Laboratory, Brookhaven National Laboratory, Fermi National Accelerator Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory,

Pacific Northwest National Laboratory, Princeton Plasma Physics Laboratory, SLAC National Accelerator Laboratory, Thomas Jefferson National Accelerator Facility)

DOE SC National Laboratories, if eligible either as a prime applicant or a proposed team member on another entity's application, should ensure that their cognizant DOE Contracting Officer provides written authorization. This authorization does not need to be submitted with the application as part of the Budget Justification for DOE SC National Laboratory Contractor File. However, this authorization must be provided prior to any award being made. [This is not required for the National Energy Technology Laboratory because it is a Government Owned/Government Operated (GOGO) Laboratory.] If a DOE SC National Laboratory Contractor is selected for award, or proposed as a team member, the proposed work will be authorized under the DOE field work authorization system or other appropriate process and performed under the laboratory Contractor's M&O contract, as applicable. The authorization may be addressed "To Whom It May Concern:". The following wording is acceptable for the authorization:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory."

(End of acceptable authorization)

If a DOE/NNSA FFRDC is selected for award negotiation, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's Management and Operating (M&O) contract.

DOE NON-SC/NNSA NATIONAL LABORATORIES

DOE Non-SC/NNSA National Laboratories (Idaho National Laboratory, Lawrence Livermore National Laboratory, Los Alamos National Laboratory, National Renewable Energy Laboratory, Sandia National Laboratories, and Savannah River National Laboratory)

DOE Non-SC/NNSA National Laboratories, if eligible either as a prime applicant or a proposed team member on another entity's application, should ensure consult with their site office or cognizant contracting officer to determine the appropriate timing to submit written authorization. This authorization may be submitted with the application as part of the Budget Justification for DOE/NNSA National Laboratory Contractor File. [This is not required for the National Energy Technology Laboratory because it is a Government Owned/Government Operated (GOGO) Laboratory.] Please note that failure to provide this authorization may result in rejection of an application prior to merit review. If a DOE/NNSA National Laboratory Contractor is selected for award, or proposed as a team member, the proposed work will be authorized under the DOE field work authorization

system or other appropriate process and performed under the laboratory Contractor's M&O contract, as applicable. The authorization may be addressed "To Whom It May Concern:". The following wording is acceptable for the authorization:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the DOE/NNSA assigned programs at the laboratory."

(End of acceptable authorization)

If a DOE/NNSA FFRDC is selected for award negotiation, the proposed work will be authorized under the DOE work authorization process and performed under the laboratory's Management and Operating (M&O) contract.

NON-DOE/NNSA FFRDCs

Non-DOE/NNSA FFRDCs, if eligible either as a prime applicant or a proposed team member on another entity's application, should follow the following guidelines:

The prime applicant must obtain written authorization for non-DOE/NNSA FFRDC participation. The cognizant Contracting Officer for the Federal agency sponsoring the FFRDC contractor must authorize in writing the participation of the FFRDC contractor on the proposed project and this authorization should be submitted with the application. The written authorization must also contain a determination that the use of a FFRDC contractor is consistent with the contractor's authority under its award and does not place the FFRDC contractor in direct competition with the private sector, in accordance with FAR Part 17.5. Please note that failure to provide this authorization may result in rejection of an application prior to merit review. The authorization may be addressed "To Whom It May Concern:". The following wording is acceptable for the authorization:

"Authorization is granted for the _____ Laboratory to participate in the proposed project. The work proposed for the laboratory is consistent with or complementary to the missions of the laboratory and will not adversely impact execution of the (insert agency) assigned programs at the laboratory. This laboratory is authorized to perform the work proposed in the application submitted under DOE Funding Opportunity Announcement <<Include the NOFO number on the cover page>> by the following statutory authority (insert statute name, citation, and section)."

(End of acceptable authorization)

OTHER FEDERAL AGENCIES

Other Federal Agencies, if eligible either as a prime applicant or a proposed team member on another entity's application, must include in their budget justifications any specific statutory authorization (other than the Economy Act) that permits their receipt of an interagency agreement or that authorizes the payment of certain costs.

4. How Consortia May be Used

INCORPORATED CONSORTIA

Incorporated consortia are eligible to apply for funding as a prime recipient (lead organization) or subrecipient (team member).

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the DOE Contracting Officer. There is no requirement that subawards be formalized into incorporated consortia.

UNINCORPORATED CONSORTIA

Unincorporated consortia (team arrangements) must designate one member of the consortium to serve as the prime recipient/consortium representative (lead organization). There is no requirement that subawards be formalized into unincorporated consortia.

Upon request, unincorporated consortia must provide the DOE Contracting Officer with a collaboration agreement, commonly referred to as the articles of collaboration, which sets out the rights and responsibilities of each consortium member. This agreement binds the individual consortium members together and should discuss, among other things, the consortium's:

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions (though neither required nor considered); and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

Note that a consortium is applied for in one application and results in one award with subawards to consortia members. Multi-institutional teams may, if permitted under this NOFO, submit collaborative applications with each institution submitting its own application with an identical Project Narrative, resulting in multiple awards to the collaborating institutions.

5. How to Submit Letters of Intent

Do not submit an LOI unless a NOFO requires or allows their submission.

It is important that the LOI be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. The PI and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a LOI. All PIs and those submitting LOIs on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.

Submit Your Letter of Intent:

- Create your LOI outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the “View / Respond to Funding Opportunity Announcements” link and find the current announcement in the list. Click the “Actions/Views” link in the Options column next to this announcement to obtain a dropdown menu. Select “Submit Letter of Intent” from the dropdown.
- On the Submit Letter of Intent page, select the institution from which you are submitting this LOI from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.
- Note that you must select one and only one PI per LOI; to do so, click the “Select PI” button on the far-right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the “Actions” link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose “Select PI.”
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the “Invite PI” link at the top left of the “Select PI” screen. You can enter an optional personal message to the PI in the “Comments” box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the LOI. Save the LOI for later work by clicking the “Save” button at the bottom of the screen. It will be stored in “My Letters of Intent” for later editing.
- Enter a title for your LOI.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the LOI file into PAMS, click the “Attach File” button at the far-right side of the screen. Click the “Browse” (or “Choose File” depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the “Upload” button to upload the file.

- At the bottom of the screen, click the “Submit to DOE” button to save and submit the LOI to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the LOI.
- If this NOFO requires that LOIs be submitted only by an authorized institutional official, the PI (or the PI’s delegate) will only be able to send the LOI to a user at the PI’s institution with the institutional “submit to DOE” privilege. That user will then apply an institutional countersignature to the LOI when it is sent to DOE.

You are encouraged to register for an account in PAMS at least a week in advance of the LOI submission deadline so that there will be no delays with your submission.

WARNING: The PAMS website at <https://pamspublic.science.energy.gov/> will permit you to revise a previously submitted LOI in the time between your submission and the deadline. Doing so will remove your previously submitted version from consideration. If you have not submitted the revision at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

Do not attach pre-applications to Field 20 of the SF-424(R&R) form or letters of intent to Field 21 of the SF-424(R&R) form. Doing so will render your application unreadable.

6. How to Submit a Pre-Application

Do not submit a pre-application unless a NOFO requires or permits their submission.

It is important that the pre-application be a single file with extension .pdf, .docx, or .doc. The filename must not exceed 50 characters. The PI and anyone submitting on behalf of the PI must register for an account in PAMS before it will be possible to submit a pre-application. All PIs and those submitting pre-applications on behalf of PIs are encouraged to establish PAMS accounts as soon as possible to avoid submission delays.

Submit Your Pre-Application:

- Create your pre-application (called a preproposal in PAMS) outside the system and save it as a file with extension .docx, .doc, or .pdf. Make a note of the location of the file on your computer so you can browse for it later from within PAMS.
- Log into PAMS and click the Proposals tab. Click the “View / Respond to Funding Opportunity Announcements” link and find the current announcement in the list. Click the “Actions/Views” link in the Options column next to this announcement to obtain a dropdown menu. Select “Submit Preproposal” from the dropdown.
- On the Submit Preproposal page, select the institution from which you are submitting this preproposal from the Institution dropdown. If you are associated with only one institution in the system, there will only be one institution in the dropdown.

- Note that you must select one and only one PI per preproposal; to do so, click the “Select PI” button on the far-right side of the screen. Find the appropriate PI from the list of all registered users from your institution returned by PAMS. (Hint: You may have to sort, filter, or search through the list if it has multiple pages.) Click the “Actions” link in the Options column next to the appropriate PI to obtain a dropdown menu. From the dropdown, choose “Select PI.”
- If the PI for whom you are submitting does not appear on the list, it means he or she has not yet registered in PAMS. For your convenience, you may have PAMS send an email invitation to the PI to register in PAMS. To do so, click the “Invite PI” link at the top left of the “Select PI” screen. You can enter an optional personal message to the PI in the “Comments” box, and it will be included in the email sent by PAMS to the PI. You must wait until the PI registers before you can submit the preproposal. Save the preproposal for later work by clicking the “Save” button at the bottom of the screen. It will be stored in “My Preproposals” for later editing.
- Enter a title for your preproposal.
- Select the appropriate technical contact from the Program Manager dropdown.
- To upload the preproposal file into PAMS, click the “Attach File” button at the far-right side of the screen. Click the “Browse” (or “Choose File” depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the “Upload” button to upload the file.
- At the bottom of the screen, click the “Submit to DOE” button to save and submit the preproposal to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the preproposal.
- If this NOFO requires that pre-applications be submitted only by an authorized institutional official, the PI (or the PI’s delegate) will only be able to send the pre-application to a user at the PI’s institution with the institutional “submit to DOE” privilege. That user will then apply an institutional countersignature to the pre-application when it is sent to DOE.

You are encouraged to register for an account in PAMS at least a week in advance of the preproposal submission deadline so that there will be no delays with your submission.

WARNING: The PAMS website at <https://pamspublic.science.energy.gov> will permit you to revise a previously submitted pre-application in the time between your submission and the deadline. Doing so will remove your previously submitted version from consideration. If you have not submitted the revision at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

Do not attach pre-applications to Field 20 of the SF-424(R&R) form or letters of intent to Field 21 of the SF-424(R&R) form. Doing so will render your application unreadable.

7. How to Register and Submit an Application in Grants.gov

This section provides the application submission and receipt instructions for applications to SC. Please read the following instructions carefully and completely.

ELECTRONIC DELIVERY

SC is participating in the Grants.gov initiative to provide the grant community with a single site to find and apply for grant funding opportunities. SC requires applicants to submit their applications online through Grants.gov.

HOW TO REGISTER TO APPLY THROUGH GRANTS.GOV

a. **Instructions:** Read the instructions below about registering to apply for SC funds. Applicants should read the registration instructions carefully and prepare the information requested before beginning the registration process. Reviewing and assembling the required information before beginning the registration process will alleviate last-minute searches for required information.

Organizations must have an active System for Award Management (SAM) registration which provides a Unique Entity Identifier (UEI), and Grants.gov account to apply for grants. If individual applicants (those submitting on their own behalf) are eligible to apply for this funding opportunity, they need only refer to steps 2 and 3 below.

Creating a Grants.gov account can be completed online in minutes, but SAM registration may take several weeks. Therefore, an organization's registration should be done in sufficient time to ensure it does not impact the entity's ability to meet required application submission deadlines.

1) *Register with SAM:* All organizations applying online through Grants.gov must register with SAM at <https://www.sam.gov>. Failure to register with SAM will prevent your organization from applying through Grants.gov. SAM registration must be renewed annually. For more detailed instructions for registering with SAM, refer to: <https://www.grants.gov/applicants/applicant-registration/>

2) *Create a Grants.gov Account:* The next step is to register an account with Grants.gov. Follow the on-screen instructions provided on the registration page.

3) *Add a Profile to a Grants.gov Account:* A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the

UEI (Unique Entity Identifier) for the organization in the UEI field. If you are an individual applicant submitting on your own behalf, you do not need a UEI to add the profile. For more detailed instructions about creating a profile on Grants.gov, refer to: <https://www.grants.gov/applicants/applicant-registration/add-profile>

4) *EBiz POC Authorized Profile Roles*: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the Electronic Business Point of Contact (EBiz POC)⁹. The EBiz POC will then log in to Grants.gov and authorize the appropriate roles, which may include the Authorized Organization Representative (AOR) role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role. For more detailed instructions about creating a profile on Grants.gov, refer to:

<https://www.grants.gov/applicants/applicant-registration/ebiz-poc-authorizes-profile-roles>

5) *Track Role Status*: To track your role request, refer to:

<https://www.grants.gov/applicants/applicant-registration/track-profile-role-status>

b. **Electronic Signature**: When applications are submitted through Grants.gov, the name of the organization applicant with the AOR role that submitted the application is inserted into the signature line of the application, serving as the electronic signature. The EBiz POC must authorize people who are able to make legally binding commitments on behalf of the organization as a user with the AOR role; this step is often missed and it is crucial for valid and timely submissions.

HOW TO APPLY TO SC VIA GRANTS.GOV

Grants.gov applicants can apply online using Workspace. Workspace is a shared, online environment where members of a grant team may simultaneously access and edit different webforms within an application. For each NOFO, you can create individual instances of a workspace.

For an overview of applying on Grants.gov using Workspaces, refer to:

<https://www.grants.gov/applicants/workspace-overview/>

1) **Create a Workspace**: Creating a workspace allows you to complete it online and route it through your organization for review before submitting.

⁹ Individuals with the EBiz POC role are commonly found in an Office of Sponsored Research or similar institutional business office. Other than small businesses, a PI would usually not have the EBiz POC role.

2) Complete a Workspace: Add participants to the workspace to work on the application together, complete all the required forms online or by downloading PDF versions, and check for errors before submission. The Workspace progress bar will display the state of your application process as you apply. As you apply using Workspace, you may click the blue question mark icon near the upper-right corner of each page to access context-sensitive help.

a. Adobe Reader: If you decide not to apply by filling out webforms you can download individual PDF forms in Workspace so that they will appear similar to other Standard forms. The individual PDF forms can be downloaded and saved to your local device storage, network drive(s), or external drives, then accessed through Adobe Reader.

NOTE: Visit the Adobe Software Compatibility page on Grants.gov to download the appropriate version of the software at: <https://www.grants.gov/applicants/adobe-software-compatibility>

b. Mandatory Fields in Forms: In the forms, you will note fields marked with an asterisk and a different background color. These fields are mandatory fields that must be completed to successfully submit your application.

c. Complete SF-424 Fields First: These forms are designed to fill in common required fields across other forms, such as the applicant's name, address, and SAM UEI. Once it is completed, the information will be transferred to the other forms.

3) Submit a Workspace: An application may be submitted through workspace by clicking the Sign and Submit button on the Manage Workspace page, under the Forms tab. Grants.gov recommends submitting your application package *at least 24-48 hours prior to the close date* to provide you with time to correct any potential technical issues that may disrupt the application submission.

4) Track a Workspace: After successfully submitting a workspace package, a Grants.gov Tracking Number (GRANTXXXXXXXX) is automatically assigned to the package. The number will be listed on the Confirmation page that is generated after submission.

For additional training resources, including video tutorials, refer to: <https://www.grants.gov/applicants/applicant-training>

Applicant Support: Grants.gov provides applicants 24/7 support via the toll-free number 1-800-518-4726 and email at support@Grants.gov. For questions related to the specific grant opportunity, contact the number listed in the application package of the grant you are applying for funding.

If you are experiencing difficulties with your submission, it is best to call the Grants.gov Support Center and get a ticket number. The Support Center ticket number will assist SC with tracking your issue and understanding background information on the issue.

TIMELY RECEIPT REQUIREMENTS AND PROOF OF TIMELY SUBMISSION

Proof of timely submission is automatically recorded by Grants.gov. An electronic date/time stamp is generated within the system when the application is successfully received by Grants.gov. The applicant AOR will receive an acknowledgement of receipt and a tracking number (GRANTXXXXXXXX) from Grants.gov with the successful transmission of their application. Applicant AORs will also receive the official date/time stamp and Grants.gov Tracking number in an email serving as proof of their timely submission.

When SC successfully retrieves the application from Grants.gov, and acknowledges the download of submissions, Grants.gov will provide an electronic acknowledgment of receipt of the application to the email address of the applicant with the AOR role. Again, proof of timely submission shall be the official date and time that Grants.gov receives your application. Applications received by Grants.gov after the established due date for the program will be considered late and may not be considered for funding by SC.

Applicants using unreliable internet connections should be aware that the process of completing the Workspace can take some time. Therefore, applicants should allow enough time to prepare and submit the application before the package closing date.

Grants.gov will provide either an error or a successfully received submission message in the form of an email sent to the applicant with the AOR role attempting to submit the application.

If you do not promptly receive an email from Grants.gov with an agency tracking number, indicating receipt of the application by SC, please contact the Grants.gov Helpdesk at 800-518-4726 (toll-free) or support@Grants.gov immediately. SC will have no records of your attempted submission without the second email from Grants.gov.

8. How to Prepare an Application

APPLICATION PREPARATION

You must submit the application through Grants.gov at <https://www.Grants.gov/>, using either the online webforms or downloaded forms. (Additional instructions are provided [above](#).)

You are required to use the compatible version of Adobe Reader software to complete a [Grants.gov](#) Adobe application package. To ensure you have the [Grants.gov](#) compatible

version of Adobe Reader, visit the software compatibility page at <https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html>.

You must complete the mandatory forms and any applicable optional forms (e.g., Disclosure of Lobbying Activities (SF-LLL)) in accordance with the instructions on the forms and the additional instructions below.

Files that are attached to the forms must be PDF files unless otherwise specified in this NOFO. Attached PDF files must be plain files consisting of text, numbers, and images without editable fields, signatures, passwords, redactions, or other advanced features available in some PDF-compatible software. Do not use PDF portfolios or binders.

Please note the following restrictions that apply to the names of all files attached to your application:

- Please limit file names to 50 or fewer characters
- Do not attach any documents with the same name. All attachments must have a unique name.
- Please use only the following characters when naming your attachments: A-Z, a-z, 0-9, underscore, hyphen, space, period, parenthesis, curly braces, square brackets, ampersand, tilde, exclamation point, comma, semi colon, apostrophe, at sign, number sign, dollar sign, percent sign, plus sign, and equal sign. Attachments that do not follow this rule may cause the entire application to be rejected or cause issues during processing.

RENEWAL APPLICATIONS

For renewal applications only, the PI is required to submit a Renewal Proposal Products section through the PAMS website at <https://pamspublic.science.energy.gov>. The PI must enter into PAMS each product created during the course of the previous project period. Types of products include publications, intellectual property, technologies or techniques, and other products such as databases or software. As soon as the renewal application is assigned to a DOE Program Manager, the PI will receive an automated email from PAMS (<PAMS.Autoreply@science.doe.gov>) instructing him or her to navigate to the PAMS Task tab to complete and submit the Renewal Proposal Products. The submitted product list will be sent for merit review as part of the application. The application will not be considered complete and cannot be sent for review until the product list has been submitted.

RESUBMISSION OF APPLICATIONS

Applications submitted under this NOFO may be withdrawn from consideration by using the PAMS website at <https://pamspublic.science.energy.gov>. Applications may be withdrawn at any time between when the applicant submits the application and when DOE makes the application available to merit reviewers. Such withdrawals take effect

immediately and cannot be reversed. Please exercise due caution. After the application is made available to merit reviewers, the applicant may contact the DOE program office identified in this NOFO to request that it be withdrawn.

After an application is withdrawn, it may be resubmitted, if this NOFO is still open for the submission of applications. Such resubmissions will only count as one submission if this NOFO restricts the number of applications from an applicant.

Note that there may be a delay between the application's submission in Grants.gov and when it is available to be withdrawn in PAMS. SC will usually consider the last submission, according to its Grants.gov timestamp, to be the intended version. Please consult with your program manager to resolve any confusion about which version of an application should be considered.

IMPROPER CONTENTS OF APPLICATIONS

Applications submitted under this NOFO will be stored in controlled-access systems, but they may be made publicly available if an award is made. As such, it is critical that applicants follow these guidelines:

- Do not include information that a non-Federal entity may not openly distribute, whether classified, export control, or unclassified controlled nuclear information. Non-Federal entities are not subject to any restrictions on distributing controlled unclassified information (CUI).
- Do not include sensitive and protected personally identifiable information, including social security numbers, birthdates, citizenship, marital status, or home addresses. Pay particular attention to the content of biographical sketches and curriculum vitae.
- Do not include letters of support from Federal officials.
- Do not include letters of support on Federal letterhead. Letters that are not letters of support (such as letters confirming access to sites, facilities, equipment, or data; or letters from cognizant Contracting Officers) may be on Federal letterhead.
- Clearly mark all proprietary or trade-secret information.

CHANGE OF RECIPIENT INSTITUTION

If a recipient chooses to relinquish an award made under this NOFO to permit the transfer of the award to a new institution, the new institution must apply under the then-available SC "annual" or "open" NOFO.

9. How to Prepare a Biographical Sketch

As part of the application, each covered individual at the applicant and subrecipient level must submit a biographical sketch ("*Biosketch*"). Use [SciENCv \(Science Experts Network Curriculum Vitae\)](#) to produce a DOE/NNSA compliant PDF version of the *Biosketch*. Note

that there is no page limitation for the *Biosketch*, though some fields in SciENCv have character limitations for consistency.

Consistent with the instructions in [NSPM-33 Implementation Guidance Pre- and Post-award Disclosures Relating to the Biographical Sketch and Current and Pending \(Other\) Support](#)¹⁰ and the DOE/NNSA NOFO-Specific Biosketch Instructions below, the *Biosketch* and *CPS Common Form* must together include a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual’s research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. All connections with [malign foreign talent recruitment programs](#) must be identified.

Please note the following:

- With the exception of “covered individual”, which is defined in [Section IX](#), all other definitions of terms used in the *Biosketch* are available at: [NSPM-33 Definitions](#).
- If there is any conflict between [NSPM-33 Implementation Guidance Pre- and Post-award Disclosures Relating to the Biographical Sketch and Current and Pending \(Other\) Support](#) and the DOE/NNSA NOFO-Specific Biosketch Instructions below, follow the DOE/NNSA NOFO-Specific Biosketch Instructions.

DOE/NNSA NOFO-Specific Biosketch Instructions	
Persistent Identifier (PID) of the Covered Individual	The PID field is required for all applications sent to SC.
Appointments and Positions Reporting Timeframe	Identify all domestic and foreign professional appointments and positions outside of the primary organization for a period up to three years from the date the applicant submits the application.
Products: Limitation on number provided	List up to 10 products most closely related to the proposed project. For each publication, identify the names of all authors (in the same sequence in which they appear in the publication), the article title, book or journal title, volume number, page numbers, year of publication, and website address if available electronically. Patents, copyrights and software systems developed may be provided in addition to or substituted for publications. An abbreviated style such as the Physical Review Letters (PRL) convention for citations (list

¹⁰ This table supersedes in its entirety, Table 2a and Paragraph 7 of the Disclosure Requirements and Standardization Section of the NSPM-33 Implementation Guidance.

	only the first author) may be used for publications with more than 10 authors.
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Biographical sketches must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

Personally Identifiable Information: Do not include sensitive and protected personally identifiable information including social security numbers, birthdates, citizenship, marital status, or home addresses. Do not include information that a merit reviewer should not make use of.

10. How to Prepare a List of Individuals Who Should Not Serve as Reviewers

To assist in identifying individuals who should not serve as merit reviews, provide the following information for each senior/key person who is planned to be or is identified in Section A of the R&R Budget for the applicant and any proposed subrecipients:

- Advisees (graduate students or postdocs) of the senior/key person
- Advisors of the senior/key person while a graduate student or a postdoc
- Close associates of the senior/key person over the past 48 months
- Co-authors of the senior/key person over the past 48 months
- Co-editors of the senior/key person over the past 48 months
- Co-investigators of the senior/key person over the past 48 months
- Collaborators of the senior/key person over the past 48 months

Do not identify any personnel at the applicant institution or any proposed subrecipient or team institution: Those personnel are prohibited from serving as merit reviewers.

Large collaborations of 10 or more researchers do not require that all collaborators be identified: rather, only list the researchers with whom the senior/key person collaborated.

For all identified individuals, provide the following information:

- The senior/key person to whom the individual was an advisee, advisor, close associate, co-author, co-editor, co-investigator, or collaborator, identified by first name and last name
- The individual's first (given) name
- The individual's last (family) name
- The individual's Open Researcher and Contributor ID (ORCID), if known
- The individual's institutional affiliation spelling out acronyms (For joint appointments, separate each institution with a slash ("/"). Do not list departmental affiliations.)
- The reason for listing the individual (advisee, advisor, close associate, co-author, co-editor, co-investigator, collaborator)
- The year when the individual last was a close associate, co-author, co-editor, co-investigator, or collaborator

You may also provide a list of all senior/key personnel who are planned to be or are identified in Section A of the R&R Budget for the applicant and any proposed subrecipients.

The lists do not need to be sorted in any method.

The lists must be submitted in tabular format, preferably as Microsoft Excel (.xls or .xlsx) files.

For your convenience, a Collaborator Template is available at <https://science.osti.gov/grants/Policy-and-Guidance/Agreement-Forms>. The template may also be posted with this NOFO in Grants.gov. If using the template:

- Do not add tabs to the spreadsheet
- Do not merge the existing tabs
- Do not remove headers
- Fill out the requested headers on both tabs with the same information
- Ensure that given and family names are presented in the correct columns

11. How to Prepare Current and Pending Support

Current and Pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. The PI and each senior/key person at the prime applicant and any proposed subaward must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. Include the current application and any application submitted to any source of funding in a list of current and pending support. All sources of support must be disclosed, but for work that is subject to government classification or enforceable non-disclosure agreements, the general area of the research should be described without disclosing sensitive details and the sponsor should be listed as "Government Agency" or "private sponsor." All connections with malign foreign talent recruitment programs must be identified in current and pending support.

SC requires the use of the interagency common format, which may be generated by the Science Experts Network Curriculum Vitae (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>. The fillable PDFs provided by the National Science Foundation are no longer available.

Covered individuals must provide a Digital Persistent Identifier.

For every activity, list the following items:

- The sponsor of the activity or the source of funding.
- The award or other identifying number.
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research.
- The total cost or value of the award or activity, including direct and indirect costs. For pending proposals, provide the total amount of requested funding.
- The award period (start date – end date).
- The person-months of effort per year being dedicated to the award or activity.

If required to identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.

SC strongly recommends the use of SciENCv to reduce administrative burden by allowing the use of digital persistent identifiers, including the Open Researcher and Contributor ID (ORCID). If not using SciENCv, append the following signed and dated certification to current and pending support:

I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Current and Pending Support Disclosure Statement is true, complete, and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3733 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to DOE's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

Current and pending support must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE.

Submission of current and pending support constitutes the individual's certification that they have complied with the [Research Security Training](#) requirement.

12. How to Prepare a Data Management and Sharing Plan

Data Management and Sharing Plans (DMSPs) must be provided for the proposed research following DOE and DOE sponsoring office guidelines. If needed, updates to the DMSP,

through the course of the R&D, must be provided to DOE for review and approval. In general, a DMSP should address the following requirements:

1. Validation and replication of results

The DMSP should describe how scientific data generated in the course of the research project will be publicly shared and preserved in a timely and fair manner that enables validation and replication of results. If data will not be publicly shared and preserved (see "Data sharing limitations"), the DMSP should describe how results could be validated and replicated.

2. Timely and fair access

The DMSP should provide a plan for making all scientific data displayed in peer-reviewed scholarly publications resulting from the proposed research open, machine-readable, and digitally accessible to the public at the time of publication. This includes data that are displayed in charts, figures, images, etc. In addition, the underlying digital scientific data used to generate peer-reviewed scholarly publications should be made freely available and publicly accessible at the time of publication, in accordance with the principles stated above. The published article should indicate how these data can be accessed. The DMSP should also provide a timeline for sharing digital scientific data produced under the DOE funded R&D effort not associated with peer-reviewed scholarly publications.

3. Data repository selection

The DMSP should specify the use of digital repositories that align, to the extent practicable, with the National Science and Technology Council document entitled "Desirable Characteristics of Data Repositories for Federally Funded Research," by the Subcommittee on Open Science of the National Science and Technology Council, May 2022.¹¹ In general, DOE does not endorse or require sharing in any specific repository and encourages researchers to select the repository that is most appropriate for their data type and discipline, though individual sponsoring research offices may provide specific guidance or designate a specific repository.

4. Data management and sharing resources

The DMSP should describe the data management and sharing resources that may be available and used in the course of the proposed research. In particular, a DMSP that explicitly or implicitly commits data management and sharing resources at a facility beyond what is conventionally made available to approved users should be accompanied by written approval from that facility. In determining the resources available for data management and sharing at DOE scientific user facilities,

¹¹ NSTC Subcommittee on Open Science. Desirable Characteristics of Data Repositories for Federally Funded Research. (2022) DOI: <https://doi.org/10.5479/10088/113528>

researchers should consult the published description of data management resources and practices at that facility and reference it in the DMSP.

5. Data sharing limitations

The DMSP must address any limitations of scientific data sharing to facilitate the protection of confidentiality, privacy, business confidential information, and/or security; avoid negative impact on intellectual property rights, innovation, program and operational improvements, and U.S. competitiveness; consider maximizing appropriate sharing through risk-mitigated limited access; preserve the balance between the relative value of long-term preservation and access and the associated cost and administrative burden; and otherwise be consistent with all applicable laws, regulations, and DOE orders and policies. Depending on the DOE funding agreement, a contractor or financial award recipient may have the right to assert copyright to or protect from public release for certain scientific data products. When contractors or award recipients assert copyright of scientific data, the DMSP should address licensing requirements and any limitations for sharing the copyrighted data. When contractors or award recipients assert data protection, the scientific data will not be shared with the public during the data protection period.

To improve the discoverability of and attribution for datasets created and used in the course of research, DOE encourages the citation of publicly available datasets within the reference section of publications, including using the persistent identifiers associated with the dataset, such as a Digital Object Identifier (DOI).

In addition, scientific data made publicly available through the implementation of a DMSP are required to be reported under any applicable reporting requirements to DOE's Office of Scientific and Technical Information (OSTI). A DOI is a type of persistent identifier that may be assigned to a dataset prior to reporting to OSTI, e.g., by the repository hosting the data or by a publisher. When there is a DOI assigned to a dataset, it must be provided within the metadata record submitted to OSTI. In cases where a data record does not already have an associated DOI, OSTI will assign a DOI for the data record.

DMSPs will be reviewed as part of the overall SC research application merit review process. Applicants are encouraged to consult the SC website for further information and suggestions for how to structure a DMSP: <https://science.osti.gov/funding-opportunities/digital-data-management>.

13. How to Prepare a Research and Related Budget and Justification

The following advice will improve the accuracy of your budget request:

- Funds requested for personnel (senior, key, and other) must be justified as the product of their effort on the project and their institutional base salary.

- Funds requested for fringe benefits must be calculated as the product of the requested salary and, if present, the negotiated fringe benefit rate contained in an institution’s negotiated indirect cost rate agreement.
- Funds requested for indirect costs must be calculated using the correct indirect cost base and the negotiated indirect cost rate.
- If a field is required (indicated with either an asterisk or a differently-colored background) and no funds are being requested, enter a zero “0.”
- You are encouraged to include the rate agreement used in preparing a budget as a part of the budget justification.
- Do not prepare a budget justification using the expired DOE form F4260.1.

If you are proposing indirect costs and do not already have an Indirect Cost Rate Agreement with your Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, it is recommended that you begin preparing an Indirect Cost Rate Proposal to be submitted, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

For your convenience in preparing an Indirect Cost Rate proposal, a link to applicant resources, including indirect rate model templates, has been provided below:

<https://science.osti.gov/sbir/applicant-resources/grant-application/>.

Institutions of higher education must either include their negotiated Indirect Cost Rate Agreement or a Uniform Resource Locator (URL, commonly referred to as a web link) where their agreement can be found in their budget justifications.

BUDGET FIELDS

Section A Senior/Key Person	For each Senior/Key Person, enter the requested information. List personnel, base salary, the number of months that person will be allocated to the project, requested salary, fringe benefits, and the total funds requested for each person. The requested salary must be the product of the base salary and the effort. Include a written narrative in the budget justification that justifies the need for requested personnel. Within the justification, explain the fringe benefit rate used if it is not the standard faculty rate.
Section B Other Personnel	List personnel, the number of months that person will be allocated to the project, requested salary fringe benefits, and the total funds requested for each person. Include a written narrative in the budget justification that fully justifies the need for requested personnel. Within the justification, provide the number of positions being filled in each category of other personnel.

<p>Section C Equipment</p>	<p>For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of \$10,000 or more and an expected service life of more than one year, unless a different threshold is specified in a negotiated Facilities and Administrative Cost Rate. (Note that this designation applies for proposal budgeting only and differs from the DOE definition of capital equipment.) List each item of equipment separately and justify each in the budget justification section. Do not aggregate items of equipment. Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose office equipment is not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.</p>
<p>Section D Travel</p>	<p>For purposes of this section only, travel to Canada or to Mexico is considered domestic travel. In the budget justification, list each trip's destination, dates, estimated costs including transportation and subsistence, number of staff traveling, the purpose of the travel, and how it relates to the project. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). To qualify for support, attendance at meetings or conferences must enhance the investigator's capability to perform the research, plan extensions of it, or disseminate its results. Domestic travel is to be justified separately from foreign travel. Within the budget justification, detail the number of personnel planning to travel and the estimated per-traveler cost for each trip.</p>
<p>Section E Participant/Trainee Support Costs</p>	<p>If applicable, submit training support costs. Educational projects that intend to support trainees (precollege, college, graduate and postgraduate) must list each trainee cost that includes stipend levels and amounts, cost of tuition for each trainee, cost of any travel (provide the same information as needed under the regular travel category), and costs for any related training expenses. Participant costs are those costs associated with conferences, workshops, symposia or institutes and breakout items should indicate the number of participants, cost for each participant, purpose of the conference, dates and places of meetings and any related administrative expenses. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).</p>
<p>Section F Other Direct Costs</p>	<ul style="list-style-type: none"> • Materials and Supplies: Enter total funds requested for materials and supplies in the appropriate fields. In the budget justification, indicate general categories such as glassware, and

	<p>chemicals, including an amount for each category (items not identified under “Equipment”). Categories less than \$1,000 are not required to be itemized. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).</p> <ul style="list-style-type: none"> • Publication Costs: Enter the total publication funds requested. The proposal budget may request funds for the costs of documenting, preparing, publishing or otherwise making available to others the findings and products of the work conducted under the award. In the budget justification, include supporting information. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Consultant Services: Enter total funds requested for all consultant services. In the budget justification, identify each consultant, the services he/she will perform, total number of days, travel costs, and total estimated costs. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • ADP/Computer Services: Enter total funds requested for ADP/Computer Services. Cloud computing costs must be included under this item. The cost of computer services, including computer-based retrieval of scientific, technical and education information may be requested. In the budget justification, include the established computer service rates at the proposing organization if applicable. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Subawards/Consortium/Contractual Costs: Enter total costs for all subawards/consortium organizations and other contractual costs proposed for the project. In the budget justification, justify the details. • Equipment or Facility Rental/User Fees: Enter total funds requested for Equipment or Facility Rental/User Fees. In the budget justification, identify each rental/user fee and justify. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • Alterations and Renovations: Enter total funds requested for Alterations and Renovations. In the budget justification, itemize by category and justify the costs of alterations and renovations, including repairs, painting, removal or installation of partitions, shielding, or air conditioning. Where applicable, provide the square footage and costs.
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	<ul style="list-style-type: none"> • Other: Add text to describe any other Direct Costs not requested above. Enter costs associated with “Other” item(s). Use the budget justification to further itemize and justify.
Section G Direct Costs	This represents Total Direct Costs (Sections A through F).
Section H Other Indirect Costs	Enter the Indirect Cost information, including the rates and bases being used, for each field. Only four general categories of indirect costs are allowed/requested on this form, so please consolidate if needed. Include the cognizant Federal agency and contact information if using a negotiated rate agreement. Within the budget justification, explain the use of multiple rates, if multiple rates are used.
Section I Total Direct and Indirect Costs	This is the total of Sections G and H.

GUIDANCE FOR APPLICATION BUDGETS AND COSTS

All costs requested in a budget must adhere to standard requirements for all Federal awards:

- Costs must be reasonable, using a prudent-person standard. (2 CFR 200.404),
- Costs must be allocable, related to the particular Federal award. (2 CFR 200.405),
- Costs must be allowable under the relevant Federal cost principles. (See 2 CFR 200.420 and following),
- Costs must be consistently treated, whether they are paid for with Federal funds or institutional funds. (2 CFR 200.403(c))

Allowable costs may include, but are not limited to, the following, subject to the applicable cost principles:

- “Buying out” faculty time dedicated to teaching or administrative responsibilities,
- Support for administrative personnel dedicated to the proposed activity,
- Support for professional development, training, mentoring of students and junior researchers,
- Travel to meet with collaborators at other institutions and relevant DOE/NNSA national laboratories, including costs for internships at the national laboratories; or to attend one or more science team, user facility, scientific conference, workshop, or professional society meetings relevant to the proposed research; or for the conduct of off-site research,
- Fringe benefits, which must be paid in accordance with an institution’s negotiated rates agreement, institutional policies, and the individual’s appointment,
- Temporary dependent-care costs incurred during travel,
- Membership costs in relevant professional societies, including both scientific societies and those dedicated to research administration,

- Instrumentation required to conduct proposed research,
- Equipment (items with a useful life of more than 12 months and a per-item acquisition cost of more than \$10,000) required to conduct proposed research,
- Purchase of equipment, modification of equipment, or provision of services necessary to enable work to be carried out by project personnel with a disability,
- Stipends and benefits for students and post-doctoral researchers, recognizing their dual nature as both trainees and employees,
- Participation in standards development relevant to the proposed research, including travel and membership costs,
- Salary support to cover time to participate in outreach for recruitment, internships, and training events, science team meetings, partnership development, or information gathering, and
- Other direct costs, e.g., materials and supplies such as office supplies, desktop or laptop computer, and/or software licenses that are directly necessary to enable the proposed activities.

14. How to Register in PAMS

After you submit your application through Grants.gov, the application will automatically transfer into the Portfolio Analysis and Management System (PAMS) for processing by the DOE SC. Many functions for grants and cooperative agreements can be done in PAMS, which is available at <https://pamspublic.science.energy.gov>.

You will want to “register to” your application: a process of linking yourself to the application after it has been submitted through Grants.gov and processed by DOE.

You must register in PAMS to submit a pre-application or a LOI.

Notifications sent from the PAMS system will come from the PAMS email address <PAMS.Autoreply@science.doe.gov>. Please make sure your email server/software allows delivery of emails from the PAMS email address to yours.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with (“register to”) your institution. Detailed steps are listed below.

CREATE PAMS ACCOUNT:

To register, click the “Create New PAMS Account” link on the website <https://pamspublic.science.energy.gov/>.

- Click the “No, I have never had an account” link and then the “Create Account” button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the “Save and Continue” button.

- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the “Create Account” button.
- Read the user agreement and click the “Accept” button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
- PAMS will take you to the “Having Trouble Logging In?” page. (If you have been an SC merit reviewer or if you have previously submitted an application, you may already be linked to an institution in PAMS. If this happens, you will be taken to the PAMS home page.)

REGISTER TO YOUR INSTITUTION:

- Click the link labeled “Option 2: I know my institution and I am here to register to the institution.” (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the “Register to Institution” link.)
- PAMS will take you to the “Register to Institution” page.
- Type a word or phrase from your institution name in the field labeled, “Institution Name like,” choose the radio button next to the item that best describes your role in the system and click the “Search” button. A “like” search in PAMS returns results that contain the word or phrase you enter; you do not need to enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (If your institution has a frequently used acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may find it easiest to search for the acronym under “Institution Name like.” Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the “Actions” link in the Options column next to the institution name to obtain a dropdown list. Select “Add me to this institution” from the dropdown. PAMS will take you to the “Institutions – List” page.
- If you do not see your institution in the initial search results, you can search again by clicking the “Cancel” button, clicking the Option 2 link, and repeating the search.
- If, after searching, you think your institution is not currently in the database, click the “Cannot Find My Institution” button and enter the requested institution information into PAMS. Click the “Create Institution” button. PAMS will add the institution to the system, associate your profile with the new institution, and return you to the “Institutions – List” page when you are finished.

For help with PAMS, click the “PAMS Help” link on the PAMS website, <https://pamspublic.science.energy.gov/>. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855)

818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this NOFO should reference the NOFO number printed on the cover page.

15. How to View Applications in PAMS

Each Grants.gov application submitted to the DOE SC automatically transfers into PAMS and is subsequently assigned to a program manager. At the time of program manager assignment, the three people listed on the SF-424 (R&R) cover page will receive an email with the subject line, "Receipt of Proposal 0000xxxxxx by the DOE Office of Science." These three people are the PI (Block 14), Authorized Representative (Block 19), and Point of Contact (Block 5). In PAMS notation, applications are known as proposals, the PI is known as the PI, the Authorized Representative is known as the Sponsored Research Officer/Business Officer/Administrative Officer (SRO/BO/AO), and the Point of Contact is known as the POC.

There will be a period of time between the application's receipt at Grants.gov and its assignment to a DOE SC program manager. Program managers are typically assigned two weeks after applications are due at Grants.gov: please refrain from attempting to view the proposal in PAMS until you receive an email providing the assignment of a program manager.

Once the email is sent, the PI, SRO/BO/PO, and POC will each be able to view the submitted proposal in PAMS. Viewing the proposal is optional.

Following are two sets of instructions for viewing the submitted proposal, one for individuals who already have PAMS accounts and one for those who do not.

If you already have a PAMS account, follow these instructions:

1. Log in to PAMS at <https://pamspublic.science.energy.gov/>.
2. Click the "Proposals" tab and click "Access Previously Submitted Grants.gov Proposal."
3. Enter the following information:
 - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, "Receipt of Proposal ...".
 - Email (as entered in Grants.gov application): Enter your email address as it appears on the SF424(R&R) Cover Page.
 - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select "SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer)." If your name appears

in block 14 of the SF424 R&R cover page as the PI, select “Principal Investigator (PI).” If your name appears in block 5 of the SF424 R&R as the point of contact, select “Other (POC).”

4. Click the “Save and Continue” button. You will be taken to your “My Proposals” page. The Grants.gov proposal will now appear in your list of proposals. Click the “Actions/Views” link in the options column next to this proposal to obtain a dropdown list. Select “Proposal” from the dropdown to see the proposal. Note that the steps above will work only for proposals submitted to the DOE SC since May 2012.

If you do not already have a PAMS account, follow these instructions:

1. To register, click the “Create New PAMS Account” link on the website <https://pamspublic.science.energy.gov/>.
2. Click the “No, I have never had an account” link and then the “Create Account” button.
3. You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the “Save and Continue” button.
4. On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the “Create Account” button.
5. Read the user agreement and click the “Accept” button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
6. You will be taken to the Register to Institution page. Select the link labeled, “Option 1: My institution has submitted a proposal in Grants.gov. I am here to register as an SRO, PI, or POC (Sponsored Research Officer, Principal Investigator, or Point of Contact).”
7. Enter the following information:
 - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, “Receipt of Proposal ...”.
 - Email (as entered in Grants.gov proposal): Enter your email address as it appears on the SF424(R&R) Cover Page.
 - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select “SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer).” If your name appears in block 14 of the SF424 R&R cover page as the PI, select “Principal Investigator (PI).” If your name appears in block 5 of the SF424 R&R as the point of contact, select “Other (POC).”

8. Click the “Save and Continue” button. You will be taken to your “My Proposals” page. The Grants.gov proposal will now appear in your list of proposals. Click the “Actions/Views” link in the options column next to this proposal to obtain a dropdown list. Select “Proposal” from the dropdown to see the proposal.

If you were listed as the PI on a prior submission but you have not previously created an account, you may already be listed in PAMS. If this is the case, you will be taken to the PAMS home page after agreeing to the Rules of Behavior. If that happens, follow the instructions listed above under “If you already have a PAMS account...” to access your Grants.gov proposal.

16. How to Register in Other Systems Before Submitting an Application

SYSTEMS TO REGISTER IN

Applicants must register with FedConnect at www.FedConnect.net. The full, binding version of assistance agreements will be posted to FedConnect. To create an organization account, your organization’s SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf

Recipients must register with the Federal Funding Accountability and Transparency Act Subaward Reporting System at <https://www.fsrs.gov>. This registration must be completed before an award may be made: you are advised to register while preparing your application.

REGISTERING IN GRANTS.GOV

Applicants must register with Grants.gov, following the instructions at <https://www.grants.gov/applicants/applicant-registration> and described above.

WHERE TO SUBMIT AN APPLICATION

You must submit the application through Grants.gov at www.Grants.gov, using either the online webforms or downloaded forms, or a system-to-system service

Submit electronic applications through the “Apply for Grants” function at www.Grants.gov. If you have problems completing the registration process or submitting your application, call Grants.gov at 1-800-518-4726 or send an email to support@Grants.gov.

Please ensure that you have read the applicable instructions, guides, help notices, frequently asked questions, and other forms of technical support on Grants.gov.

DOE SC PORTFOLIO ANALYSIS AND MANAGEMENT SYSTEM (PAMS)

Applicants must register in the Portfolio Analysis and Management System (PAMS) to submit letters of intent and pre-applications, to view merit reviewer comments, or to take a number of post-award actions.

C. Administrative and National Policy Requirements

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulations).

2. Availability of Funds

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the DOE Contracting Officer for this award and until the recipient receives notice of such availability, to be confirmed in writing by the DOE Contracting Officer.

3. Buy America Preference for Infrastructure Projects

1. OVERVIEW

Made law via the passage of the Infrastructure Investment and Jobs Act (P.L. 117-58), the Build America, Buy America Act ("BABA") mandates that all iron, steel, manufactured products, and construction materials used in Federally-funded projects meets certain domestic assembly and domestic content requirements. Applicants are strongly encouraged to read this section carefully, as this requirement may impact project budget and/or timeline; it is crucial that applicants properly understand the requirements of BABA as they scope out their projects.

As is detailed more thoroughly below, BABA applies to any project that is receiving Federal financial assistance where the prime recipient is a State, local, or tribal government, nonprofit organization, or institution of higher education. It does not apply to projects that have a for-profit organization serving as the prime recipient.

2. DEFINITIONS

There are several terms of art that are given specific definitions with respect to the application and execution of BABA. [Full definitions of these terms can be found by](#)

[following this hyperlink to the relevant section \(2 CFR 184.3\) of the Code of Federal Regulations](#). Any additional context not present in the Code of Federal Regulations definition for a given term is provided below.

a. *Buy America Preference* (Sometimes also referred to as the Buy America Requirement or Domestic Content Procurement Preference). Note that, despite the use of the word “Preference,” this is very much a mandatory compliance requirement. The statute, implementing regulations, and OMB guidance characterize this requirement as the “Buy America Preference,” and so that terminology is reflected here to ensure consistency with the statute and existing guidance.

b. *Component*

c. *Construction Materials*

d. *Infrastructure Project*

e. *Iron or steel products*

f. *Manufactured Products*

g. *Manufacturer*

h. *Predominantly of iron or steel or a combination of both*

i. *Produced in the United States* (Sometimes also referred to as the “Domestic Production requirement”)

j. [Section 70917\(c\)](#) *Materials* (i.e., certain materials used in construction that are specifically excluded from being categorized as “construction materials”; as such, the Buy America Preference is not applied to these materials.

Additionally, the following terms are not defined in 2 CFR 184.3, but are important for a proper understanding of BABA and its application:

k. *Project* – means the construction, alteration, maintenance, or repair of public infrastructure in the United States.

l. *Infrastructure* – Infrastructure includes, at a minimum: the structures, facilities, and equipment for roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; buildings and real property; and structures, facilities, and equipment that generate, transport, and distribute energy, including electric vehicle (EV) charging.

m. *Public infrastructure* – The Buy America Preference does not apply to non-public (private) infrastructure. For purposes of compliance with BABA, infrastructure should be considered “public” if it is:

(1) publicly owned (owned, operated, funded and managed, in whole or in part, by any unit or authority of a Federal, State, or Local government-including U.S. Territories and Indian Tribes); or

(2) privately owned but utilized primarily for a public purpose. Infrastructure should be considered to be “utilized primarily for a public purpose”, and therefore “public”,

if it is privately owned but operated on behalf of the public or is a place of public accommodation.

3. BUY AMERICA PREFERENCE

A. The Buy America Preference

Absent an approved waiver, none of the funds provided under a federal award (i.e., whether paid for with federal share or recipient cost-share) may be used for a project for infrastructure unless all iron, steel, manufactured products, and/or construction materials are “produced in the United States.”

In general, applicants should ask the following questions to determine BABA applicability to their award:

1. Is the recipient a State, local, or tribal government; nonprofit organization, or institution of higher education? (If the prime is a for-profit organization, BABA does not apply. Otherwise, move on to question 2);
2. Does the project include the construction, alteration, maintenance, and/or repair of infrastructure in the United States? (“Infrastructure” is defined in the BABA statute and regulations, and is quite broad; although the definition provides several specific items that are considered infrastructure, it also includes broad categories such as “buildings and real property,” which casts a wide net. If the project does not include work on infrastructure, then BABA does not apply. Otherwise, move to question 3);
3. Is the infrastructure in question publicly owned or privately owned but utilized primarily for a public purpose? (Anything owned by a public entity is publicly owned, by definition. “privately owned but utilized primarily for a public purpose” generally means privately owned infrastructure that is operated on behalf of the public, or that serves as a place of public accommodation. DOE has the final say on this determination, so applicants who do not think their infrastructure is “privately-owned but utilized primarily for a public purpose” should have justifications prepared supporting their determination).

If the answer to the above questions is “yes,” then BABA applies to your project.

If a determination is made that BABA will apply to a project, recipients must then ensure that all iron, steel, manufactured products, and construction materials used in the project are “produced in the United States.” Standards to satisfy this requirement differ based on the category a given material falls under:

- a. All iron and steel used in the project is produced in the United States—this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

b. All manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation. (Note: 2 CFR 184.5 provides specific guidance for determining the cost of components for manufactured products); and
c. All construction materials are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. (Note: 2 CFR 184.6 provides additional standards that must be satisfied for some specified construction materials in order for those materials to be considered “produced in the United States”).

Recipients are responsible for administering their award in accordance with the terms and conditions, including the Buy America Preference. The recipient must ensure that the Buy America Preference flows down to all subawards and that the subawardees and subrecipients comply with the Buy America Preference. The Buy America Preference term and condition must be included all sub-awards, contracts, subcontracts, and purchase orders for work performed under the infrastructure project.

B. Specific Application of the Preference

The Domestic Production requirement only applies to the iron or steel products, manufactured products, and construction materials used for the construction, alteration, maintenance, or repair of public infrastructure in the United States. Only items that are consumed in, incorporated into, or permanently affixed to the infrastructure in the project are required to meet the “produced in the United States” requirements. As such, this requirement does not apply to tools, equipment, and supplies - such as temporary scaffolding - brought into the construction site and removed at or before the completion of the infrastructure project. This is likewise applicable to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project but are not an integral part of the structure or permanently affixed to the infrastructure project.

C. Section 70917(c) Materials

The BABA Statute at Section 70917(c) provides a list of materials which are specifically excluded from categorization as “construction materials,” and therefore may be used without meeting the relevant “produced in the United States” standard.

Generally referred to as “Section 70917(c) Materials,” these are:

- cement and cementitious materials;

- aggregates such as stone, sand, or gravel; or
- aggregate binding agents or additives as provided in Section 70917(c) of BABA.

Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel. Accordingly, asphalt is also excluded from the definition of Construction materials.

[Section 70917\(c\)](#) materials, on their own, are not manufactured products. Further, [Section 70917\(c\)](#) materials should not be considered manufactured products when they are used at or combined proximate to the work site—such as is the case with wet concrete or hot mix asphalt brought to the work site for incorporation. However, certain [Section 70917\(c\)](#) materials (such as stone, sand, and gravel) may be used to produce a manufactured product, such as is precast concrete. Precast concrete is made of components, is processed into a specific shape or form, and is in such state when brought to the work site. Furthermore, wet concrete should not be considered a manufactured product if not dried or set prior to reaching the work site.

Further clarification is provided in 2 CFR 184 on the circumstances under which a determination is made that [Section 70917\(c\)](#) materials should be treated as components of a manufactured product. That determination is based on consideration of: (i) the revised definition of the “manufactured products” at [2 CFR 184.3](#); (ii) a new definition of “[Section 70917\(c\)](#) materials” at [2 CFR 184.3](#); (iii) new instructions at [2 CFR 184.4\(e\)](#) on how and when to categorize articles, materials, and supplies; and (iv) new instructions at [2 CFR 184.4\(f\)](#) on how to apply the Buy America preference by category.

4. CERTIFICATION OF COMPLIANCE

Recipients must request a certification from a product manufacturer that the iron, steel, manufactured product or construction material they are acquiring from the manufacturer were “produced in the United States” (i.e., that they meet the requisite standards outlined at the beginning of Section 3, above). DOE will not provide any sort of “certification template” for this purpose; recipients are responsible for ensuring that a certification contains enough information that it properly validates the BABA compliance of the item(s) listed within the certification.

Although DOE does not require a specific format for the certification, the following elements must be present:

- A listing of all products covered by the certification, including their category (e.g., iron, steel, manufactured product, or construction material);
- A recitation of the relevant “produced in the United States” standard for any categories (iron, steel, manufactured product, or construction material) provided in the above list, to ensure the manufacturer properly understands the standards to be met;

- A clear statement that the products listed meet the relevant “produced in the United States” standard(s);
- A signature from an authorized representative of the manufacturer certifying the contents of the compliance statement; and
- Any other information the recipient deems necessary for the certification to demonstrate compliance with the BABA requirements.

Recipients must also maintain certifications or equivalent documentation for proof of compliance that those articles, materials, and supplies that are consumed in, incorporated into, affixed to, or otherwise used in the infrastructure project, not covered by a waiver or exemption, are produced in the United States. The certification or proof of compliance must be provided by the suppliers or manufacturers of the iron, steel, manufactured products and construction materials and flow up from all subawardees, contractors and vendors to the recipient. Recipients must keep these certifications with the award/project files and be able to produce them upon request from DOE, auditors or Office of Inspector General.

5. WAIVERS

When necessary, recipients may apply for, and DOE may grant, a waiver from the Buy America Preference. In general, DOE will not review or consider waiver requests from applicants. Waiver requests are subject to review by DOE and the Office of Management and Budget, as well as a public comment period of no less than 15 calendar days.

Waivers must be based on one of the following justifications:

- a. Public Interest- Applying the Buy America Preference would be inconsistent with the public interest;
- b. Non-Availability- The types of iron, steel, manufactured products, or construction materials are not produced in the United States in sufficient and reasonably available quantities or of a satisfactory quality; or
- c. Unreasonable Cost- The inclusion of iron, steel, manufactured products, or construction materials produced in the United States will increase the cost of the overall project by more than 25 percent.

Additional information on the submission and processing of a waiver request will be provided to applicants whose applications are selected for award negotiations. Alternatively, applicants can find more information about the process on [DOE’s Build America, Buy America home page](#).

4. Conference Spending (February 2015)

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that

would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed \$20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of the date, location, and number of employees attending such conference.

5. Commitment of Public Funds

(a) A DOE financial assistance award is valid only if it is in writing and is signed, either in writing or electronically, by a DOE Contracting Officer.

(b) Recipients are free to accept or reject the award. A request to draw down DOE funds constitutes the Recipient's acceptance of the terms and conditions of this Award.

6. Corporate Felony Conviction and Federal Tax Liability Representations (March 2014)

In submitting an application in response to this NOFO the Applicant represents that:

- It is not a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months,
- It is not a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

- A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

7. Covered Individual Definition, Designation, and Responsibility

For the purposes of this NOFO, a Covered Individual means an individual who (a) contributes in a substantive, meaningful way to the development or execution of the scope of work of a project proposed for funding by DOE, and (b) is designated as a covered individual by DOE.

DOE designates as covered individuals any principal investigator (PI); project director (PD); co-principal investigator (Co-PI); co-project director (Co-PD); project manager; and any individual regardless of title that is functionally performing as a PI, PD, Co-PI, Co-PD, or project manager. Status as a consultant, graduate (master's or PhD) student, or postdoctoral

associate does not automatically disqualify a person from being designated as a “covered individual” if they meet the definition in (a) above.

The prime applicant is responsible for assessing the applicability of (a) against each person listed on the application. Further, the prime applicant is responsible for identifying any such individual to DOE for designation as a covered individual, if not already designated by DOE as described above.

Individuals committing no measurable effort or “as-needed” effort are not automatically exempt from being designated as a covered individual. The prime applicant’s listing of an individual in the “Senior/Key Person” section of an SF-424(R&R) budget serves as an acknowledgement that DOE designates that person as a covered individual.

DOE may further designate covered individuals during award negotiations or the award period of performance.

8. Digital Persistent Identifier (PID)

Individuals that are required to submit Biographical Sketch and/or Current and Pending (Other) Support disclosures must provide a digital persistent identifier (PID) in such disclosures as part of the application. Included PIDs must meet the common/core standards specified in an [ORCID iD](#).

Include this information for each covered individual with the [Current and Pending \(Other\) Support](#) submission as described above and in [Section IX](#).

9. Environmental, Safety and Health (ES&H) Performance of Work at DOE Facilities

With respect to the performance of any portion of the work under this award which is performed at a DOE-owned or controlled site, the recipient agrees to comply with all state and Federal ES&H regulations, and with all other ES&H requirements of the operator of such site.

Prior to the performance on any work at a DOE-owned or controlled site, the recipient shall contact the site facility manager for information on DOE and site-specific ES&H requirements.

The recipient shall apply this provision to all subrecipients at any tier.

10. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Government may seek the advice of qualified non-Federal personnel as reviewers. The Government may also use non-Federal personnel to conduct routine, nondiscretionary administrative activities. The applicant, by submitting its application, consents to the use of non-Federal reviewers/administrators. Non-Federal reviewers must sign a conflict-of-interest agreement and a certificate of confidentiality prior to reviewing an application. Non-Federal personnel conducting administrative activities must sign a non-disclosure agreement.

11. Federal, State, and Local Requirements

With respect to the performance of any portion of the work under this award, the recipient agrees to comply with all applicable local, state, and Federal ES&H regulations. The recipient shall apply this provision to all subrecipients at any tier.

12 Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. § 40118), commonly referred to as the “Fly America Act,” and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a United States flag carrier, if service is available.

13. Framework for Nucleic Acid Synthesis Screening Requirement

Entities conducting life sciences R&D activities, or technical assistance to support life sciences R&D activities awards issued after October 2024 with synthetic nucleic acids – including but not limited to Deoxyribonucleic acid (DNA) and ribonucleic acid (RNA), whether single- or double- stranded, as well as whole organism genomes (e.g., viruses, bacteria), or the use of any benchtop equipment capable of synthesizing nucleic acids are required to obtain synthetic nucleic acids or devices capable of synthesizing them – from Providers or Manufacturers that attest to implementing 2024 OSTP Framework for Nucleic Acid Synthesis Screening.

The attestation may be provided through: (1) a publicly posted statement (e.g., public website) or (2) directly to the Grants Officer and the prime recipient/subrecipient for subawards by the Provider or Manufacturer. The Provider or Manufacturer must ensure that the attestation is signed by an individual with authority to respond on behalf of the organization.

Flowdown of requirements to subrecipients. The prime recipient shall incorporate the substance of this term in its terms and conditions, including this paragraph, in all subawards in support of the award that may involve the procurement of synthetic nucleic acids and benchtop nucleic acid synthesis equipment.

14. Funding Restrictions

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

Cost Principles: Costs must be allowable, allocable and reasonable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation).

Pre-award Costs: Recipients may charge to an award resulting from this NOFO pre-award costs that were incurred within the 90-day calendar period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation). Recipients must obtain the prior approval of the DOE Contracting Officer for any pre-award costs that are for periods greater than this 90-day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

15. Government Right to Reject or Negotiate

DOE reserves the right, without qualification, to reject any or all applications received in response to this NOFO and to select any application, in whole or in part, as a basis for negotiation and/or award.

16. Implementation of Presidential Memorandum Simplifying the Funding of Energy Infrastructure and Critical Mineral and Material Projects

Pursuant to this Presidential Memorandum, DOE may share and use within the Government any application information provided by or on behalf of the applicant. Accordingly, in accordance with applicable law and notwithstanding any other provisions herein, by submitting an application or agreeing to a financial assistance arrangement with DOE under this NOFO, the applicant is providing consent for any properly marked trade secret, confidential, proprietary, privileged or otherwise sensitive application information provided by or on behalf of the applicant to be disclosed to the Executive Office of the President and relevant Agencies offering loans, grants, equity, guarantees or other federal

funding, for the purposes of the Presidential Memorandum on Simplifying the Funding of Energy Infrastructure and Critical Mineral and Material Project.

17. Intergovernmental Review

This program is not subject to Executive Order 12372 Intergovernmental Review of Federal Programs.

18. Logos and Wordmarks

DOE created a logo that recipients may use. The logos and best practices may be found at <https://www.energy.gov/management/pf-2023-19-department-energy-awardee-usage-branding-and-logo-guide>. Information about the DOE logo, seal, and wordmark may be found at <https://www.energy.gov/design>. Information about the SC logo may be found at <https://science.osti.gov/About/Resources/Logos>.

19. Modifications

Notices of any modifications to this NOFO will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or a NOFO message is posted by registering with FedConnect as an interested party for this NOFO. It is recommended that you register as soon after release of the NOFO as possible to ensure you receive timely notice of any modifications or other NOFOs. More information is available at www.FedConnect.net.

20. National Environmental Policy Act (NEPA) Compliance

DOE would determine if NEPA applies to the proposal in accordance with Section 2.1 of the DOE NEPA Implementing Procedures [[DOE NEPA Implementing Procedures \(June 2025\) | Department of Energy](#)], by evaluating the information provided in question 4.a. on the “Research and Related Other Project Information” form. If NEPA applies, DOE would then determine the required level of NEPA review following the procedures described in Section 2.2 of the DOE NEPA Implementing Procedures. If DOE could not apply a categorical exclusion (CX) to the proposed action, DOE would evaluate the significance of the proposed action’s reasonably foreseeable effects consistent with section 3.2 of the DOE NEPA Implementing Procedures:

1. If the proposed action is evaluated in a prior NEPA document by DOE or any other agency, DOE will consider relying on the existing document, or any pertinent part thereof, and supplementing that document as needed;
2. If the proposed action is not likely to have a reasonably foreseeable significant effect on the quality of the human environment, or if the significance of the effects of

the proposed action is unknown, DOE will prepare an environmental assessment (EA), as described in chapter 6 of the DOE NEPA Implementing Procedures; or 3. If the proposed action is likely to have a reasonably foreseeable significant effect on the quality of the human environment, DOE will prepare an environmental impact statement (EIS), as described in Chapter 7 of the DOE NEPA Implementing Procedures.

This NEPA process would need to be completed prior to the applicant taking any action on the proposed project that could have adverse environmental effects or that could limit the choice of reasonable alternatives. The process would begin with a request from DOE for an environmental disclosure. If DOE is able to make a CX determination based on that disclosure, that would end the NEPA process. If DOE determines that an EA or EIS is necessary, it would need to be funded by the applicant. DOE has the expectation that the recipient will disclose the potential environmental effects, which would serve to initiate dialogue with DOE as necessary. The inability to satisfy the NEPA requirements after an award would result in cancellation of the award.

21. Nondisclosure and Confidentiality Agreements Representations (June 2015)

By submitting an application in response to this NOFO, the Applicant represents that:

- (1) It does not and will not require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contractors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a Federal department or agency authorized to receive such information.
- (2) It does not and will not use any Federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:
 - a. *“These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling.”*
 - b. The limitation above shall not contravene requirements applicable to Standard Form 312, Form 4414, or any other form issued by a Federal department or agency governing the nondisclosure of classified information.
 - c. Notwithstanding provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other

than an employee or officer of the United States Government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States Government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

22. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this program include those which describe and promote the understanding of scientific and technical aspects of specific energy technologies, but not those which encourage or support political activities such as the collection and dissemination of information related to potential, planned or pending legislation.

23. Portable Document Format (PDF) Generation

The Project Narrative in an application must be one single PDF file that contains the DOE Title Page, Project Narrative, all required appendices, and other attachments. This single PDF file may not be scanned from a printed document and must be attached in Field 8 on the Grants.gov form. This must be a plain PDF file consisting of text, numbers, and images. The Project Narrative will be read by SC staff using the full version of Adobe Acrobat: Please ensure that the narrative is readable in Acrobat.

Do not submit files with editable fields, password-protection, encryption, redactions, comments, or any other advanced features in some PDF-compatible software. If a file cannot be opened and searched, an application may be declined.

If combining multiple files into one Project Narrative, ensure that a PDF portfolio or binder is not created.

If creating PDF files using any software other than Adobe Acrobat, please use a “Print to PDF” or equivalent process to ensure that all content is visible in the Project Narrative.

Once a Project Narrative has been assembled, please submit the combined Project Narrative file through a “Print to PDF” or equivalent process to ensure that all content is visible in one PDF file that can be viewed in Adobe Acrobat.

Review your submission to ensure that blank pages are not present.

24. Prohibition on the Use of Funds for Activities Related to FASC-Prohibited Unmanned Aircraft Systems

Pursuant to the prohibition in section 1825 of the American Security Drone Act of 2023 ([Public Law 118-31](#)), on or after December 22, 2025, the following prohibition applies to the use of funds provided through this award:

- 1) Definition - The terms "FASC-prohibited unmanned aircraft system" and "unmanned aircraft system" have the definitions provided in [48 CFR 40.201](#), or successor regulation.
- 2) Prohibition – No Federal funds awarded through this award may be used by a recipient or subrecipient:
 - a) To procure a FASC-prohibited unmanned aircraft system; or
 - b) In connection with the operation of a FASC-prohibited unmanned aircraft system.

25. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

As set forth in 2 CFR 200.216, recipients and subrecipients are prohibited from obligating or expending project funds (federal funds and recipient cost share) to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that use covered telecommunications equipment or services as a substantial or essential component of any system, or as critical technology as part of any system. As described in Section 889 of Public Law 115-232, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

See Public Law 115-232, Section 889, 2 CFR 200.216, and 2 CFR 200.471 for additional information.

26. Prohibition on Discrimination and Harassment

All people conducting, supporting, or participating in scientific research under this award must be able to do so on the basis of their abilities and without any unnecessary barriers. Recipients of awards resulting from this NOFO are prohibited from engaging in discrimination on any basis prohibited by law, including harassment (sexual or non-sexual) as contained in 10 CFR 1040, 1041, and 1042.

Recipients may contact the DOE's Office of Civil Rights for technical assistance in meeting their institutional requirements under these regulations, including assistance in addressing complaints of discrimination or harassment. DOE is committed to meeting its obligations under Title IV of the Civil Rights Act. The United States Equal Employment Opportunity

Commission also makes a number of resources available at <https://www.eeoc.gov/eeoc/publications/index.cfm> to ensure that employees may perform their work without hindrance. Graduate students and post-doctoral researchers are understood to have a dual role as both trainees and employees, in accordance with 2 CFR 200.400 (f).

27. Prohibition on Entities of Concern

PROHIBITION

No Entity of Concern as defined in [Section 10114 of Public Law 117-167 \(42 USC 18912\)](#), may receive any grant, contract, cooperative agreement, or loan of \$10 million or more in Department of Energy funds, including funds made available by the Consolidated Appropriations Act, 2024 ([Public Law 118-42](#)).

In addition, for all awards involving Departmental activities authorized under [Public Law 117-167](#), no Entity of Concern (including an individual that owns or controls, is owned or controlled by, or is under common ownership or control with an Entity of Concern) may receive DOE funds or perform work under any award, subject to certain penalties. See [Section 10114 of Public Law 117-167 \(42 USC 18912\)](#) and [Division D, Title III, Section 310 of Division D of the Consolidated Appropriations Act of 2024 \(Pub. L. No. 118-42\)](#) for additional information.

By submitting an application to this NOFO, the applicant is certifying that neither the applicant nor any of the project participants qualify as Entities of Concern.

DEFINITIONS

Entity of Concern is defined in section 10114 of Public Law 117-167 (42 USC 18912), also known as the CHIPS and Science Act, as any entity, including a national, that is—

(A) identified under section 1237(b) of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (50 U.S.C. 1701 note; Public Law 105-261);

(B) identified under [section 1260H](#) of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (10 U.S.C. 113 note; Public Law 116- 283);

(C) on the [Entity List maintained by the Bureau of Industry and Security of the Department of Commerce](#) and set forth in Supplement No. 4 to part 744 of title 15, Code of Federal Regulations;

(D) included in the list required by section 9(b)(3) of the Uyghur Human Rights Policy Act of 2020 (Public Law 116-145; 134 Stat. 656); or

(E) identified by the Secretary, in coordination with the Director of the Office of Intelligence and Counterintelligence and the applicable office that would provide, or is providing, covered support, as posing an unmanageable threat—

- (i) to the national security of the United States; or
- (ii) of theft or loss of United States intellectual property.

28. Prohibition on Lobbying Activity

By accepting funds under this award, you agree that none of the funds obligated on the award shall be expended, directly or indirectly, to influence congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 USC 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

29. Prohibition Related to Malign Foreign Talent Recruitment Programs

PROHIBITION

Individuals participating in a [Malign Foreign Talent Recruitment Program](#) are prohibited from participating in this award.

Should an award result from this NOFO, the recipient must exercise ongoing due diligence to reasonably ensure that no such individuals participating on the DOE-funded project are participating in a *Malign Foreign Talent Recruitment Program*. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy.

Further, the recipient must notify DOE within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a malign foreign talent recruitment program. DOE may modify and add requirements related to this prohibition to the extent required by law.

REQUIRED CERTIFICATIONS

- a. Each covered individual must certify that they are not party to a [Malign Foreign Talent Recruitment Program](#).
- b. The applicant and the subrecipients must certify that the covered individuals in their respective employment have been made aware of the Malign Foreign Talent

Recruitment Program prohibition and have complied with their certification responsibilities identified in a.

NON-DISCRIMINATION

DOE will ensure that the Malign Foreign Talent Recruitment Program Prohibition is carried out in a manner that does not target, stigmatize, or discriminate against individuals on the basis of race, ethnicity, or national origin, consistent with title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.).

DEFINITIONS

Malign Foreign Talent Recruitment Program. as defined in P.L. 117-167, Section 10638(4):

- A. any program, position, or activity that includes compensation in the form of cash, in-kind compensation, including research funding, promised future compensation, complimentary foreign travel, things of non de minimis value, honorific titles, career advancement opportunities, or other types of remuneration or consideration directly provided by a foreign country at any level (national, provincial, or local) or their designee, or an entity based in, funded by, or affiliated with a foreign country, whether or not directly sponsored by the foreign country, to the targeted individual, whether directly or indirectly stated in the arrangement, contract, or other documentation at issue, in exchange for the individual—
 - i. engaging in the unauthorized transfer of intellectual property, materials, data products, or other nonpublic information owned by a United States entity or developed with a federal research and development award to the government of a foreign country or an entity based in, funded by, or affiliated with a foreign country regardless of whether that government or entity provided support for the development of the intellectual property, materials, or data products;
 - ii. being required to recruit trainees or researchers to enroll in such program, position, or activity;
 - iii. establishing a laboratory or company, accepting a faculty position, or undertaking any other employment or appointment in a foreign country or with an entity based in, funded by, or affiliated with a foreign country if such activities are in violation of the standard terms and conditions of a federal research and development award;
 - iv. being unable to terminate the foreign talent recruitment program contract or agreement except in extraordinary circumstances;
 - v. through funding or effort related to the foreign talent recruitment program, being limited in the capacity to carry out a research and development award or required to engage in work that would result in substantial overlap or duplication with a federal research and development award;

- vi. being required to apply for and successfully receive funding from the sponsoring foreign government's funding agencies with the sponsoring foreign organization as the recipient;
 - vii. being required to omit acknowledgment of the recipient institution with which the individual is affiliated, or the federal research agency sponsoring the research and development award, contrary to the institutional policies or standard terms and conditions of the federal research and development award;
 - viii. being required to not disclose to the federal research agency or employing institution the participation of such individual in such program, position, or activity; or
 - ix. having a conflict of interest or conflict of commitment contrary to the standard terms and conditions of the federal research and development award; and
- B. a program that is sponsored by—
- i. a foreign country of concern or an entity based in a foreign country of concern, whether or not directly sponsored by the foreign country of concern;
 - ii. an academic institution on the list developed under section 1286(c)(8) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note;¹Public Law 115–232); or
 - iii. a foreign talent recruitment program on the list developed under section 1286(c)(9) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note;¹Public Law 115–232).

Consistent with applicable law (42 U.S.C. 19232), this provision does not prohibit, unless such activities are funded, organized, or managed by an academic institution or a foreign talent recruitment program on the lists developed under paragraphs (8) and (9) of section 1286(c) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 4001 note; Public Law 115–232)—

- A. making scholarly presentations and publishing written materials regarding scientific information not otherwise controlled under current law;
- B. participation in international conferences or other international exchanges, research projects or programs that involve open and reciprocal exchange of scientific information, and which are aimed at advancing international scientific understanding and not otherwise controlled under current law;
- C. advising a foreign student enrolled at an institution of higher education or writing a recommendation for such a student, at such student's request; and
- D. other international activities determined appropriate by the federal research agency head or designee.

30. Proprietary Application Information

Department of Energy (DOE) takes very seriously the confidentiality of all applicants and will treat information submitted in applications, as well as the identity of applicants, as confidential to the fullest extent permissible under Federal law. In order for DOE to protect confidential information, the applicant must also treat the information as confidential and properly mark it as described below. DOE will not be able to protect information that the applicant has released publicly or is in the public domain. For additional information on DOE's Freedom of Information Act (FOIA) regulations, see 10 CFR 1004.

Applicants should not include business sensitive information (e.g., commercial or financial information that is privileged or confidential), trade secrets, proprietary, or otherwise confidential information in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the NOFO. Applicants are advised to not include any critically sensitive proprietary detail.

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the FOIA. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

Applications and other submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the FOIA or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The cover sheet of the Application and other submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: “Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure.” In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

IMPORTANT GUIDANCE FOR COMPANY SUBMITTERS:

As per DOE’s FOIA regulations and Department of Justice FOIA guidance, if DOE receives a FOIA request the following general steps will be taken:

1. DOE will review the request to determine whether your company’s information is subject to the request. Only federal records are subject to FOIA requests. Depending on the circumstances, information submitted by an outside entity may be considered “federal records” for purposes of FOIA.
2. If your company information is determined to be a federal record and responsive to a FOIA request, DOE will review what was submitted in order to determine if DOE can make a determination whether the information is legally exempt.
 - a. If DOE determines your information is fully exempt under an exemption and that it will not be released, DOE may not contact you.
 - b. If DOE is unable to determine whether the information is exempt under an exemption or is planning on releasing some or all of your information, DOE will first contact you in order for you to have an opportunity to respond and provide additional justification as to why it may be exempt. DOE will do all that it can to work with company submitters to be in compliance with the law and maintain positive relations with company submitters.
 - c. It is critical if DOE or DOE’s contractors who are processing your FOIA contact you that you respond in a timely manner. DOE is under strict deadlines when processing a FOIA request.

31. Publications

The recipient is expected to publish scientific results in peer-reviewed journals or otherwise make publicly available the results of the work conducted under any award resulting from this NOFO. Publications and other methods of public communication describing any work based on or developed under an award resulting from this NOFO must contain an acknowledgment of SC support. The format for such acknowledgments is provided at <https://science.osti.gov/funding-opportunities/acknowledgements/>. The author’s copy of any peer-reviewed manuscript accepted for publication must be announced to DOE’s Office of Scientific and Technical Information (OSTI) and made publicly available in accordance with the instructions contained in the Reporting Requirements Checklist incorporated in all Assistance Agreements. Awards made under this NOFO are subject to DOE’s [Public Access](#)

[Plan](#). Full-text versions of scientific publications must be made publicly accessible at no charge to readers.

32. Registration Requirements

Additional administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 25 (See: www.eCFR.gov). Prime recipients must keep their data in SAM current at www.SAM.gov. Subrecipients at all tiers must obtain UEI numbers and provide the UEI to the prime recipient before the subaward can be issued.

33. Research Misconduct

Scientific discoveries can only take place when scientific research is conducted in a fair, transparent, and honestly reported manner. Any form of dishonesty—whether plagiarism, falsifying results, or misrepresenting conditions—makes it impossible to advance our understanding of the physical universe.

Recipients are “responsible for maintaining the integrity of research of any kind under an award from DOE including the prevention, detection, and remediation of research misconduct, and the conduct of inquiries, investigations, and adjudication of allegations of research misconduct,” and conducting appropriate administrative processes in response to allegations of research misconduct in accordance with 2 CFR 910.132. Allegations of any misconduct under an award resulting from this NOFO must be reported to the appropriate institutional officials in accordance with institutional policies against misconduct. Additional information on DOE research misconduct policies can be found at: <https://science.osti.gov/grants/Policy-and-Guidance/Research-Misconduct>.

34. Research Security Training Requirement

Covered individuals listed on applications are required to certify that they have taken research security training consistent with Section 10634 of the CHIPS and Science Act of 2022. In addition, an applicant who receives an award must maintain sufficient records (records must be retained for the time period noted in [2 CFR 200.334](#) and made available to DOE upon request) of its compliance with this requirement for covered individuals at the applicant/recipient organization and it must extend this requirement to any and all subrecipients.

Include this information for each covered individual with the [Current and Pending Support](#) submission as described above.

35. Rights in Technical Data

Normally, the government has unlimited rights in technical data created under a DOE agreement, including the right to distribute to the public. Delivery or third-party licensing of proprietary software or data developed solely at private expense (“Limited Rights Data”) will not normally be required except as specifically negotiated in a particular agreement to satisfy DOE’s own needs or to ensure the commercialization of technology developed under a DOE agreement.

If software is specified for delivery to DOE, or if other special circumstances exist, e.g., DOE specifying “open-source” treatment of software, then the DOE Contracting Officer, after negotiation with the recipient, may include in the award special provisions requiring the recipient to obtain written approval of the DOE Contracting Officer prior to asserting copyright in the software, modifying the retained Government license, and/or otherwise altering the copyright provisions.

36. Statement of Federal Stewardship

DOE will exercise normal federal stewardship in overseeing the project activities performed under DOE awards. Stewardship activities include but are not limited to conducting site visits; reviewing performance and financial reports; providing assistance and/or temporary intervention in unusual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

37. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR 170. (See: www.eCFR.gov). Prime recipients must register with the new Federal Funding and Transparency Act Subaward Reporting System (FSRS) at <https://www.fsrs.gov> and report the required data on their first tier subrecipients. Prime recipients may be required to report the total compensation for their five most highly compensated executives as part of their registration profile in SAM.gov and for first-tier subrecipients’ five most highly compensated executives as in FSRS.gov.

38. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below:

- Nonprofit organizations or small business firms: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), nonprofit organizations or small business firms as defined by 35 U.S.C. 201 may elect to retain title to their subject inventions.

- All other parties: The federal Non-Nuclear Energy Act of 1974, 42 U.S.C. 5908, provides that the government obtains title to new inventions unless a waiver is granted (see below).
- Patent Waiver: DOE has issued Class Patent Waiver W(C) 2022-03 which allows domestic large businesses providing at least 20% cost share to elect to retain title to their subject inventions. Class Patent Waiver W(C) 2022-03 includes a U.S. Competitiveness provision requiring any products embodying or produced through the use of a subject invention first created or reduced to practice in the performance of work under this NOFO to be substantially manufactured in the United States. A domestic large business is any for-profit entity that does not qualify as a “small business” and is incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and is not owned, controlled, or influenced by a foreign government, agency, firm, corporation, or person. Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this NOFO, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784. For more information, see <https://www.energy.gov/gc/office-assistant-general-counsel-technology-transfer-and-intellectual-property> Nonprofit organizations and small business firms do not need a patent waiver in order to retain title to their subject inventions (see above).
- Determination of Exceptional Circumstances (DEC): On June 07, 2021, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES (DEC) UNDER THE BAYH-DOLE ACT TO FURTHER PROMOTE DOMESTIC MANUFACTURE OF DOE SCIENCE AND ENERGY TECHNOLOGIES. In accordance with this DEC, all awards, including sub-awards, under this NOFO shall include the U.S. Competitiveness Provision in accordance with [Section IX](#) of this NOFO. A copy of the DEC can be found at <https://www.energy.gov/gc/determination-exceptional-circumstances-decs>.
- Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.
- DOE may issue and publish on the website above further DEC's prior to the issuance of awards under this NOFO. DOE may require additional submissions or requirements as authorized by any applicable DEC.
- [IF APPLICABLE] DEC: QUANTUM INFORMATION SCIENCE TECHNOLOGIES DEC: On August 28, 2020, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES UNDER THE BAYH-DOLE ACT FOR QUANTUM INFORMATION SCIENCE TECHNOLOGIES, pursuant to 37 CFR 401.3(a)(2), which applies to agreements issued under this NOFO requiring each applicant to agree to a

U.S. Competitiveness Provision. DOE has determined that exceptional circumstances exist that warrant the modification of the standard patent rights clause for small businesses and non-profit recipients under the Bayh-Dole Act, 35 U.S.C. 200 et seq., to the extent necessary to ensure that DOE “obtains sufficient rights in the federally supported inventions to meet the needs of [DOE]” and “to promote the commercialization and public availability of inventions made in the United States by United States industry and labor” and/or further promote other purposes of the Bayh-Dole Act. 35 U.S.C. § 200. In accordance with this DEC, all awards, including sub-awards, under this NOFO shall include the U.S. Competitiveness Provision in accordance with [Section IX](#) of this NOFO. A copy of the DEC can be found at <https://www.energy.gov/gc/determination-exceptional-circumstances-decs>.

[IF APPLICABLE] Class Patent Waiver: DOE has issued Class Patent Waiver No. W(C) 2020-001 of Patent Rights Related to Quantum Information Science and its Technology Applications that applies to this NOFO for any domestic large business that is a recipient, or subrecipient at any tier to this NOFO and is providing at least 20% cost share. Under this Class Patent Waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class patent waiver, a domestic large business must agree that any products embodying or produced using a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States. Entities not eligible under the Class Patent Waiver are still able to petition DOE for rights under an Advanced or Identified Patent Waiver as described above.

Nonprofit organizations and small business firms do not need a patent waiver in order to retain title to their subject inventions (see above).

39. Trafficking in Persons

Awards resulting from this NOFO are subject to the requirements of 2 CFR 175 (<https://www.ecfr.gov>) which prohibit recipients, their employees, subrecipients, and their employees from severe forms of trafficking in persons; the procurement of a commercial sex act during the period of time that this award or any subaward is in effect; the use of forced labor in the performance of this award or any subaward; or acts that directly support or advance trafficking in persons.

40. U.S. Competitiveness

A primary objective of DOE’s multi-billion-dollar research, development and demonstration investments is to cultivate new research and development ecosystems, manufacturing capabilities, and supply chains for and by U.S. industry and labor. Therefore, in exchange for receiving taxpayer dollars to support an applicant’s project, the applicant must agree to a U.S. Competitiveness provision requiring to any products embodying any subject invention

or produced using any subject invention will be manufactured substantially in the United States unless the Recipient can show to the satisfaction of DOE that it is not commercially feasible. Award terms, including the U.S. Competitiveness Provision, are available at <https://www.energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards>.

Please note that a subject invention is any invention conceived or first actually reduced in performance of work under an award. An invention is any invention or discovery which is or may be patentable. The recipient includes any awardee, recipient, sub-awardee, or sub-recipient.

As noted in the U.S. Competitiveness Provision, if an entity cannot meet the requirements of the U.S. Competitiveness Provision, the entity may request a modification or waiver of the U.S. Competitiveness Provision. For example, the entity may propose modifying the language of the U.S. Competitiveness Provision in order to change the scope of the requirements or to provide more specifics on the application of the requirements for a particular technology. As another example, the entity may request that the U.S. Competitiveness Provision be waived in lieu of a net benefits statement or U.S. manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the U.S. economy and competitiveness. Examples of such commitments could include manufacturing specific products in the U.S., making a specific investment in a new or existing U.S. manufacturing facility, keeping certain activities based in the U.S. or supporting a certain number of jobs in the U.S. related to the technology. DOE may, in its sole discretion, determine that the proposed modification or waiver promotes commercialization and provides sufficient U.S. economic benefits, and grant the request. If granted, DOE will modify the award terms and conditions for the requesting entity accordingly. More information and guidance on the waiver and modification request process can be found in the DOE Financial Assistance Letter on this topic, available here at <https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-doe-determination-exceptional-circumstances-under>. Additional information on DOE's Commitment to Domestic Manufacturing for DOE-funded R&D is available at <https://www.energy.gov/gc/us-manufacturing>.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See [Section IX](#).

41. Updating Your Portfolio Analysis and Management System (PAMS) Profile

All applicants are encouraged to update their profiles in the PAMS website at <https://pamspublic.science.energy.gov> regularly to ensure SC has your most up to date information. The PAMS profile allows individuals to provide responses to various fields, including selecting a "Do not wish to provide" option. Your individual information will not

be shared with peer reviewers and the information in your PAMS profile is protected by the requirements established in the Federal Privacy Act of 1974.

D. Reference Material

Glossary of Useful Grants and Cooperative Agreement terms

Acquisition cost	<i>Acquisition cost</i> means the cost of the asset including the cost to ready the asset for its intended use. Acquisition cost for equipment, for example, means the net invoice price of the equipment, including the cost of any modifications, attachments, accessories, or auxiliary apparatus necessary to make it usable for the purpose for which it is acquired. Acquisition costs for software includes those development costs capitalized in accordance with generally accepted accounting principles (GAAP). Ancillary charges, such as taxes, duty, protective in transit insurance, freight, and installation may be included in or excluded from the acquisition cost in accordance with the non-Federal entity's regular accounting practices.
Administrative requirements	<i>Administrative requirements</i> mean the general business management practices that are common to the administration of all grants, such as financial accountability, reporting, equipment management, and retention of records.
Advance payment	<i>Advance payment</i> means a payment that a Federal awarding agency or pass-through entity makes by any appropriate payment mechanism, including a predetermined payment schedule, before the non-Federal entity disburses the funds for program purposes.
Allocation	<i>Allocation</i> means the process of assigning a cost, or a group of costs, to one or more cost objective(s), in reasonable proportion to the benefit provided or other equitable relationship. The process may entail assigning a cost(s) directly to a final cost objective or through one or more intermediate cost objectives.
Allocability	<i>Allocability</i> means the principle which requires that an expense or service charged must directly benefit and be necessary for the performance of the project; when multiple projects are benefited reasonable proportions must be able to be assigned. See 2 CFR 200.405.
Allowable cost	<i>Allowable cost</i> means a cost incurred by a recipient that is: (1) reasonable for the performance of the award; (2) allocable; (3) in conformance with any limitations or exclusions set forth in the Federal cost principles applicable to the organization incurring the cost or in the award documents as to the type or amount of cost; (4) consistent with regulations, policies, and procedures of the recipient that are applied uniformly to both federally supported and other activities of the organization; (5) accorded consistent treatment as a direct or indirect cost; (6) determined in accordance with generally accepted accounting principles; and (7) not included as a cost in any other federally supported award (unless specifically authorized by statute). See 2 CFR 200.403.
Application	<i>Application</i> means a request for financial support of a project or activity submitted to DOE on specified forms and in accordance with DOE instructions. Also known as a proposal.
Appropriation Act	<i>Appropriation act</i> means the statute that provides the authority for Federal agencies to incur obligations to and make payments out of the U.S. treasury for specified purposes.

Approved budget	The <i>approved budget</i> for the Federal award summarizes the financial aspects of the project or program as approved during the Federal award process. It may include either the Federal and non-Federal share or only the Federal share, depending upon Federal awarding agency requirements. It must be related to performance for program evaluation purposes whenever appropriate. See 2 CFR 200.308(a).
Assurance	<i>Assurance</i> means a certification by an applicant, normally included with the application or State plan, indicating that the entity complies with, or that it will comply with, a particular requirement if awarded a Federal grant.
Authorized organizational representative	<i>Authorized organizational representative</i> means the individual, named by the applicant organization, who is authorized to act for the applicant and to assume the obligations imposed by the Federal laws, regulations, requirements, and conditions that apply to grant applications or grant awards.
Award	<i>Award</i> means the provision of funds by DOE, based on an approved application and budget or progress report, to an organizational entity or an individual to carry out a project or activity.
Award documents	<i>Award documents</i> means the entirety of the documents describing the legal relationship between DOE and an awardee or recipient. The award documents include an Assistance Agreement and other documents which may be incorporated by reference or as attachments to the Assistance Agreement. The award documents are the official, legally binding document, signed (or the electronic equivalent of signature) by a Contracting Officer that: notifies the recipient of the award of an award; contains or references all the terms and conditions of the grant and Federal funding limits and obligations; and, provides the documentary basis for recording the obligation of Federal funds in the DOE accounting system.
Bayh-Dole Act	<i>Bayh-Dole Act</i> means a law which encourages universities and researchers to develop their inventions into marketable products; formal citation is Section 6 of the Patent and Trademark Amendment of 1980, Pub. L 96-517 as amended.
Budget	<i>Budget</i> means the financial plan for the project or program that the Federal awarding agency or pass-through entity approves during the Federal award process or in subsequent amendments to the Federal award. It may include the Federal and non-Federal share or only the Federal share, as determined by the Federal awarding agency or pass-through entity.
Budget period	<i>Budget period</i> means the intervals of time (usually 12 months each) into which a project period is divided for budgetary and funding purposes.
Business officer	<i>Business officer</i> means the financial official of the recipient who has primary fiscal responsibility for the grant. Also known as authorized organizational representative.
Capital assets	<i>Capital assets</i> means tangible or intangible assets used in operations having a useful life of more than one year which are capitalized in accordance with GAAP. Capital assets include: (a) Land, buildings (facilities), equipment, and intellectual property (including software) whether acquired by purchase, construction, manufacture, lease-purchase, exchange, or through capital leases; and

	(b) Additions, improvements, modifications, replacements, rearrangements, reinstallations, renovations or alterations to capital assets that materially increase their value or useful life (not ordinary repairs and maintenance).
Carryover	<i>Carryover</i> means unobligated Federal funds remaining at the end of any budget period that may be carried forward to another budget period to cover allowable costs of that budget period (whether as an offset or additional authorization). Obligated, but unliquidated, funds are not considered carryover.
Change in scope	<i>Change in scope</i> means an activity whereby the objectives or specific aims identified in the approved grant application are significantly changed by the recipient after award. Contracting Officer prior approval is required for a change in scope to be allowable under an award.
Closeout	<i>Closeout</i> means the process by which a Federal awarding agency determines that all applicable administrative actions and all required work under an award have been completed by the recipient and the Federal awarding agency.
Competitive segment	<i>Competitive segment</i> means the initial project period recommended for support or each extension of a project period resulting from a renewal award.
Conference (domestic or international)	<i>Conference (domestic or international)</i> means a symposium, seminar, workshop, or any other organized and formal meeting, whether conducted face-to-face or via the Internet, where individuals assemble (or meet virtually) to exchange information and views or explore or clarify a defined subject, problem, or area of knowledge, a published report results from such meeting.
Consortium or sub-award agreement	<i>Consortium or sub-award agreement</i> means a formalized agreement whereby a research project is carried out by the recipient and one or more other organizations that are separate legal entities. Under the agreement, the recipient must perform a substantive role in the conduct of the planned research and not merely serve as a conduit of funds to another party or parties. These agreements typically involve a specific level of effort from the consortium organization's PD/PI and a categorical breakdown of costs, such as personnel, supplies, and other allowable expenses, including F&A costs. The relationship between the recipient and the collaborating organizations is considered a sub-award relationship.
Consultant	<i>Consultant</i> means an individual who provides professional advice or services for a fee, but not as an employee of the engaging party. To prevent apparent or actual conflicts of interest, recipients and consultants must establish written guidelines indicating the conditions of payment of consulting fees. Consultants also include firms that provide professional advice or services. See 2 CFR 200.459.
Continuation application/award	<i>Continuation application/award</i> means a financial assistance request (in the form of an application or progress report) or resulting award for a subsequent budget period within a previously approved project period for which a recipient does not have to compete with other applicants.
Contract	<i>Contract</i> means a legal instrument by which a non-Federal entity purchases property or services needed to carry out the project or program under a Federal award. The term as used in this part does not include a legal instrument, even if the non-Federal entity considers it a contract,

	when the substance of the transaction meets the definition of a Federal award or sub-award (see 2 CFR 200.1 Subaward).
Contractor	<i>Contractor</i> means an entity that receives a contract as defined in 2 CFR 200.1 Contract.
Contracting (or Grants) Officer	<i>Contracting (or Grants) Officer</i> means a DOE official responsible for the business management aspects of grants and cooperative agreements, including review, negotiation, award, and administration, and for the interpretation of grants administration policies and provisions. COs and GOs are delegated the authority to obligate DOE to the expenditure of funds and permit changes to approved projects on behalf of DOE.
Contracting (or Grants Management) specialist	<i>Contracting (or Grants Management) specialist</i> means a DOE staff member who works with a Contracting or Grants Officer and is assigned the day-to-day management of a portfolio of grants and/or cooperative agreements. These activities include, but are not limited to, evaluating grant applications for administrative content and compliance with statutes, regulations, and guidelines; negotiating grants; providing consultation and technical assistance to recipients; and administering grants after award.
Cooperative agreement	<i>Cooperative agreement</i> means a type of financial assistance used when there will be substantial Federal scientific or programmatic involvement. Substantial involvement means that, after award, scientific or program staff will assist, guide, coordinate, or participate in project activities.
Cost principles	<i>Cost principles</i> means the government-wide principles, 2 CFR 200 Subpart E (or, in the case of commercial organizations, the Federal Acquisition Regulation [48 CFR 31], or, in the case of hospitals, see Appendix IX to Part 200—Hospital Cost Principles, Appendix E, “Principles for Determining Costs Applicable to Research and Development Under Grants and Contracts with Hospitals”), on allowability and unallowability of costs under federally sponsored agreements.
Cost sharing or matching	<i>Cost sharing or matching</i> means the portion of project costs not paid by Federal funds (unless otherwise authorized by Federal statute). See also 2 CFR 200.306 Cost sharing or matching.
Deadline	<i>Deadline</i> means the published date and/or time that a grant application is to be submitted to the funding agency.
Debarment and suspension	<i>Debarment and suspension</i> mean the actions taken by a debarring official in accordance with OMB guidance at 2 CFR 180, “Non-procurement Debarment and Suspension,” to exclude a person or organization from participating in grants and other non-procurement awards government-wide. If debarred or suspended, the person or organization may not receive financial assistance (under a grant, cooperative agreement, or sub-award, or contract under a grant) for a specified period of time. Debarments and suspensions carried out pursuant to 2 CFR 376 are distinct from post-award suspension action by an awarding agency. See 2 CFR 901 for DOE implementation.
Direct costs	<i>Direct costs</i> mean costs that can be identified specifically with a particular sponsored project, an instructional activity, or any other institutional activity, or that can be directly assigned to such activities relatively easily with a high degree of accuracy. See 2 CFR 200.413.
Disallowed costs	<i>Disallowed costs</i> mean those charges to a Federal award that the Federal awarding agency or pass-through entity determines to be unallowable, in accordance with the applicable Federal statutes, regulations, or the terms and conditions of the Federal award.

Domestic organization	<i>Domestic organization</i> means a public (including a State or other governmental agency) or private non-profit or for-profit organization that is located in the United States or its territories, is subject to U.S. laws, and assumes legal and financial accountability for awarded funds and for the performance of the grant-supported activities.
Effort	<i>Effort</i> means the amount of time, usually expressed as a percentage of the total, which a faculty member or other employee spends on a sponsored project. No one is allowed to spend more than 100% total commitment on all academic activities, including grant-sponsored research, university-sponsored research, teaching, administration, advising and other contracted duties. Effort is indicated on the budget in units of person-months.
Equipment	<i>Equipment</i> means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or \$10,000. See also 2 CFR 200.1 Capital assets, Computing devices, General purpose equipment, Information technology systems, Special purpose equipment, and Supplies.
Expanded authorities	<i>Expanded authorities</i> means authorization to recipients under certain research grant mechanisms which waives the requirement for prior agency approval for specified actions related to awards. Example: 90-day pre-award spending authority, no cost extensions for up to one additional year, and automatic carryover of unobligated funds from one budget period to the next. The expanded authorities are now contained in Uniform Guidance of 2 CFR 200 as being applicable to all research awards.
Expiration date	<i>Expiration date</i> means generally, the date signifying the end of the current project period, after which the recipient is not authorized to obligate grant funds.
Facilities and administrative costs	<i>Facilities and administrative costs</i> mean costs that are incurred by a recipient for common or joint objectives and that, therefore, cannot be identified specifically with a particular project or program. These costs also are known as indirect costs.
Federal financial report	<i>Federal financial report</i> means submitted on Standard Form (SF) 425, to indicate the status of awarded funds for the period covered. Frequency of reporting is specified in the Reporting Checklist provided as part of the award documents.
Financial assistance	<i>Financial assistance</i> means transfer by DOE of money or property to an eligible entity to support or stimulate a public purpose authorized by statute.
Financial status report	<i>Financial status report</i> means see Federal Financial Report.
Foreign travel	<i>Foreign travel</i> is meant to include travel outside of North America (Canada, Mexico, and the United States) and U.S. territories and possessions (Guam, American Samoa, Puerto Rico, the U.S. Virgin Islands. A trip is considered foreign travel for all legs of the itinerary if the traveler does not return to his or her post prior to departure for a foreign destination. Costs for foreign travel may be restricted by the language of a Funding Opportunity Announcement.

Grant agreement	<p><i>Grant agreement</i> means a legal instrument of financial assistance between a Federal awarding agency or pass-through entity and a non-Federal entity that, consistent with 31 USC 6302, 6304:</p> <p>(a) Is used to enter into a relationship the principal purpose of which is to transfer anything of value from the Federal awarding agency or pass-through entity to the non-Federal entity to carry out a public purpose authorized by a law of the United States (see 31 USC 6101(3)); and not to acquire property or services for the Federal awarding agency or pass-through entity’s direct benefit or use;</p> <p>(b) Is distinguished from a cooperative agreement in that it does not provide for substantial involvement between the Federal awarding agency or pass-through entity and the non-Federal entity in carrying out the activity contemplated by the Federal award.</p> <p>(c) Does not include an agreement that provides only:</p> <p>(1) Direct United States Government cash assistance to an individual;</p> <p>(2) A subsidy;</p> <p>(3) A loan;</p> <p>(4) A loan guarantee; or</p> <p>(5) Insurance.</p>
Grant-supported project or activity	<p><i>Grant-supported project or activity</i> means those activities specified or described in a grant application or in a subsequent submission that are approved by DOE for funding, regardless of whether Federal funding constitutes all or only a portion of the financial support necessary to carry them out.</p>
Grants.gov	<p><i>Grants.gov</i> (https://www.Grants.gov/) has been designated by the Office of Management and Budget as the single access point for all grant programs offered by 26 Federal grant-making agencies. It provides a single interface for agencies to announce their grant opportunities and for all applicants to find and apply for those opportunities.</p>
Indirect costs (facilities & administrative)	<p><i>Indirect (F&A) costs</i> mean those costs incurred for a common or joint purpose benefitting more than one cost objective, and not readily assignable to the cost objectives specifically benefitted, without effort disproportionate to the results achieved. To facilitate equitable distribution of indirect expenses to the cost objectives served, it may be necessary to establish several pools of indirect (F&A) costs. Indirect (F&A) cost pools must be distributed to benefitted cost objectives on bases that will produce an equitable result in consideration of relative benefits derived.</p>
Institutional base salary	<p><i>Institutional base salary</i> means the annual compensation paid by an organization for an employee’s appointment, whether that individual’s time is spent on research, teaching, patient care, or other activities. Base salary excludes any income that an individual may be permitted to earn outside of duties for the applicant/recipient organization. Base salary may not be increased as a result of replacing organizational salary funds with grant funds.</p>
Matching or cost sharing	<p><i>Matching or cost sharing</i> means the value of third-party in-kind contributions and the portion of the costs of a federally assisted project or program not borne by the Federal government. Matching or cost sharing may be required by statute or program regulation. Costs used to satisfy matching or cost-sharing requirements are subject to the same policies governing allowability as other costs under the approved budget.</p>

Merit (or peer) review	<i>Merit (or peer) review</i> means the process that involves the consistent application of standards and procedures that produce fair, impartial, and objective examinations of applications based on an evaluation of scientific or technical merit or other relevant aspects of the application. The review is performed by experts (reviewers) in the field of endeavor for which support is requested. Merit review is intended to provide guidance to the DOE individuals responsible for making award decisions.
Monitoring	<i>Monitoring</i> means a process whereby the programmatic and business management performance aspects of a grant are assessed by reviewing information gathered from various required reports, audits, site visits, and other sources.
NEPA	<i>NEPA</i> means the National Environmental Policy Act (NEPA), Public Law 91-190, as amended. NEPA requires Federal agencies to assess the environmental effects of proposed major Federal actions prior to making decisions.
No-cost extension	<i>No-cost extension</i> means an extension of time to a project period and/or budget period to complete the work of the grant under that period, without additional Federal funds or competition.
Non-Federal share	<i>Non-Federal share</i> means when cost sharing or matching is required as a condition of an award, the portion of allowable project/program costs not borne by the Federal government.
Notice of Funding Opportunity (NOFO)	<i>Notice of Funding Opportunity (NOFO)</i> means a publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. NOFOs may be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the Agency and type of program. NOFOs can be found at www.Grants.gov . A NOFO may also be known as a solicitation. NOFOs were previously known as Funding Opportunity Announcements (FOAs).
Obligations	<i>Obligations</i> , when used in connection with a non-Federal entity's utilization of funds under a Federal award, mean orders placed for property and services, contracts and sub-awards made, and similar transactions during a given period that require payment by the non-Federal entity during the same or a future period.
OMB circulars	<i>OMB circulars</i> are government-wide guidance issued to Heads of Federal agencies by the Director of the Office of Management and Budget.
Other significant contributors	<i>Other significant contributors</i> mean individuals who have committed to contribute to the scientific development or execution of the project, but are not committing any specified measurable effort (i.e., person months) to the project. These individuals are typically presented at "effort of zero person months" or "as needed." Individuals with measurable effort may not be listed as Other Significant Contributors (OSCs). Consultants should be included if they meet this definition.
Program participant	<i>Program participants</i> are the recipients of service or training provided at a workshop, conference, seminar, symposium or other short-term instructional or information-sharing activity funded by an external grant or award, or the training beneficiaries of the project or program funded by an external grant or award. A participant is not involved in providing any deliverable to the recipient or a third party or would not be terminated or replaced for failure to perform.

Participant support costs	<i>Participant support costs</i> mean direct costs for items such as stipends or subsistence allowances, travel allowances, and registration fees paid to or on behalf of participants or trainees (but not employees) in connection with conferences, or training projects.
Person months	<i>Person months</i> is the metric for expressing the effort (amount of time) PD/PI(s), faculty and other senior/key personnel devote to a specific project. The effort is based on the type of appointment of the individual with the organization, e.g., calendar year, academic year, and/or summer term; and the organization's definition of such. For instance, some institutions define the academic year as a nine (9)-month appointment while others define it as a 10-month appointment.
Pre-application or pre-proposal	<i>Pre-application or pre-proposal</i> means a brief outline or narrative of proposed work and sometimes budget, for informal review by a sponsor to determine whether an application should be submitted. Three predominant reasons for requiring submission of a preliminary pre-application are: Reduce the applicant's unnecessary effort in proposal preparation when the chance of success is very small. This is particularly true of exploratory initiatives where the community senses that a major new direction is being identified, or competitions that will result in a small number of actual awards. Increase the overall quality of the submission. Distill the number of applications that will be submitted to the agency and the number of anticipated reviewers needed to review.
Pre-award costs	<i>Pre-award costs</i> mean any cost incurred prior to the beginning date of the project period or the initial budget period of a competitive segment (under a multi-year award), in anticipation of the award and at the applicant's own risk, for otherwise allowable costs.
Prior approval	<i>Prior approval</i> means written approval from the designated Contracting Officer.
Program Director/ Principal Investigator	<i>Program Director/ Principal Investigator</i> means the individual(s) designated by the applicant organization to have the appropriate level of authority and responsibility to direct the project or program to be supported by the award. The applicant organization may designate multiple individuals as program directors/principal investigators (PD/PIs) who share the authority and responsibility for leading and directing the project, intellectually and logistically. When multiple PD/PIs are named, each is responsible and accountable to the applicant organization, or as appropriate, to a collaborating organization for the proper conduct of the project or program including the submission of all required reports. The presence of more than one PD/PI on an application or award diminishes neither the responsibility nor the accountability of any individual PD/PI.

Program income	<p><i>Program income</i> means gross income earned by the non-Federal entity that is directly generated by a supported activity or earned as a result of the Federal award during the period of performance except as provided in 2 CFR 200.307 paragraph (f). (See 2 CFR 200.1 Period of performance.)</p> <p>Program income includes but is not limited to income from fees for services performed, the use or rental of real or personal property acquired under Federal awards, the sale of commodities or items fabricated under a Federal award, license fees and royalties on patents and copyrights, and principal and interest on loans made with Federal award funds. Interest earned on advances of Federal funds is not program income. Except as otherwise provided in Federal statutes, regulations, or the terms and conditions of the Federal award, program income does not include rebates, credits, discounts, and interest earned on any of them. See also 2 CFR 200.407 Prior written approval (prior approval). See also 35 USC 200-212 “Disposition of Rights in Educational Awards” for inventions made under Federal awards.</p>
Program Manager	<p><i>Program Manager</i> means the DOE official responsible for the programmatic, scientific, and/or technical aspects of a grant. The same role is filled by Program Directors, Program Officers, or Project Directors at other Federal agencies.</p>
Progress report	<p><i>Progress report</i> means periodic, frequently annual, report submitted by the recipient and used by DOE to assess progress and to determine whether to provide funding for the budget period that covered by the report.</p>
Project/performance site	<p><i>Project/ performance site</i> means location(s) of where the work described in the research plan will be conducted.</p>
Project period	<p><i>Project period</i> means the total time for which Federal support of a project has been programmatically approved as shown in the award documents; however, it does not constitute a commitment by the Federal government to fund the entire period. The total award period comprises the initial competitive segment, any subsequent competitive segments resulting from a renewal award(s), and extensions.</p>
Proposal	<p>See application.</p>
Re-budgeting	<p><i>Re-budgeting</i> means reallocation of funds available for spending between approved budget categories to allow best use of funds to accomplish the project goals.</p>
Real Property	<p><i>Real property</i> means land, including land improvements, structures and appurtenances thereto, but excludes moveable machinery and equipment.</p>
Recipient	<p><i>Recipient</i> means the organization or individual awarded a grant or cooperative agreement by DOE that is responsible and accountable for the use of the funds provided and for the performance of the grant-supported project or activity. The recipient is the entire legal entity even if a particular component is designated in award documents. The recipient is legally responsible and accountable to DOE for the performance and financial aspects of the grant-supported project or activity. Also known as awardee or grantee.</p>
Renewal application	<p><i>Renewal application</i> means an application requesting additional funding for a period subsequent to that provided by a current award. Renewal applications compete for funds with all other peer reviewed applications and must be developed as fully as though the applicant is applying for the first time.</p>

Research	<i>Research</i> is defined as a systematic study directed toward fuller scientific knowledge or understanding of the subject studied. See 2 CFR 200.1 Research and Development (R&D).
Research misconduct	<i>Research misconduct</i> means fabrication, falsification, or plagiarism in proposing, performing, or reviewing research, or in reporting research results, but does not include honest error or differences of opinion. See 10 CFR 733.
SAM.gov	<i>SAM.gov</i> is the System for Award Management (SAM) a consolidated service that includes Entity Registration, Assistance Listings, and other services for making, managing, and receiving Federal awards.
Scope of work	<i>Scope of work</i> means the aims, objectives, and purposes of a grant; as well as the methodology, approach, analyses or other activities; and the tools, technologies, and timeframes needed to meet the grant’s objectives. This includes the research or training plan included with the original grant application, along with any approved modifications.
Senior/Key Personnel	<i>Senior/Key personnel</i> means the PD/PI and other individuals who contribute to the scientific development or execution of a project in a substantive, measurable way, whether or not they receive salaries or compensation under the grant. Typically, these individuals have doctoral or other professional degrees, although individuals at the masters or baccalaureate level may be considered senior/key personnel if their involvement meets this definition. Consultants and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition. “Zero percent” effort or “as needed” is not an acceptable level of involvement for Senior/Key Personnel.
Significant re-budgeting	<i>Significant re-budgeting</i> means a threshold that is reached when expenditures in a single direct cost budget category deviate (increase or decrease) from the categorical commitment level established for the budget period by more than 25 percent of the total costs awarded. Significant re-budgeting is one indicator of change in scope.
Small business concern	<i>Small business concern</i> means a business that meets the regulatory and size requirements established by the SBA at 13 CFR 121.
Solicitation	See Funding Opportunity Announcement.
Subaward	<i>Subaward</i> means a legal instrument by which a recipient provides funds (or property in lieu of funds) to an eligible subrecipient (or a lower-tier transaction) to perform a substantive portion of the grant-supported program or project. The term includes such financial assistance when provided by any legal agreement (even if the agreement is called a contract) but does not include any form of assistance which is excluded from the definition of a grant, including the recipient’s procurement of property or services needed to carry out the project or program. The term includes consortium agreements.
Subrecipient	<i>Subrecipient</i> means a non-Federal entity that receives a subaward from a pass-through entity to carry out part of a Federal program; but does not include an individual that is a beneficiary of such program. A sub-recipient may also be a recipient of other Federal awards directly from a Federal awarding agency.
Supplement	<i>Supplement</i> means a request for an increase in support during a current budget period for expansion of the project’s scope or to meet increased costs unforeseen at the time of the new or renewal application. A supplement may increase support for future years in addition to the

	current year. Supplements require applications and are subject to administrative and merit review.
Terms and conditions of award	<i>Terms and conditions of award</i> means all legal requirements imposed on a grant by DOE, whether based on statute, regulation, policy, or other document referenced in the grant award, or specified by the grant award document itself. The award documents may include both standard and special conditions that are considered necessary to attain the grant’s objectives, facilitate post-award administration of the grant, conserve grant funds, or otherwise protect the Federal government’s interests.
UEI	<i>UEI</i> is the Unique Entity Identifier, a twelve-digit alphanumeric sequence established and assigned by the System for Award Management at https://www.SAM.gov to uniquely identify an entity.
Unallowable costs	<i>Unallowable costs</i> mean costs that cannot be charged, directly or indirectly, to Federal awards because the costs are prohibited by law, regulation (including applicable cost principles), or the terms and conditions of award. Costs that are not allowable, allocable, or reasonable are unallowable.
Unliquidated obligation	<i>Unliquidated obligations</i> mean, for financial reports prepared on a cash basis, obligations incurred by the non-Federal entity that have not been paid (liquidated). For reports prepared on an accrual expenditure basis, these are obligations incurred by the non-Federal entity for which an expenditure has not been recorded.
Unobligated balance	<i>Unobligated balance</i> means the amount of funds under a Federal award that the non-Federal entity has not obligated. The amount is computed by subtracting the cumulative amount of the non-Federal entity’s unliquidated obligations and expenditures of funds under the Federal award from the cumulative amount of the funds that the Federal awarding agency or pass-through entity authorized the non-Federal entity to obligate.
Validate	In the context of the data management plan requirements, <i>validate</i> means to support, corroborate, verify, or otherwise determine the legitimacy of the research findings. Validation of research findings could be accomplished by reproducing the original experiment or analyses, comparing and contrasting the results against those of a new experiment or analyses, or by some other means.