

**DEPARTMENT OF ENERGY (DOE)
OFFICE OF SCIENCE (SC)**



**FY 2024 FUNDING FOR ACCELERATED, INCLUSIVE RESEARCH
(FAIR)**

**FUNDING OPPORTUNITY ANNOUNCEMENT (FOA) NUMBER:
DE-FOA-0003207**

**FOA TYPE: AMENDMENT 000001
CFDA NUMBER: 81.049**

Amendment 000001 is issued to extend the application deadline by one week in recognition of the impact of Hurricane Beryl.

FOA Issue Date:	March 12, 2024
Submission Deadline for Pre-Applications:	April 23, 2024 at 5:00 PM Eastern Time A Pre-Application is required. Pre-Applications must be submitted by an authorized institutional representative.
Pre-Application Response Date:	May 28, 2024 at 11:59 PM Eastern Time
Submission Deadline for Applications:	July 23, 2024 at 11:59 PM Eastern Time

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UPDATES AND REMINDERS

RECOMMENDATION

The Department of Energy (DOE) Office of Science (SC) encourages you to register in all systems as soon as possible. You are also encouraged to submit letters of intent (LOIs), pre-applications, and applications well before the deadline.

INFORMATIONAL WEBINAR

SC plans to hold an informational webinar about this FOA on Wednesday, March 20, 2024 at 3:00 pm ET. SC also plans to hold office hours on April 9, April 17, July 2, and July 10, 2024, at 2:00 pm ET for administrative questions related to the FOA. Registration instructions and other details will be posted at <https://science.osti.gov/Initiatives/FAIR/Funding-Opportunities>. Frequently asked questions (FAQ) will also be posted at <https://science.osti.gov/Initiatives/FAIR>.

PROMOTING INCLUSIVE AND EQUITABLE RESEARCH (PIER) PLAN

All new and renewal applications must provide a Promoting Inclusive and Equitable Research (PIER) Plan as an appendix to the project narrative. Please read the instructions in [Section IV](#) and the associated review criteria in [Section V](#).

INTERAGENCY FORMATS FOR CURRENT AND PENDING SUPPORT AND BIOGRAPHICAL SKETCHES

Interagency common instructions for preparing current and pending support and biographical sketches are being developed. The Science Experts Network Curriculum Vitae (SciENcv) system at <https://www.ncbi.nlm.nih.gov/sciencv/> will be updated to support the forthcoming common instructions and formats. The fillable PDFs provided by the National Science Foundation are no longer available. When interagency common formats and instructions are promulgated, their use will be required. See <https://new.nsf.gov/funding/senior-personnel-documents> for more information. SC strongly encourages all researchers to use the online SciENcv system to ensure that their documents are prepared in the appropriate format with the least inconvenience.

INDIVIDUALS WHO SHOULD NOT SERVE AS MERIT REVIEWERS

Follow the updated instructions in [Section VIII](#) and consider the use of the Collaborator Template available at <https://science.osti.gov/grants/Policy-and-Guidance/Agreement-Forms>. Do not include this list as part of the biographical sketch.

LIVING WAGES

SC is committed to ensuring that students, trainees, and postdoctoral fellows are paid a fair and equitable wage sufficient to allow a reasonable standard of living. Applicant institutions are strongly encouraged to examine their institutional pay scales to ensure that all personnel earn a living wage. The provision of fellowships, traineeships, stipends, honoraria, subsistence allowances, and other similar payments may be allowable expenses on SC financial assistance

awards, per 2 CFR 200.430, § 200.431, and § 200.466. For graduate students, SC considers a reasonable living wage to be an annual income of \$45,000, excluding benefits.

SC STATEMENT OF COMMITMENT

The DOE SC is fully and unconditionally committed to fostering safe, diverse, equitable, and inclusive work, research, and funding environments that value mutual respect and personal integrity. SC is committed to advancing belonging, accessibility, justice, equity, diversity, and inclusion across the portfolio of activities we sponsor. SC's effective stewardship and promotion of safe, accessible, diverse, and inclusive workplaces that value and celebrate the diversity of people, ideas, cultures, and educational backgrounds across the country and that foster a sense of belonging in our scientific community is foundational to delivering on our mission. We are committed to promoting people from all backgrounds, including individuals and communities that were historically underrepresented and minoritized in science, technology, engineering, and math (STEM) fields and the activities we sponsor in recognition of our responsibility to serve the public. We also recognize that harnessing a broad range of views, expertise, and experiences drives scientific and technological innovation and enables the SC community to push the frontiers of scientific knowledge for U.S. prosperity and security. Discrimination and harassment undermine SC's ability to achieve its mission by reducing productivity, discouraging, or inhibiting talent retention and career advancement, and weakening the integrity of the SC enterprise overall. SC does not tolerate discrimination or harassment of any kind, including sexual or non-sexual harassment, bullying, intimidation, violence, threats of violence, retaliation, or other disruptive behavior at institutions receiving SC funding or other locations where activities funded by SC are carried out. All applicants and collaborators should familiarize themselves with the SC Statement of Commitment available at <https://science.osti.gov/SW-DEI/SC-Statement-of-Commitment>.

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, at least annually, to ensure SC has your most up to date information. The PAMS profile now requires that individuals provide responses to the demographic related fields. SC strongly encourages personnel at applicant and recipient institutions, including Principal Investigators (PIs), Co-PIs, and other Key Personnel, to provide their demographic information. By providing your demographic information, you are assisting with SC's continued commitment to advancing diversity, equity, and inclusion in its business practices. Alternatively, for information you wish not to disclose, please select, "Do not wish to provide." Your individual demographic 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. Aggregate, anonymized demographic information may be shared with confidential review committees who are charged to evaluate the quality and efficacy of SC's business practices. For example, summary statistics of all applicants to or award selections from a particular SC FOA may be reviewed by a Committee of Visitors.

PORTABLE DOCUMENT FORMAT (PDF) GENERATION

The project narrative in an application must be 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. 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 research 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.

Checklist for Avoiding Common Errors:

Item	Issue
Pre-Applications	<ul style="list-style-type: none"> - Submit your pre-application in PAMS by an authorized institutional representative. - 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. - Follow the instructions in Section IV for the preparation of a pre-application. <p>Include:</p> <ul style="list-style-type: none"> - Title page - Objective and Technical Approach - Letter of Collaboration - List of Individuals who Should not Serve as Merit Reviews (upload a separate .xls file as an “Additional Attachment” in PAMS)
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.
Page Limits	<p>Strictly followed throughout application, including particular attention to:</p> <ul style="list-style-type: none"> - Project narrative and appendices

Item	Issue
	<ul style="list-style-type: none"> - Biographical sketches - Data Management Plans (DMPs) - Promoting Inclusive and Equitable Research (PIER) Plan - Letter(s) of Collaboration or Access
Personally Identifiable Information	None present in the application
Project Narrative	Composed of one PDF file including all appendices (bibliography, facilities, equipment, DMP, PIER)
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 Plans (DMP)	<ul style="list-style-type: none"> - If referring to an experiment's DMP, describe the relationship to the proposed research. - Include a DMP even if no experimental data is expected.
Promoting Inclusive and Equitable Research (PIER) Plan	PIER Plans are required for new and renewal applications.

Section I – FUNDING OPPORTUNITY DESCRIPTION

GENERAL INQUIRIES ABOUT THIS FOA SHOULD BE DIRECTED TO:

Technical Contacts:

Questions regarding the specific program areas/technical requirements can be directed to the technical contacts listed within the FOA.

Administrative Contact:

Questions about budgets, eligibility, and similar topics should be directed to sc.fair@science.doe.gov.

STATUTORY AUTHORITY

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

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

SUMMARY

The Office of Science (SC) seeks applications for fundamental research in fields supported by SC to build research capacity at institutions historically underrepresented in the SC portfolio, i.e. non-R1 minority serving institutions (MSIs)^{1,2} and non-R1 emerging research institutions (ERIs).³ This FOA aims to build research capacity, including infrastructure and expertise at these institutions, through mutually beneficial relationships between applicants and DOE national laboratories, SC scientific user facilities, or R1 MSI/ERIs. A list of institutions and their

¹ The Carnegie Classification of Institutions of Higher Education can be found at <https://carnegieclassifications.acenet.edu>. A list of institutions with very high research activity (R1 institutions) is available at https://carnegieclassifications.acenet.edu/institutions/?basic2021_du%5B%5D=15.

² MSI designations are based on the Department of Education eligibility matrix (<https://www2.ed.gov/about/offices/list/ope/idades/eligibility.html>). Eligible MSIs are listed as Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs), Alaska Native and Native Hawaiian Serving Institutions (AANHs), Hispanic Serving Institutions (HSIs), Native American Serving Non-Tribal Institutions (NASNTI), Predominantly Black Institutions (PBIs), Historically Black Colleges and Universities (HBCUs), and Tribally Controlled Colleges and Universities (TCCUs). For the purposes of this FOA, institutions marked in the eligibility matrix as either being eligible to receive funding or as receiving funding will be considered an MSI.

³ Emerging research institution was defined in the CHIPS and Science Act of 2022. Federal research expenditures are based on the National Science Foundation's Higher Education Research and Development Survey: Fiscal Year 2021 (<https://nces.nsf.gov/surveys/higher-education-research-development/2021>).

designations is provided at <https://science.osti.gov/grants/Applicant-and-Awardee-Resources/Institution-Designations>.

SC supports fundamental research in applied mathematics, biology, chemistry, computer science, engineering, geoscience, isotope research, materials science, fusion energy science, and physics to transform our understanding of nature and catalyze scientific discoveries that can lead to technical breakthroughs. All applications to SC should focus on hypothesis-driven basic research. SC does not support applied research, product development, or prototyping.

SUPPLEMENTARY INFORMATION

Program Objective

FAIR is focused on building research capacity at academic institutions that have been historically underrepresented in the SC portfolio. Capacity building is interpreted broadly to include both personnel expertise and infrastructure and is expected to be durable, contributing over time toward sustained research strength at the lead institution. Because collaboration is critical to SC research, relationship building through the partnership is considered a key component of the FAIR program. All applications must be submitted on behalf of a lead institution and include a single partnering team member. The lead institution must be a non-R1 MSI or a non-R1 ERI and the partner must be either a DOE National Laboratory (<https://www.energy.gov/national-laboratories>), an SC Scientific User Facility (<https://science.osti.gov/User-Facilities>), or an R1 MSI/ERI.

Applications may include costs for infrastructure such as lab equipment, instrumentation, and computing resources that support the proposed research. Applications may also include funds directed toward building relationships, for example for travel by the PI, key personnel, and students to the partner institution, conferences, or scientific meetings. Applications do not need to be at or near the award ceiling. Equal budgets for each year of the award are not required; for example, the first year of the award could include one-time costs for equipment purchases.

In addition to FAIR, SC also administers the Reaching a New Energy Sciences Workforce (RENEW) initiative. The primary differences between the two initiatives are the goals of each. Training is the primary goal for RENEW, and applications to RENEW must include training activities beyond conduct of research. Whereas training is not the primary goal of FAIR which supports fundamental research to build research capacity, including infrastructure and expertise, at institutions historically underrepresented in the SC portfolio. However, research supported by FAIR may include support for students or postdoctoral researchers. Applicants may apply to one or both funding opportunities. However, the same application is unlikely to be relevant to both solicitations.

Office of Science Research

The 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. 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:

- 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.
- Science for energy and the environment—building the knowledge foundation to spur discoveries and innovations for advancing the Department's mission in energy and environment. 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.

SC manages its research portfolio through eight scientific programs. The following program descriptions, websites, and technical points of contact are offered to provide more in-depth information on scientific and technical areas of interest to SC:

1. Advanced Scientific Computing Research (ASCR)

- (a) [Applied Mathematics](#)
- (b) [Computer Science](#)
- (c) [Advanced Computing Technologies](#)

2. Basic Energy Sciences (BES)

- (a) [Scattering and Instrumentation Sciences Research](#)
- (b) [Condensed Matter and Materials Physics Research](#)
- (c) [Materials Discovery, Design, and Synthesis Research](#)
- (d) [Fundamental Interactions Research](#)
- (e) [Chemical Transformations Research](#)
- (f) [Photochemistry and Biochemistry Research](#)

3. Biological and Environmental Research (BER)

- (a) [Biological Systems Science](#)
- (b) [Earth and Environmental Systems Sciences](#)

4. Fusion Energy Sciences (FES)

- (a) [Burning Plasma Science: Foundations—Advanced Tokamak](#)

- (b) [Enabling Research and Development](#)
- (c) [Burning Plasma Science: Foundations—Spherical Tokamak](#)
- (d) [Burning Plasma Science: Foundations—Theory & Simulation](#)
- (e) [Burning Plasma Science: Long Pulse—Tokamak](#)
- (f) [Burning Plasma Science: Long Pulse—Stellarator](#)
- (g) [Burning Plasma Science: Long Pulse—Materials](#)
- (h) [Burning Plasma Science: Long Pulse—Fusion Nuclear Science](#)
- (i) [Discovery Plasma Science: Plasma Science and Technology](#)
- (j) [Discovery Plasma Science: Measurement Innovation](#)

5. High Energy Physics (HEP)

- (a) [Experimental Research at the Energy Frontier in High Energy Physics](#)
- (b) [Experimental Research at the Intensity Frontier in High Energy Physics](#)
- (c) [Experimental Research at the Cosmic Frontier in High Energy Physics](#)
- (d) [Theoretical Research in High Energy Physics](#)
- (e) [Computational Research in High Energy Physics](#)
- (f) [Accelerator Science and Technology Research and Development in High Energy Physics](#)
- (g) [Detector Research and Development in High Energy Physics](#)
- (h) [Quantum Information Science for High Energy Physics Research](#)

6. Nuclear Physics (NP)

- (a) [Medium Energy Nuclear Physics](#)
- (b) [Heavy Ion Nuclear Physics](#)
- (c) [Nuclear Structure and Nuclear Astrophysics](#)
- (d) [Fundamental Symmetries](#)
- (e) [Nuclear Theory](#)
- (f) [Nuclear Data](#)
- (g) [Nuclear Physics Computing](#)
- (h) [Accelerator Research and Development for Current and Future Nuclear Physics Facilities](#)
- (i) [R&D in Quantum Information Science \(QIS\)](#)

7. Isotope R&D and Production (DOE IP)

- (a) [Isotope Production Research](#)
- (b) [Isotope Processing, Purification, Separation, and Radiochemical Synthesis](#)
- (c) [Biological Tracers and Imaging](#)
- (d) [Isotopic Enrichment Technology](#)

8. Accelerator R&D and Production (ARDAP)

Program Descriptions

1. Advanced Scientific Computing Research (ASCR)

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

ASCR's mission is to advance applied mathematics and computer science; deliver the most advanced computational scientific applications in partnership with disciplinary science; advance

computing and networking capabilities; and develop future generations of computing hardware and software tools for science and engineering, in partnership with the research community, including U.S. industry. The ASCR program gives the science and technology community, including U.S. industry, access to world-class supercomputers and the tools to use them for science and engineering. ASCR accomplishes this by developing and maintaining world-class computing and network facilities for science; and advancing research in applied mathematics, computer science, and advanced networking.

The computing resources and high-speed networks required to meet the scientific needs of the future exceed the state-of-the-art by a significant margin. Furthermore, the algorithms, software tools, the software libraries and the distributed software environments needed to accelerate scientific discovery through modeling and simulation are beyond the realm of commercial interest. To establish and maintain DOE's modeling and simulation leadership in scientific areas that are important to its mission, ASCR operates Leadership Computing facilities, a high-performance production computing center, and a high-speed network, and implements a broad base research portfolio to solve complex problems on computational resources that are on a trajectory to reach well beyond hundreds and thousands of petaflops within a few years.

Proposed research under ASCR for the FY 2024 Funding for Accelerated, Inclusive Research (FAIR) FOA must be responsive to one of the specific subprograms below:

(a) Applied Mathematics

This subprogram supports basic research leading to fundamental mathematical advances and computational breakthroughs across DOE and SC missions. Applied Mathematics efforts span a range of research in scalable high-performance solvers, adaptive multiscale mathematical models, and coupled scientific data analysis, statistical methodologies, and algorithms. These research developments are the foundation for enabling predictive models, simulations, and analysis of DOE-relevant science and engineering applications. The specific topic areas of interest are:

(i) Extreme-Scale Algorithms for Scientific Computing

Technical Contact: Steven Lee, Steven.Lee@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 such as:

- High computational and communication complexity and the development of efficient algorithms,
- Better algorithm scalability for low-power, high-performance computing,
- Reduced ill-conditioning and sensitivity for inverse problems, and
- Improved algorithm reliability and robustness to noise

These challenges should be addressed in the context of future architectures where extreme parallelism, data placement and movement, resilience, and extreme heterogeneity may be significant considerations. The ASCR workshop report on “Randomized Algorithms for Scientific Computing” includes the types of algorithms and research directions that are in scope for this topic area.

Topics and research areas that are out of scope for sub-topic (1) include:

- Pre-applications that do not address one or more of the four grand challenges described above.
- Pre-applications and applications that do not address research for creating a body of knowledge and understanding that will inform future advances in extreme-scale science;
- Pre-applications that do 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 or quantum computing algorithms.

(ii) Scalable Scientific Data Analysis and Reduction

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

The incorporation of increasingly massive data sets in scientific computing is a growing challenge for the scientific community. This topic area seeks rigorous and innovative mathematical and computationally efficient approaches that address the use of such data sets, relevant to the DOE mission, in three ways: (1) machine learning algorithms in accordance with priority research directions outlined in the *Report on Basic Research Needs for Scientific Machine Learning: Core Technologies for Artificial Intelligence*; (2) analyzing and extracting information and insight from large-scale data, especially the integration of observational data, experimental data, simulations and/or models using new statistical methodologies; and (3) the reduction of data consistent with the core research topics presented in the *Workshop Brochure on Data Reduction for Science*.

Topics and research areas that are out of scope for sub-topic (2) include:

- Pre-applications and applications that do not address any of the three specified scenarios detailed above.
- Research and development that requires or assumes that the bulk of the data are all in one place, rather than widely distributed geographically.
- Use of machine learning algorithms to address a specific problem; proposed research should advance the mathematics of machine learning, not apply machine learning.
- Use of data reduction algorithms to address a specific problem; proposed research should advance the mathematics of data reduction, not apply data reduction.

(iii) Multiscale Mathematics for the Modeling and Simulation of Complex Systems

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

Innovative mathematics research is needed to improve the fidelity and predictability of continuous and/or distributed complex systems that accurately capture the physics and/or

subcomponent interactions across vastly different time and length scales. This topic area is focused on the challenges of accurately coupling different multi-physics systems, the rigorous development of hybrid or hierarchical mathematical models that incorporate machine learning or reduced order models, and other approaches that bring together multiple facets of more realistic, predictive modeling and simulation.

Topics and research areas that are out of scope for sub-topic (3) include: pre-applications and applications that do not address innovation in coupling or multifaceted mathematical models.

Overall, the topics and research areas that are out of scope for Applied Mathematics include:

- Approaches for specific scientific or engineering problems that are not applicable to a broader class of problems,
- Approaches with a primary emphasis on tailoring, or the implementation of, existing numerical methods for specific scientific problems,
- Computational implementation or frameworks for scientific or engineering problems that are primarily based on specific programming models or architecture,
- Research that results in incremental improvements to the existing state of practice.

Important note for encourage and discourage decisions: 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 lack of such details is sufficient for discouragement of the proposed research.

References:

- (1) Workshop report on Randomized Algorithms for Scientific Computing (RASC), <https://doi.org/10.2172/1807223>
- (2) Data Reduction for Science, <https://doi.org/10.2172/1770192>
- (3) Basic Research Needs for Scientific Machine Learning: Core Technologies for Artificial Intelligence, <https://doi.org/10.2172/1478744>
- (4) Opportunities and Challenges from Artificial Intelligence and Machine Learning for the Advancement of Science, Technology, and the Office of Science Missions - <https://doi.org/10.2172/1734848>
- (5) AI for Science: Report on the Department of Energy (DOE) Town Halls on Artificial Intelligence (AI) for Science - <https://doi.org/10.2172/1604756>
- (6) 2018 Basic Research Needs Workshop on Extreme Heterogeneity, <https://doi.org/10.2172/1473756>
- (7) Report on Applied Mathematics Research for Exascale Computing, <https://doi.org/10.2172/1149042>
- (8) DOE Workshop Report on Multiphysics Simulations <https://science.osti.gov/-/media/ascr/pdf/programdocuments/docs/MultiPhysics-Simulations-Report.pdf>
- (9) Report on the Extreme Scale Solvers Workshop, <https://science.osti.gov/-/media/ascr/pdf/programdocuments/docs/reportExtremeScaleSolvers2012.pdf>
- (10) Report on A Multifaceted Mathematical Approach for Complex Systems https://science.osti.gov/-/media/ascr/pdf/programdocuments/docs/Multifaceted_Mathematical_Approach_for_Complex_Systems.pdf

(b) Computer Science

This subprogram supports research that enables computing and networking at extreme scales and the understanding of extreme scale and complex data from both simulations and experiments. It aims to make high performance scientific computers and networks highly productive and efficient to solve scientific challenges while attempting to reduce domain science application complexity as much as possible.

Topics of interest for this FOA are focused on the following key core computer science research areas:

(i) Systems

Technical Contact: Hal Finkel, Hal.Finkel@science.doe.gov

- a. Programming Models and Environments:** Innovative programming models for developing applications on next-generation platforms, exploiting unprecedented parallelism, heterogeneity of memory systems (e.g. Non-Uniform Memory Access [NUMA], non-coherent shared memory, high-bandwidth memory [HBM], scratchpads, and heterogeneity of processing (e.g., Graphics Processing Units [GPUs], Field-Programmable Gate Arrays [FPGAs], Coarse-Grained Reconfigurable Architectures [CGRAs], other types of accelerators, big-small cores, processing in memory, and near memory, etc.), with particular emphasis on making it easier to program at scale. All phases of the software-development cycle are relevant, including but not limited to, design, implementation, verification, optimization, and integration. Particularly welcome are methods that infuse artificial intelligence/machine learning into the programming environment.
- b. Operating and Runtime Systems:** System software that provides intelligent, adaptive resource management and support for highly parallel software and workflow-management systems, and that facilitates effective and efficient use of heterogeneous computing technologies, including diverse execution models, processors, accelerators, memory, and storage systems. Target workloads include modeling and simulation, data analysis, and the processing of large-scale, streaming data from experiments.
- c. Performance Portability and Co-design:** Methods that support performance portability, which provides the ability to efficiently use diverse kinds of hardware platforms with minimal changes to the application source code, and/or hardware/software co-design, which is a method for designing and/or adapting both hardware and software design as part of a holistic process. These methods include automated and semi-automated refinements from high-level specification of an application and/or hardware design to low-level code, optimized when compiled and/or, for software, at runtime, to different HPC platforms. The focus is on enabling performance portability of, and/or the design of future hardware for, applications developed for extreme-scale computing and beyond.

Applications are not restricted to a single Systems topic above and may span all of them, provided the scope of work remains appropriate for the program.

(ii) Data Management, Visualization, and Analytics

Technical Contact: Margaret Lentz, Margaret.Lentz@science.doe.gov

- a. **Data Management** approaches for managing and analyzing large and complex data (multidimensional, multimodal, etc.) from scientific experiments and simulations are of interest as highlighted recent ASCR Workshop on the Management and Storage of Scientific Data, building on the outcomes of prior community activities, including Storage Systems and I/O: Organizing, Storing, and Accessing Data for Scientific Discovery and the Office of Science Roundtable on Data for AI. Areas of interest include:
 - Innovative interfaces and management methods that allow for flexible, high-performance access to large data sets, potentially federated across different kinds of memory, edge devices, and repositories, capturing and management relevant usage statistics, provenance, and other metadata.
 - Innovative methods to design scientific-data-management services for state-of-the-art storage and networking devices, including those providing computational capabilities.

- b. **Analytic Methods and Environments** includes approaches to improve visual exploration and understanding of petabyte to exabyte multi-scale, multi-physics scientific data sets from simulations and/or experimental platforms; to support efficient analysis of data across federated resources; to support interactivity with simulation and/or real-time steering of experiments, including remote interactions; and to help answer scientifically relevant questions from the data about, for example, uncertainty, sensitivity analysis, causality, and the debugging of codes and methods. As appropriate, applicants are encouraged to consider evaluation methods for new visualization tools and techniques resulting from the proposed research. These areas highlighted in the recent ASCR Workshop on Visualization for Scientific Discovery, Decision-Making, and Communication. Areas of interest include:
 - Advancing Theory and Techniques for Visualization to Support the Analysis and Understanding of Complex Scientific Data
 - Introducing Interoperable and Adaptable Visualization to Support Diverse Scientific Workflows Across All Scales
 - Harnessing Technology Innovations to Accelerate Science through Visualization
 - Developing Intelligent Approaches for Adaptive, Context-Aware Visualization of Scientific Data and AI

The primary focus of the proposed work for either topic A or B must be on innovative computer- science techniques, which may include explainable machine learning and AI techniques to help address the aforementioned areas of data management, visualization, and analytics.

Topics that are out of scope for the Computer Science subprogram include:

- Pre-applications and applications that do not address the specific Computer Science topics described above.
- Pre-applications and applications that do not explain/describe their relevance to current

and future high performance computing platforms and/or data-centric science as well as their relevance to the mission of SC and ASCR.

- Pre-applications and applications that focus primarily on the development or application of data-reduction techniques (see Applied Mathematics Topic on Scientific Machine Learning, Data Analysis and Reduction).
- Pre-applications and applications that are primarily focused on the mathematics of AI (see Applied Mathematics Topic on Scientific Machine Learning, Data Analysis and Reduction).
- Pre-applications and applications with primary emphasis on computer hardware design, fabrication, or integration; materials science; and computing devices and/or device/circuit design and/or manufacturing.
- Research primarily focused on advancing discipline-specific research or capabilities without also proposing a generalization of this research to other SC priority mission areas.
- Research primarily focused on advancing Virtual Reality and Augmented Reality technologies.
- Research focused on the World Wide Web and/or Internet.
- Research that is only applicable to hand-held, tablets, laptops, portable, desktop, embedded or cloud computing.
- Research focused on quantum computing.

References:

- (1) DOE Workshop report: Reimagining Codesign. <https://www.osti.gov/biblio/1822199/>
- (2) DOE Workshop report: The Management and Storage of Scientific Data. United States, 2023. <https://www.osti.gov/biblio/1845707/>
- (3) DOE Workshop report: Management, Analysis and Visualization of Experimental and Observational Data: The Convergence of Data and Computing <https://www.osti.gov/biblio/1440647>
- (4) DOE Workshop report: Crosscut Report: Exascale Requirements Reviews, March 2017. [https://science.osti.gov/~media/ascr/pdf/programdocuments/docs/2018/DOE-ExascaleReport- CrossCut.pdf](https://science.osti.gov/~media/ascr/pdf/programdocuments/docs/2018/DOE-ExascaleReport-CrossCut.pdf)
- (5) DOE Workshop report: Storage Systems and Input/Output: Organizing, Storing, and Accessing Data for Scientific Discovery. <https://www.osti.gov/biblio/1491994/>
- (6) DOE Workshop report: Data and Models: A Framework for Advancing AI in Science <https://www.osti.gov/biblio/1579323>
- (7) DOE Workshop brochure: Visualization for Scientific Discovery, Decision-Making, and Communication. <https://www.osti.gov/biblio/1845708>

(c) Advanced Computing Technologies (ACT)

This subprogram supports quantum computing and networking efforts and Research and Evaluation Prototypes (REP). The REP activity addresses the challenges of next generation computing systems. By actively partnering with the research community, including industry and Federal agencies, on the development of technologies that enable next-generation machines, ASCR ensures that commercially available architectures serve the needs of the scientific community. The REP activity also prepares researchers to effectively use future generation of scientific computers, including novel technologies, and seeks to reduce risk for future major

procurements. The specific topic areas of interest are:

(i) Quantum Computing and Networking

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

- Research to evaluate the suitability of specific quantum computing hardware architectures or devices for science applications, including resource estimates for quantum computing applications of interest to SC.
- Theoretical methods and software tools to assess the performance of real-world quantum processors, facilitate device-specific optimization of individual operations ranging from state preparation and measurement through gate implementation and compilation, suppress noise, mitigate crosstalk, control errors, and maintain optimally high-fidelity operations in the absence of formal error correction.
- Proof-of-concept demonstrations of technology required for distributing quantum entanglement in a multi-node network.
- Theoretical explorations of possible applications of a quantum network for advancing scientific research.

(ii) Emerging Computing

Technical Contact: [Robinson Pino, Robinson.Pino@science.doe.gov](mailto:Robinson.Pino@science.doe.gov)

- **Neuromorphic Computing:** Research and development of biological and computational neuroscience-inspired computing software tools and techniques as well as energy-efficient hardware. The aim is to create computing environments that will help accelerate artificial intelligence for scientific research while advancing the development of neuromorphic approaches to computation.
- **Advanced Wireless:** Research and development approaches to reinvent the digital continuum linking the wireless edge to advanced high-performance computing and data centers, and effectively integrate data collection from advanced wireless scientific sensors or edge computing devices through enhanced or new computational software tools that can provide end-to-end services such as data movement, analysis, integrity, and performance optimization.
- **Microelectronics:** Research and development approaches leveraging microelectronic technologies, leading edge devices, application specific architectures, advanced packaging, algorithms, and the software tools required to design, simulate, and prototype emerging computing systems.

Topics that are out of scope for the Advanced Computing Technologies subprogram include:

- Research that does not address the specific ACT topics described above;
- Development of application-specific techniques to use quantum computers or application-specific quantum algorithms that do not generalize to multiple scientific domains;
- Development of new candidate qubit systems or improvements to physical qubits;
- Development of integrated circuits for quantum computing;
- Cryptography and cryptanalysis;
- Quantum Key Distribution and other security-focused approaches to quantum communication;
- Error correction codes and implementation of error correction codes for quantum computers;

and

- Research solely relevant to large-scale, high-fidelity, fault-tolerant quantum computers; and
- Projects that are duplicative of or competitive with industry.

2. Basic Energy Sciences (BES)

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

The mission of the [Basic Energy Sciences \(BES\)](#) program is to support fundamental research to understand, predict, and ultimately control matter and energy at the electronic, atomic, and molecular levels. BES research provides the foundations to develop new energy technologies, to mitigate the climate and environmental impacts of energy generation/use, and to support DOE missions in energy, environment, and national security. The portfolio supports fundamental research in [Materials Sciences and Engineering \(MSE\)](#) and [Chemical Sciences, Geosciences, and Biosciences \(CSGB\)](#). BES accomplishes its mission through excellence in scientific discovery in the energy sciences, and through stewardship of world-class scientific user facilities that enable cutting-edge research and development.

The research disciplines that BES supports—condensed matter and materials physics, chemistry, geosciences, and aspects of biosciences—touch virtually every important aspect of energy resources, production, conversion, transmission, storage, efficiency, and waste mitigation, providing a knowledge base for achieving a secure and sustainable clean energy future. The Basic Energy Sciences Advisory Committee (BESAC) report, “[A Remarkable Return on Investment in Fundamental Research](#)” provides key examples of major technological, commercial, and national security impacts, including clean energy technologies, directly traceable to BES-supported basic research.

Subprograms

Technical Contact: BES-FAIR.FOA@science.doe.gov

Program Manager to select when submitting a pre-application: Viviane Schwartz

The BES program funds research in the following subprograms. **Proposed research must be responsive to one of the core research areas in one of the following six subprograms:**

(a) [Scattering and Instrumentation Sciences Research](#)

Advancing science using new tools and techniques to characterize materials structure and dynamics across multiple length and time scales, including ultrafast science, and to correlate this data with materials performance under real world and extreme conditions. Core research areas include [x-ray scattering](#), [neutron scattering](#), [electron and scanning probe microscopies](#), and [accelerator and detector research](#).

(b) [Condensed Matter and Materials Physics Research](#)

Understanding the foundations of material functionality and behavior including electronic, thermal, optical, and mechanical properties; the impact of extreme environments; and materials whose properties arise from the effects of quantum mechanics. Core research areas include

[experimental condensed matter physics](#), [theoretical condensed matter physics](#), [physical behavior of materials](#), [mechanical behavior and radiation effects](#), and [quantum information science](#).

(c) [Materials Discovery, Design, and Synthesis Research](#)

Developing the knowledge base and synthesis strategies to design and precisely assemble structures to control properties and enable discovery of new materials with unprecedented functionalities, including approaches learned from biological systems. Core research areas include [materials chemistry](#), [biomolecular materials](#), and [synthesis and processing science](#).

(d) [Fundamental Interactions Research](#)

Discovering the foundational factors controlling chemical reactivity and dynamics in gas and condensed phases, and at interfaces, based on understanding quantum interactions among photons, electrons, atoms, and molecules. Core research areas include [atomic, molecular, and optical sciences](#), [gas phase chemical physics](#), [condensed phase and interfacial molecular science](#), [computational and theoretical chemistry](#), and [quantum information science](#).

(e) [Chemical Transformations Research](#)

Understanding and controlling the mechanisms of chemical catalysis, synthesis, separation, stabilization, and transport in complex chemical and subsurface systems, from atomic to geologic scales. Core research areas include [catalysis science](#), [separation science](#), [heavy element chemistry](#), and [geosciences](#).

(f) [Photochemistry and Biochemistry Research](#)

Elucidating the molecular mechanisms of the capture of light energy and its conversion into electrical and chemical energy through biological and chemical pathways. Core research areas include [solar photochemistry](#), [photosynthetic systems](#), and [physical biosciences](#).

Additional information about BES sponsored research can be found at the [BES website](#). There you will find [BES-sponsored workshop reports](#) that address future directions of some important research areas, as well as providing information on the current status of related technologies. In addition, [MSE](#) and [CSGB Principal Investigators' Meetings Reports](#) contain abstracts of BES supported research and the [facilities web pages](#) contain links to BES user facilities.

3. Biological and Environmental Research (BER)

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

The Biological and Environmental Research (BER) program supports transformative science and scientific user facilities to achieve a predictive understanding of complex biological, Earth, and environmental systems to inform clean energy innovations and climate solutions.

The BER subprograms and their objectives follow:

(a) Biological Systems Science

Subprogram Website: <https://science.osti.gov/ber/Research/bssd>

Technical Contact: Boris Wawrik, Boris.Wawrik@science.doe.gov, and Vijay Sharma, Vijay.Sharma@science.doe.gov

Research supported by the Biological Systems Science Division (BSSD) and its facilities aims to provide the necessary fundamental science to understand, predict, manipulate, and design biological systems that underpin innovations for bioenergy and bioproduct production and enhance our understanding of natural, DOE-relevant environmental processes. By integrating genome science with advanced computational and experimental approaches, the Division seeks to gain a predictive understanding of living systems, from microbes and microbial communities to plants and ecosystems. This foundational knowledge enables design and reengineering of microbes and plants underpinning a broad clean energy and bioeconomy portfolio, including improved biofuels, bioproducts and biomaterials, improved carbon storage capabilities, and improved understanding of the biological cycling and transformation of nutrients, materials, and contaminants in the environment. The major research portfolio elements include:

(i) Genomic Science (<https://genomicscience.energy.gov/>)

The Genomic Science Program (GSP) seeks to understand genomic information and how it directs the functional characteristics of cells, organisms, and whole biological systems. The core research areas supported by the GSP are **Bioeconomy and Bioenergy Research, Biosystems Design, Environmental Microbiome Research, and Computational Biology**. Within these areas, of interest to the GSP are questions related to the molecular and regulatory mechanisms governing genotype to phenotype translation needed to predictively understand genome-scale functional properties of microbes, plants, and microbiomes relevant to BER's research efforts; develop experimental "-omics" capabilities and enabling technologies needed to achieve a dynamic, system-level understanding of cellular and microbiome functions; and develop the knowledgebase, computational infrastructure, and modeling capabilities to advance predictive understanding and design of biological systems for a variety of bioenergy, environmental and synthetic biology applications underpinning a broader bioeconomy.

In the area of **Bioeconomy and Bioenergy Research**, efforts seek to provide the fundamental science needed to underpin the sustainability, production, breakdown, conversion, and use of plant biomass as a renewable alternative to petroleum. The scope of this research includes gaining a basic understanding of plant and microbial genomics for dedicated crop development and conversion of plant biomass into products and pursuing fundamental insights into the sustainability of bioenergy crop production and developing capabilities in plant transformation research. In addition, through multi-scale modeling efforts, BSSD seeks to advance our understanding of how large-scale planting of biomass feedstocks will affect ecosystem services and the economics of the bioeconomy supply chain. Research within BSSD seeks to expand this body of knowledge to extend the range of biofuels and bioproducts that can be produced from biomass feedstocks. This includes topics that expand a genome-level understanding of plant metabolism, physiology, and growth to develop new bioenergy feedstocks with traits tailored for bioenergy and bioproduct production. BSSD's bioenergy research also seeks a better understanding of microbial metabolism and the design new strains, communities, or enzymes

capable of converting plant biomass components into fuels, chemicals, and bioproducts, as well as the genomic properties of plants and microbes, that enable the development of new, sustainable approaches for bioenergy crop production on marginal lands with few or no agricultural inputs, while minimizing ecological impacts under changing environmental conditions.

BSSD's **Biosystem Design** research aims to advance our fundamental understanding of genome biology and develop the genome-scale engineering technologies needed to design, manipulate, and control plants and microbes for desired beneficial purposes. This includes novel broadly applicable approaches for DNA delivery and expression in plants and microbes, high-throughput characterization, testing, and phenotyping; the elucidation of mechanisms or the acquisition, storage, transport, and chemical transformation of substrates in engineered organisms; research to build new genetic, regulatory, and biosynthetic networks to biologically produce useful molecules. Also included are topics related to secure biosystems design, which leverages advances in genome science and synthetic biology to design and engineer DOE-relevant biological systems with built-in biocontainment measures and to develop strategies to address risks of unintended release of engineered organisms into the environment, while enabling a sustainable bioeconomy.

BSSD's **Environmental Microbiome** portfolio supports process-level research that improves our understanding of microbiome function and ecosystem impacts on elemental cycling (particularly carbon and nutrients) in the environment. This includes both experimental and computational research to understand microbial community interactions and biogeochemical cycling across broad time and space scales. In this context, BSSD supports studies that interrogate the functional characteristics and activities of the vast, uncharacterized genomic diversity of environmental microbes. Relevant efforts are closely tied to developing a better understanding of microbial impacts on sustainable bioenergy crop growth and yield. BSSD also seeks to leverage emerging opportunities in synthetic and computational biology by exploring the potential of synthetic microbiome science to advance predictive capabilities and to understand gene function across microbial taxa and ecosystems.

In the area of **Computational Biology**, BSSD seeks to create open-access and integrated computational capabilities tailored to large-scale data science investigations for molecular, structural, genomic, and omics-enabled research on plants and microorganisms for a range of DOE mission goals. Effort in this area include the creation of next-generation data systems and algorithms needed for large-scale systems biology data science that connects observations across scales and integrates molecular, structural, genomic, and other omics data with cellular and multicellular processes; the development of explainable artificial intelligence algorithms to identify relationships among different parts of genomes and build integrated biological models that capture higher-order complexity of the interactions among cellular components that lead to phenotypic differences; and the creation of algorithms and data-handling techniques to process and integrate imaging and structural biology data with simulations and other biological measurements.

(ii) Biomolecular Characterization and Imaging Science

[\(https://genomicscience.energy.gov/biomolecular-characterization-and-imaging-science/\)](https://genomicscience.energy.gov/biomolecular-characterization-and-imaging-science/)

BSSD's **Biomolecular Characterization and Imaging Science (BCIS)** provides access to imaging and measurement technologies and develops new ones to visualize the spatial and temporal relationships of key metabolic processes governing phenotypic expression in plants and microbes. These processes are key to the bioenergy and biogeochemical systems of interest to BER's Genomic Science and Environmental System science areas (see descriptions above and below). Both static and dynamic imaging are of interest to provide information on biosystem components and functions. Dynamic imaging can further provide information on the time and place of chemical reactions to identify causal relationships between biological activators and downstream effectors.

To aid and advance genomic and environmental system science, BCIS seeks to improve or develop new classical and quantum imaging science and technology; quantum sensing; and technologies associated with cryo-EM, and synchrotron light and neutron facilities for structural biology and biological imaging. Example approaches of interest include but are not limited to developing technologies that will accelerate measurements or increase signal to noise improving resolution, introduce samples for interrogation with little to no perturbation.

NOTE: A more detailed description of BSSD's Program elements can be found in the Division Strategic Plan: <https://genomicscience.energy.gov/doe-ber-biological-systems-science-division-strategic-plan/>.

Applicants are encouraged to reach out to Program technical contacts for more information and/or whether specific topic areas are within the scope of BSSD's supported research efforts.

The following areas are **NOT within BSSD's scope**:

With respect to Genomics Science, BSSD does NOT support research on food, food crops, or food products; animal feed; biofuels, bioproducts, or biomaterials derived from starch, waste, natural gas or coal; microbial fuel cells; electrosynthesis; electrochemistry; wastewater; municipal solid waste; bioremediation; bioprospecting; biomimetics/biohybrids; production of ethanol, biogas, hydrogen, pharmaceuticals, nutraceuticals, cosmetics; marine algal systems; applied projects, techno-economic analysis (TCA), life cycle analysis (LCA), or projects focused primarily on titer/yield improvement or scale-up production; animal or plant pathogens; studies that target human or environmental health; studies focused on marine environments, including estuaries, their sediments, and coastal marine wetlands; agroecosystems other than bioenergy crops; or animal microbiomes.

Efforts in Biomolecular Characterization and Imaging do NOT include medical imaging, disease diagnostics, or therapies in animal and human systems; the development of novel materials or fundamental chemical processes; quantum processes or materials with primary intended application to quantum computing or communications; or acquisition of commercially available imaging systems that do not include innovative advances or validation of new technologies. While applications proposing innovative integrated imaging platforms could be eligible, stand-alone development of imaging probes, biomarkers, biological microfluidics devices are not the focus of BER's bioimaging efforts.

Descriptive projects that primarily seek genomic or metagenomic sequencing should be directed to the DOE Joint Genome Institute's (JGI) Community Science Program

(<https://jgi.doe.gov/user-programs/program-info/csp-overview/>).

Research that would result in only incremental knowledge or technological advances, or applications focused solely on technology development will not be considered.

(b) Earth and Environmental Systems Sciences

Subprogram Website: <https://science.osti.gov/ber/Research/eessd>

Technical Contacts: Justin Hnilo, Justin.Hnilo@science.doe.gov

The Earth and Environmental Systems Sciences Division (EESSD) supports fundamental research needed to address key uncertainties arising from the interactions and interdependencies of the atmospheric, terrestrial, subsurface, cryospheric, oceanic, and human-energy components of the Earth system. Using an approach to enhance system predictability, EESSD-supported research strives to understand and anticipate how environmental stressors behave within a nonlinear system. These stressors, in turn, can influence the robustness and resilience of U.S. energy infrastructures. Particular emphasis is placed on understanding how natural and human-derived factors contribute to variabilities and trends spanning local to global scales. The scope of EESSD process research spans scales from molecular to global and durations from nanoseconds to many decades, in order for DOE to achieve its goals involving foundational science, environment, energy, economic, and security.

To address the EESSD mission, the Division is organized into three programmatic areas:

(i) Atmospheric System Research (ASR)

ASR supports research to quantify the interactions among aerosols, clouds, precipitation, and radiation to improve understanding of key cloud, aerosol, precipitation, and radiation processes that affect the Earth's radiative balance and hydrological cycle, especially processes that limit the predictive ability of regional and global models. For the most part, ASR investments are based on measurements of radiation, aerosols, clouds, precipitation, thermodynamics, turbulence, and state variables from the Atmospheric Radiation Measurement (ARM) user facility. ARM's continuous observational datasets are supplemented with process models, laboratory studies, and shorter duration ground-based and airborne field campaigns to target specific atmospheric processes in different atmospheric and climatic regimes and across a range of spatial and temporal scales. ASR's four priority research areas are focused on reducing the large uncertainties in Earth system prediction that can be traced to: aerosol processes, warm boundary-layer processes, convective processes, and high-latitude processes. Earth system models incorporate ASR research results to both understand the processes that govern atmospheric components and to improve model predictions.

(ii) Environmental System Science (ESS)

ESS supports research to advance understanding of terrestrial ecosystems and watersheds, which include interdependent microbial, biogeochemical, ecological, hydrological, and physical processes across spatiotemporal scales. To support this goal, the ESS research focuses on exploring complex systems with integrated experimental-modeling approaches to achieve a

realistic, robust, and scale-aware predictive understanding of the processes and controls underlying the Earth's terrestrial environment. The ESS research scope spans from molecular to global and extends from the bedrock to the atmosphere. ESS supports fundamental process research in terrestrial ecology and watershed science that addresses key knowledge gaps within and across terrestrial systems and their interfaces, as well as model development to capture system processes, functions, and feedbacks. The Environmental Molecular Science Lab (EMSL) is a user facility that allows one to obtain a mechanistic understanding of physical, chemical, and intra- and inter-cellular processes and interactions, and to incorporate this information into numerical models to better understand how biological, environmental, atmospheric, and energy systems function at higher spatial- and temporal scales. Please see for details (<https://science.osti.gov/ber/Facilities/User-Facilities/EMSL>).

(iii) Earth and Environmental Systems Modeling (EESM)

EESM supports the development and application of high-fidelity models representing Earth system changes in order to improve understanding of the significant drivers, feedbacks, and uncertainties within the integrated Earth system and to provide vital information needed for effective energy and connected infrastructure planning. Earth system, in this context, is defined as the interdependency of the atmospheric, oceanic, cryogenic, terrestrial, and human components that in turn influence a region's climate, hydrology, and land use. EESM supports the development of advanced computational, numerical, statistical, dynamical, biogeochemical and physical representations of the Earth system; seeks to understand the factors that determine regional variability and change; develops modeling capabilities that involve next-generation terrestrial and atmospheric algorithms for global models and validation of datasets spanning scales from process-to-global; and seeks to advance scientific understanding of the complex interactions, interdependencies, and co-evolutionary pathways of human and natural systems, including interdependencies among sectors and infrastructures.

In addition to the three programmatic areas, the Data Management for Environmental Data activity supports EESSD-relevant data science and open-data practices to develop and make available to the community novel scale-aware visualization and analysis methods involving observational and model-generated data.

The following areas are **NOT within EESSD's scope**:

As the focus of the scope of EESSD research is on basic science, the following are examples of topics that are out of scope for EESSD: applied, operational, or regulatory topics; policy and regulation; ecosystem or environmental services; land, water, or natural resource management; wildlife; agriculture, aquaculture/fisheries, or forestry practices; air pollution measurements, control technology development or evaluation; and design, modeling, or technology development related to renewable energy systems including wind farms, solar arrays, and hydropower.

4. Fusion Energy Sciences (FES)

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

The mission of the Fusion Energy Sciences (FES) program is to expand the fundamental

understanding of matter at very high temperatures and densities and to build the scientific foundation needed to develop a fusion energy source. This is accomplished through the study of plasma, the fourth state of matter, and how it interacts with its surroundings.

Once developed, fusion will provide a clean energy source well-suited for on-demand, dispatchable electricity production, supplementing intermittent renewables and fission. Energy from fusion will be carbon-free, inherently safe, with a virtually limitless fuel supply, and without the production of long-lived radioactive waste.

To achieve its mission, 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, future blanket concepts and tritium fuel cycle, and innovation in measurement techniques.

In addition to its fusion energy mission, FES also supports discovery plasma science, which is focused on research at the frontiers of basic and low temperature plasma science (with applications to microelectronics) and high-energy-density laboratory plasmas.

Finally, FES invests in transformational technologies such as artificial intelligence and machine learning (AI/ML), fundamental science to transform advanced manufacturing, and quantum information science (QIS), that have the potential to accelerate progress in several mission areas. FES research is guided by the Long-Range Plan “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>),
- 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

Proposed research under FES must be responsive to one of the specific subprograms below. For more information about a specific subprogram, contact the designated program manager.

(a) Burning Plasma Science: Foundations—Advanced Tokamak

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

The Advanced Tokamak (AT) program area addresses gaps in the physics basis for the conventional tokamak approach to magnetic confinement fusion. The AT program develops methods that simultaneously obtain high plasma pressure, stationary plasma profiles, high plasma confinement, and adequate particle and power handling. The program includes research and facility operations on the DIII-D SC user facility at General Atomics in San Diego, CA, and

small-scale advanced tokamak research conducted on university-scale devices. DIII-D is the largest magnetic fusion research experiment in the U.S. It can magnetically confine plasmas at temperatures relevant to burning plasma conditions. Its extensive set of advanced diagnostic systems and extraordinary flexibility to explore various operating regimes make it a world-leading tokamak research facility. Small-scale advanced tokamak research is complementary to the efforts at DIII-D and other user facilities, providing rapid and cost-effective development of new techniques, prototyping of new concepts, and detailed validation of theoretical models.

Applications focusing on the use of innovative or transformational approaches and technologies such as AI/ML, advanced manufacturing, and engineered materials are also encouraged.

(b) Enabling Research and Development

Technical Contact: Guinevere Shaw, Guinevere.Shaw@science.doe.gov

The realization of fusion energy and the advancement of plasma science requires advances in supporting technologies to achieve higher levels of performance and flexibility to explore new plasma regimes. The purpose of the Enabling Research and Development (R&D) program element is to develop these supporting technologies for deployment on existing and next-generation fusion research facilities. Applications to this area must focus on experimental research and/or model validation pertaining to supporting technologies required to achieve higher levels of performance and flexibility to explore new plasma regimes.

(c) Burning Plasma Science: Foundations—Spherical Tokamak

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

The Spherical Tokamak Research program seeks to utilize spherical tokamak research facilities with low aspect ratios to develop the physics knowledge needed to advance the FES energy mission. An improved understanding of the spherical tokamak magnetic confinement configuration is needed to establish the physics basis for next-step spherical tokamak facilities, broaden the scientific understanding of plasma confinement for ITER, and maintain U.S. world leadership in spherical tokamak research capabilities. Operation at higher magnetic field, reduced collisionality, and with controllable fully non-inductive current-drive are necessary next steps for assessing the spherical tokamak as a potentially cost-effective path to fusion energy. The program includes major domestic (i.e., National Spherical Torus Experiment-Upgrade [NSTX-U]) and international facilities, as well as small scale facilities conducting high-risk high-reward research.

A variety of important research topics that broadly support the foundational science for burning plasmas are uniquely possible through the study of spherical tokamak plasmas. Specifically, spherical tokamaks have demonstrated much higher normalized plasma pressure than conventional aspect ratio tokamaks. Also, spherical tokamaks provide access to unique plasma turbulence, energetic particle instabilities, and edge plasma regimes.

Applications to this area must focus on experimental research and/or model validation pertaining to spherical tokamak plasmas. Applications addressing high impact studies involving low recycling walls, or non-inductive plasma startup are also encouraged.

(d) Burning Plasma Science: Foundations—Theory & Simulation

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

This program area focuses on advancing the scientific understanding of the fundamental physical processes governing the behavior of magnetically confined plasmas. 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;
- 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 Multiphysics processes at the plasma boundary 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 whole-device modeling 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 emerging high-performance computing systems. Research focused on transformative approaches such as fusion-relevant computing aspects of QIS and AI/ML are also encouraged.

(e) Burning Plasma Science: Long Pulse—Tokamak

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

This program area supports research conducted by U.S. teams on long pulse superconducting tokamaks located overseas as well as on short pulse tokamaks with unique capabilities not available in U.S. facilities. Supported teams conduct research on international facilities by building on the experience gained from the operation and optimization of U.S. fusion facilities. This research will enable the exploration of plasma regimes that cannot be sustained for long duration on domestic machines, allowing the U.S. fusion program to gain the knowledge needed to control and sustain plasma discharges in future burning plasma devices such as ITER and tokamak-based fusion power plants.

(f) Burning Plasma Science: Long Pulse—Stellarator

Technical Contact: Samuel (Sam) Barish, Sam.Barish@science.doe.gov

This program area supports research on stellarators, which offer the promise of steady-state confinement regimes without transient events driven by net plasma current. The three-dimensional (3D) shaping of the plasma in a stellarator provides for a broader range in design flexibility than is achievable in a 2D system. This program element supports research conducted

on U.S. stellarators that are focused on optimization of confinement through quasi-symmetric shaping of the toroidal magnetic field, and research by U.S. teams conducted on international facilities.

(g) Burning Plasma Science: Long Pulse—Materials

Technical Contact: Guinevere Shaw, Guinevere.Shaw@science.doe.gov

The selection of materials for future fusion device design is foundational. Every component, from the innermost chamber walls to the outer framework, demands a diverse array of materials that can endure a spectrum of conditions encompassing heat, particle exposure, and neutron fluxes. This endeavor involves advancing materials, developing physical and numerical models, and other essential tools for realizing the next generation fusion material technologies. Leveraging the FESAC Long-Range Plan and recent community workshops, underscores the urgent necessity for a fusion prototypic neutron source which can replicate fusion conditions, additional resource can be found on the FES Community Resources page. This capability serves as the fundamental basis for the materials constituting a fusion device. Alongside the neutron environment, there exists other interconnected materials challenges that broaden the spectrum of considerations for a fusion device. This subprogram supports research in the areas listed below.

Please note, some research topics are considered cross-cutting and are coupled to the fusion nuclear science program. Please indicate if the topic is cross-cutting, or contact the subprogram contact for more information.

- **Plasma Material Interactions and Plasma Facing Components (PFC):** The innermost wall of a fusion device, known as the plasma-facing components (PFCs), is exposed to the high-energy plasma. Plasma-material interactions can cause erosion, sputtering, and material migration. Research in this area aims to develop materials that can withstand the extreme heat, particle fluxes, and erosion caused by plasma interactions.
- **Structural Materials for Fusion:** Structural materials refer to those materials used in the overall construction of the fusion device, such as the vacuum vessel, blanket structure, and other supporting components. These materials must be able to withstand the structural loads, radiation, and heat while maintaining their desired material properties. Advanced structural steels, advanced alloys, and engineered composites are areas of interest for research.
- **Fundamental Modeling and Materials Behavior:** Advances in materials modeling play a crucial role in predicting how materials will behave under fusion reactor conditions. Computational tools allow researchers to simulate material responses to high temperatures, radiation, and stress, aiding in material selection and design optimization.
- **Functional Materials:** These are materials that impact the functionality of various fusion components beyond their structural integrity. For instance, materials used for sensors and heat transfer enhancement fall under this category.
- **Advanced and Additive Manufacturing:** Novel manufacturing techniques, including additive manufacturing, offer the potential to create components with enhanced material characteristics and complex geometries that might be challenging to achieve through traditional manufacturing methods. This area includes researching near-net-shape additive manufacturing and exploring ways to improve component performance and cost

compared to conventional manufacturing techniques.

(h) Burning Plasma Science: Long Pulse—Fusion Nuclear Science

Technical Contact: Guinevere Shaw, Guinevere.Shaw@science.doe.gov

Interlinked with a burning plasma and materials that can withstand fusion reactor conditions are all the key systems required to capture the power, breed fuel, and ensure the safe operation of a fusion plant. Building off the FESAC Long-Range Plan, the fusion technology community organized a series of workshops which outlined in more detail key challenges and research objectives, which can be found on the FES Community Resources Page. This program area supports research in the following areas:

- **Blanket:** Breeding tritium within the fusion plant is crucial for achieving a self-sustaining fusion reaction. Areas of interest are tritium control, functional materials, structural materials, and blanket enabling technologies.
- **Fuel Cycle:** Extraction and exhaust processing is crucial for maintaining the self-sustaining fusion reaction. Areas of interest are fueling and exhaust processing, isotope processing, rebalancing and storage, and confinement processing and tritium accountancy.
- **Advanced first wall and divertor engineering components:** Liquid metal plasma facing components included in the first wall and/or the divertor.
- **Remote Handling:** Fusion involves hazardous environments, so remote handling systems are required for maintenance, repairs, and component replacement.
- **Safety Analysis:** Safety assessments, helping to understand how the fusion plant behaves under various operational and accident scenarios.
- **Fusion Nuclear Analysis:** Incorporates neutronics for fusion devices including the development of methodologies, radiation transport simulations, nuclear heating to components, activation of in-vessel components, radiation damage to materials, and neutron and γ -ray fluxes and biological dose rates throughout the facility.
- **Activation and Waste:** Neutrons can cause activation and radiation damage in fusion materials. Studying these effects helps design materials that can withstand the fusion environment and predicting the radioactive waste generated during operation.
- **Integration and Impact Evaluation:** Fusion will be integrated into the larger energy grid and society. This involves assessing the broader impacts of fusion design choices on economic, safety, environmental, and social factors.

Please note, some of these research topics are considered cross-cutting and are coupled to the materials program. Please indicate if the topic is cross-cutting, or contact the subprogram contact for more information.

(i) Discovery Plasma Science: Plasma Science and Technology – General Plasma Science

Technical Contacts: Nirmol Podder Nirmol.Podder@science.doe.gov

The General Plasma Science (GPS) program supports research at the frontiers of basic and low temperature plasma science, including dynamical processes in laboratory, space, and astrophysical plasmas, such as magnetic reconnection, plasma dynamo, shocks, turbulence 46

cascade, structures, waves, flows and their interactions; behavior of dusty plasma, non-neutral, single component matter or antimatter plasma, and ultra-cold neutral plasma; plasma chemistry and processes in low temperature plasma (LTP), interfacial plasma, synthesis of nanomaterials, and interaction of plasma with surfaces, materials or biomaterials. Applicants are strongly encouraged to contact the Program Manager before submitting an application.

(j) Discovery Plasma Science: Plasma Science and Technology—High Energy Density Laboratory Plasmas

Technical Contact: Kramer Akli, Kramer.Akli@science.doe.gov

The High Energy Density Laboratory Plasmas (HEDLP) program supports the study of ionized matter at extremely high density and temperature, specifically, when matter is heated and compressed to a point that the stored energy in the matter reaches approximately 100 billion Joules per cubic meter, corresponding to a pressure of approximately 1 million atmospheres. Applications relevant to QIS research and inertial fusion energy are also encouraged. Applicants are strongly encouraged to contact the Program Manager before submitting an application.

(k) Discovery Plasma Science: Measurement Innovation

Technical Contact: Curt Bolton, Curt.Bolton@science.doe.gov

This program element supports the development of innovative diagnostics to make detailed measurements of the behavior of plasmas. The fusion program is entering a new era where it will be able to explore strongly burning plasmas. The Measurement Innovation program will therefore be looking for applications for new diagnostics that will be able to measure the properties of burning plasmas and be able to perform in the harsh radiation environment anticipated in burning plasmas.

5. High Energy Physics (HEP)

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

The mission of the High Energy Physics (HEP) program is to understand how the universe works at its most fundamental level 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 plan, developed by the Particle Physics Project Prioritization Panel (P5) and available at:

https://science.osti.gov/~media/hep/hepap/pdf/May-2014/FINAL_P5_Report_053014.pdf.

The HEP program focuses on three experimental scientific frontiers:

- *The Energy Frontier*, where powerful accelerators are used to create new particles, reveal their interactions, and investigate fundamental forces;
- *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; and

- *The Cosmic Frontier*, where non-accelerator-based experiments observe the cosmos and detect cosmic particles, making measurements of natural phenomena that can provide information about the nature of cosmic acceleration, including dark energy and the cosmic microwave background; searching for dark matter particles; and studying properties of the universe that impact our understanding of matter and energy.

Together, these three interrelated and complementary discovery frontiers 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 five cross-cutting research areas that enable new scientific opportunities by developing the necessary tools and methods for discoveries:

- *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;
- *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;
- *Accelerator Science and Technology Research and Development*, where the technologies and basic science needed to design, build, and operate the accelerator facilities essential for making new discoveries are developed;
- *Detector Research and Development*, where the basic science and technologies needed to design and build the High Energy Physics detectors essential for making new discoveries are developed; and
- *Quantum Information Science for High Energy Physics Research*, a new research area where innovative solutions to scientific discovery 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.

Applications that are in direct support of HEP research activities in any of the eight areas may be submitted to this FOA. Prior to any submission to this FOA, applicants are *strongly encouraged* to contact the relevant HEP subprogram managers listed below to develop applications that address program goals.

Additional information about the HEP research areas described above, and in areas (a) through (h) below, may be found at <https://science.osti.gov/hep/research/>. Furthermore, applicants should pay particular attention to the following when preparing applications to be submitted to this FOA:

1. Applications addressing two or more HEP research areas, either across a) the different HEP subprograms listed below (e.g., activities on Energy Frontier, Cosmic Frontier, Intensity Frontier, and Detector R&D) or b) different research thrusts in a particular HEP subprogram (e.g., Legacy Survey of Space and Time [LSST], Dark Energy Spectroscopic Instrument [DESI], and/or Large Underground Xenon–Zoned Proportional Scintillation in Liquid Noble

gases dark matter experiment [LZ/LUX] in the Cosmic Frontier), are accepted and reviewers will be requested to comment on each of the proposed activities and their impact.

2. Applications for support of *generic particle detector R&D* efforts should be directed to the Detector Research and Development research area described below. However, applicants proposing physics studies and pre-conceptual R&D efforts *directed towards a specific experiment* within an experimental frontier should submit their application to the relevant HEP scientific frontier research area.

(a) 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 proton-(anti)proton collisions at the highest possible energies. 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 and CMS experiments. This research area also provides graduate and postdoctoral research training for the next generation of scientists, and equipment and computational support for physics research activities. Applications addressing physics studies and pre-conceptual R&D directed towards specific future Energy Frontier collider experiments are also accepted. Support for Heavy Ion Physics research is not provided under this research area.

(b) 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. In addition, this research area includes searches for proton decay. 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.

(c) Experimental Research at the Cosmic Frontier in High Energy Physics

Technical Contacts: Kathleen (Kathy) Turner, Kathy.Turner@science.doe.gov and Bryan J. Field (Cosmology and Dark Energy), Bryan.Field@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 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.

(d) Theoretical Research in High Energy Physics

Technical Contact: William (Bill) 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 computational techniques to facilitate studies in these areas. This research area also provides 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, performed expressly for or with an experimental research collaboration, are not included in this research area.

(e) Computational Research in High Energy Physics

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

This research area supports computational, data management, data analytic, and simulation techniques and tools that target the cross-cutting needs of HEP (i.e., those that are, or have the capability to be, broadly applicable). These advanced computing techniques may include

development of AI/ML techniques and novel applications that go well beyond current research standards. This subprogram also facilitates the effective use of DOE computing resources including, but not limited to, high-performance computing.

This subprogram does not support computing research and/or activities specific to individual projects or experiments in any of the other seven research and technology R&D subprograms described in this solicitation. Support for specific operation efforts and/or hardware requests in each of the other subprograms are also outside the scope of this area. Applicants proposing such activities should submit their application to the relevant HEP subprogram.

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

Technical Contact: Ken Marken, Ken.Marken@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 particle beams, and long-range, early-stage exploratory research aimed at developing new concepts. This research area also provides 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 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. Also of interest are superconducting materials and conductor development; 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 are now coordinated through the Accelerator Stewardship program under the Accelerator R&D and Production program.

(g) Detector Research and Development 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. It supports research leading to fundamental advances in the science of particle and radiation detection, and the development of new 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 specifically encouraged.

Topics studied in the Detector R&D research area include but are not limited to: low-mass, high channel density charged particle 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 ultralow-background experiments; and advanced electronics and data acquisition systems. Support for graduate and postdoctoral research training, engineering and other technical efforts, and equipment and computational efforts required for experimental detector R&D and fabrication *is* included in this research area.

(h) Quantum Information Science for High Energy Physics Research
Technical Contact: Glen Crawford, Glen.Crawford@science.doe.gov

This research area is aligned to the SC and U.S. national initiatives in QIS, particularly those that focus on interdisciplinary partnerships between HEP and the wider QIS communities. This subprogram supports efforts that advance the HEP science drivers, as identified by P5, as well as the program mission of HEP in the context of broader benefits to QIS.

Renewal consortia applications that focus on collaborative research at the intersection of qubits, foundational field theory, quantum sensors, quantum information and complexity theory, quantum gravity, quantum entanglement and error correction, and cosmology may be submitted by interdisciplinary teams of HEP and QIS researchers. The anticipated impacts to both the HEP and QIS programs initiatives should be clearly delineated in the application. New applications proposing feasibility studies for QIS-inspired or QIS-enabled experiments that explore the HEP science drivers or ones that propose interdisciplinary HEP and QIS outreach efforts may be submitted by respective interdisciplinary groups.

6. Nuclear Physics (NP)

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

The mission of the Nuclear Physics (NP) program is to explore one of the enduring mysteries of the universe, 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 include the following:

- How are the proton's mass and spin dynamically created in the interior of the proton?
- What are the properties of the novel quark-gluon plasma discovered at RHIC?
- What is the mechanism underlying the confinement of quarks and gluons?
- The search for new exotic particles and anomalous violations of nature's symmetries.
- Understanding how nucleons—protons and neutrons—combine to form atomic nuclei and the limits of nuclear existence in nature.
- How heavy nuclei have emerged since the origin of the universe and how are they still being made in the cosmos?
- Is the neutrino its own anti-particle? Do the neutron's properties point to new physics?

- The nature of the strong force in many-body systems.
- Advanced Nuclear Data for Space, Energy, and Research.
- Searching for undiscovered forms of nuclear matter.
- Conceiving, constructing, and operating national scientific user facilities and developing novel detector and accelerator instrumentation and technologies.

Within each of these priority areas, unique nuclear physics opportunities using Artificial Intelligence or Machine Learning, new developments in Microelectronics, and R&D integration which advances 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 broad, yet tightly interrelated, scientific thrusts: Quantum Chromodynamics; Nuclei and Nuclear Astrophysics; and Fundamental Symmetries. NP supports basic research in seven subprograms areas: Medium Energy, Heavy Ion, Nuclear Structure and Nuclear Astrophysics, Fundamental Symmetries, Nuclear Theory, Nuclear Data, and Nuclear Physics Computing (a through g). Additionally, NP supports Accelerator R&D and R&D Integration for Applications and Current and Future Nuclear Physics Facilities (h), and R&D in Quantum Information Science (QIS) (i) which supports the QIS/QC initiative and Quantum Centers of SC and leverages opportunities for Nuclear Physics to benefit from advances in this topical area. If the proposed scope of work includes multiple NP subprograms contact relevant Subprogram Contacts for guidance.

While fully distinct and non-overlapping, the research topics supported by NP and High Energy Physics (HEP) may be of interest for the unique capabilities of research groups in either SC program. NP and HEP will allow for the possibility of support in their own portfolios for groups engaged in such crossover research.

To advance knowledge in nuclear science and effectively train and mentor the next generation of nuclear scientists, NP places a high priority on supporting Principal Investigators who are active-career tenured or tenure-track faculty researchers.

The NP subprograms and their objectives follow:

(a) Medium Energy Nuclear Physics

Technical Contact: Spyridon Margetis, Spyridon.Margetis@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 which hadrons can 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. 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 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) and the High Intensity Gamma Source (HIGS) at the Triangle Universities Nuclear Laboratory (TUNL). Applications are sought for physics research efforts in support of current experiments in the Medium Energy program, as well as physics studies and pre-conceptual planning directed towards specific future experiments. Applications for instrumentation development for near-term experiments will also be considered. Also of interest are R&D on concepts and emerging technologies in Machine Learning and Artificial Intelligence that go beyond simple use cases for available software packages. Searches for Dark Matter and Dark Energy may receive low or no priority from this sub-program.

(b) Heavy Ion Nuclear Physics

Technical Contact: Kenneth Hicks, Kenneth.Hicks@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. The primary facilities in the world currently capable of exploring the properties nuclear matter in these conditions are 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 quark-gluon plasma, determining the speed of sound in the quark-gluon plasma, understanding how quarks fragment and recombine to form hadronic matter (hadronization), and locating a possible critical point for the transition between the quark-gluon plasma and normal matter. The high baryon-density region of the phase diagram for nuclear matter continues to be explored. Experimental research is carried out primarily using the RHIC facility and the Large Hadron Collider (LHC) at the European Organization for Nuclear Research (CERN). Generic R&D activities supporting a detector for the future Electron-Ion Collider (EIC). Applications for instrumentation development for near-term experiments will also be considered.

(c) Nuclear Structure and Nuclear Astrophysics

Technical Contact: Sharon Stephenson, Sharon.Stephenson@science.doe.gov

The subfield of nuclear structure and reactions strives to measure, explain, and use nuclei to meet society's scientific interests and needs. The research 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 including as-yet undiscovered superheavy nuclei, 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 using the Facility for Rare Isotope Beams (FRIB) and the Argonne Tandem Linac Accelerator System (ATLAS), as well as the TUNL and the Texas A&M University Cyclotron Institute.

(d) Fundamental Symmetries

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

This subprogram supports precision experiments to test the fundamental symmetries of nature and search for evidence of new forces or particles. Questions addressed in this frontier include: *What is the nature of 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 the 2015 Long Range Plan for Nuclear Physics, *Reaching for the Horizon*: the implementation of a ton-scale neutrino-less double beta decay experiment to determine whether the neutrino is its own anti-particle.

(e) Nuclear Theory

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

The Nuclear Theory subprogram provides the theoretical pillar needed to complement and interpret the wide range of data obtained from the experimental nuclear science subprograms and to guide new ideas and hypotheses that can ascertain prospective areas of experimental investigations. This subprogram addresses all of the field's scientific thrusts described in NSAC's long range plan, as well as the specific questions listed for the experimental subprograms above. 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, how the phenomenon of quark confinement arises, and what phases of nuclear matter occur at high densities and temperatures. In Nuclei 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.

(f) Nuclear Data

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

The Nuclear Data subprogram is multi-disciplinary with applications to energy, defense, space, and medicine. Nuclear data underlies modeling and simulation software in nuclear applications so it is key for ensuring results are accurate. Working groups have been established among researchers, as well as federal programs, to help coordinate, prioritize, and fund research efforts to improve nuclear data in basic science and applied nuclear technologies.

In addition, the Nuclear Data subprogram collects, evaluates, and disseminates nuclear data with its support of the U.S. Nuclear Data Program (USNDP) and the National Nuclear Data Center (NNDC). This process combines historical and modern experiments, theory, and modeling to publish best values for nuclear properties such as cross sections and decay data. The extensive nuclear databases produced by this effort are an international resource consisting of carefully organized scientific information gathered over 50 years of low-energy nuclear physics research worldwide.

The highest priority research needs are addressed through the Nuclear Data InterAgency Working Group Funding Opportunity Announcement. However, additional research opportunities exist for both theoretical and experimental nuclear structure and nuclear reactions, with particular interest in predictive capabilities in emerging needs in applications such as, but not limited to, energy generation (fission and fusion), space exploration, and medicine. The most recent needs have been discussed at the annual Workshop on Applied Nuclear Data Activities (WANDA) found here: <https://www.nndc.bnl.gov/ndwg/workshops.html>

(g) Nuclear Physics Computing

Technical Contact: Xiaofeng Guo, Xiaofeng.Guo@science.doe.gov

Nuclear Physics Computing supports research in nuclear physics that rely on large-scale, high-performance computing (HPC). The Nuclear Physics Computing program supports the ASCR partnership program of Scientific Discovery through Advanced Computation (SciDAC) and Nuclear Theory Topical Collaborations (TC). Both NP SciDAC and TC projects are five-year multi-institution collaborative projects, with defined deliverables and milestones. They are closely aligned with the needs of the NP experimental programs and the Nuclear Physics Long Range plan. These projects investigate 1) nuclear reactions and nucleosynthesis; 2) the properties and structure of nuclei; 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. The Lattice QCD computations and the development of Lattice QCD techniques are critical to the understanding of nuclei, nuclear reactions, hadron structure, and the dynamics of strong interactions. The Nuclear Physics Computing program supports the Lattice QCD research programs jointly with HEP. The Nuclear Physics Computing program also supports two NP Exascale Computing Projects (ECP), jointly with ASCR. The two current NP ECP projects are addressing changes needed in computational NP practice in the Exascale Era, in the areas of 1) Lattice QCD, and 2) nuclear astrophysics. Some computational resources needed for NP research programs are provided by the National Energy Research Scientific Computing center (NERSC) and through the ASCR Leadership Computing Challenge (ALCC) program.

(h) Accelerator R&D and R&D Integration for Applications and Current and Future Nuclear Physics Facilities

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

The Nuclear Physics program 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. Areas of interest include R&D of technologies for the Brookhaven National Laboratory's Relativistic Heavy Ion Collider (RHIC), with heavy ion and polarized proton beams; linear accelerators such as the Continuous Electron Beam Accelerator Facility (CEBAF) at the Thomas Jefferson National Accelerator Facility (TJNAF); development of devices and/or methods that would be useful in the generation of intense rare isotope beams for the Facility for Rare Isotope Beams (FRIB) at Michigan State University and in the generation of stable isotope beams at the Argonne National Laboratory's Argonne Tandem Linac Accelerator System (ATLAS), and R&D in accelerator science and technology in support of next generation Nuclear Physics accelerator facilities such as an electron-ion collider (EIC). Also of interest are R&D in emerging technologies in AI/ML with focus on increasing cost savings and operational efficiencies of NP accelerator user facilities and their experimental programs. Research aimed at transformative advances in ion sources, superconducting radiofrequency, and beam cooling is also encouraged, as well as R&D integration which leads to new capability in particle detection and/or advanced imaging technology. New imaging capability which has broader impacts is of particular interest.

(i) NP Quantum Information Science (QIS)

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 and Technology (QIST). 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 problem, '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.

This subprogram specifically encourages exploitation of the interdisciplinary nature of Quantum Computing and QIST to expand the frontiers of NP-supported research. Applications to this subprogram may be solicited through a separate FOA. Prospective investigators are encouraged to contact the Technical Contact.

7. 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, commonly referred to as the DOE Isotope Program (DOE IP), is to produce and/or distribute stable isotopes and radioisotopes in short supply or unavailable in the U.S., including related isotope services; maintain mission readiness of critical national infrastructure and core competencies needed to manufacture isotopes and ensure national preparedness to respond to supply chain gaps during a national crisis; conduct R&D to develop transformative isotope production, separation, and enrichment technologies to enable federal, academic, and industrial innovation, research, and emerging technologies; nurture a diverse and inclusive domestic workforce with unique and world-leading core competencies; and mitigate U.S. dependence on foreign supplies of isotopes and promote robust domestic supply chains for U.S. economic resilience.

The DOE IP strives to develop and nurture a diverse and inclusive domestic workforce with unique and world-leading core competencies in order to fulfill its mission. The DOE IP 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 DOE IP utilizes national facilities and capabilities for the production and distribution of stable and radioactive isotopes to research

and commercial entities. The scientific and technical staff involved in isotope production and the associated R&D efforts are also supported. Radioactive and enriched stable isotopes are made available using unique facilities stewarded by DOE IP at Brookhaven National Laboratory, Los Alamos National Laboratory, Argonne National Laboratory, and Oak Ridge National Laboratory. DOE IP also coordinates and supports isotope production at a suite of university, national laboratory, and other federal accelerator and reactor facilities throughout the Nation to promote a reliable, domestic supply of isotopes.

DOE IP seeks to broaden the university base participating in DOE IP research by developing research infrastructure (including staff) at applicant institutions and by assisting faculty with establishing labs and research groups, and by building partnerships with DOE National Laboratories. Successful applications must outline how the proposed activities support the current scope of DOE IP research in the four subprograms listed below. The subprograms seek research and development on 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. This includes the traditional technologies for production of radioisotopes using reactor and accelerator facilities, application of novel technologies such as AI/ML or robotics for production of isotopes, and new technologies for enriching stable isotopes. Research and the development of the capacity to perform research is viewed as an essential component of the Program's portfolio. A primary document currently guiding DOE IP priorities is entitled "Meeting Isotope Needs and Capturing Opportunities for the Future: The 2015 Long Range Plan for the DOE-NP Isotope Program." This document may be accessed at:

https://science.osti.gov/~media/np/nsac/pdf/docs/2015/2015_NSACI_Report_to_NSAC_Final.pdf. Additional information about the Isotope Program may be found at: <https://science.osti.gov/Isotope-Research-Development-and-Production>.

(a) Targetry and Isotope Production Research

Technical Contact: Arne Freyberger, Arne.Freyberger@science.doe.gov, and Ethan Balkin, Ethan.Balkin@science.doe.gov

Applications to this subprogram should be focused on novel or improved capabilities for inducing transmutation of atoms in targets to create radioisotopes. This includes aspects of targetry and target fabrication, as well as the development of innovative approaches, including integration of AI and ML techniques to model and predict the behavior of targets undergoing irradiation to optimize yield and minimize target failures during routine isotope production. Robotics and advanced manufacturing techniques, as they apply to isotope production and processing, may also be proposed. It is understood that accelerator- and reactor-based isotope production have different considerations. Applications to this subprogram can address either production modality. Robotics and advanced manufacturing techniques, as they apply to isotope production and processing, may also be proposed.

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

Technical Contact: Arne Freyberger, Arne.Freyberger@science.doe.gov, and Ethan Balkin, Ethan.Balkin@science.doe.gov

Work in this subprogram might be directed toward the improvement and/or development of novel chemical and physical processes to recover and purify radioisotopes from activated targets. Applications proposing scopes of work dealing with isotopes 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) would also be considered responsive.

Additionally, the development or synthesis of chemical constructs 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 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, robotics, 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).

(c) Biological Tracers, Imaging, and Therapeutics

Technical Contact: Arne Freyberger, Arne.Freyberger@science.doe.gov, and Ethan Balkin, Ethan.Balkin@science.doe.gov

Work in 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 isotopes in this category would also be considered responsive. Included in this topic are the modification of existing agents, synthesis and development of: novel ligands, pharmacokinetic modifying linkers, or other hydrodynamic volume altering compounds. Please note that DOE IP funds only basic science R&D. Studies investigating the applications of isotopes will not be considered for funding.

(d) Isotopic Enrichment Technology

Technical Contact: Arne Freyberger, Arne.Freyberger@science.doe.gov, and April Gillens, April.Gillens@science.doe.gov

Work in this area should advance current technologies in electromagnetic ion separation (EMIS), atomic vapor laser ion separation (AVLIS), thermal diffusion and novel enrichment approaches. Responsive work scope might explore, but are not limited to: the development of EMIS-based ion sources capable of greater than 20% ionization efficiency of the lanthanide and actinide series of elements at 1 mA intensity or greater; understanding the plasma chemistry and atomic physics effects associated with high intensity heavy ion plasma and ion sources; understanding the sputter physics of materials with energy and angular dependence; development of high efficiency, high purity magnetized radiofrequency driven ion source technology for EMIS-based enrichment; resolving the uncertainty around applying modern approaches to AVLIS isotope enrichment.

Excluded from this call are applications related to the production of Mo-99, as this isotope is under the purview of the National Nuclear Security Administration Office of Materials

Management and Minimization, and the production of Pu-238, as this isotope is under the purview of the Office of Nuclear Energy. The DOE IP does NOT support investigations into the development of nuclear reactors for purposes outside the scope of the DOE IP priority areas described above.

A primary document currently guiding Isotope Program priorities is entitled “Meeting Isotope Needs and Capturing Opportunities for the Future: The 2015 Long Range Plan for the DOE-NP Isotope Program.” This document may be accessed at https://science.osti.gov/~media/np/nsac/pdf/docs/2015/2015_NSACI_Report_to_NSAC_Final.pdf. Additional information about the Isotope Program may be found at <https://science.osti.gov/np/research/idpra/>.

8. Accelerator R&D and Production (ARDAP)

Technical Contact: Camille Ginsburg, Camille.Ginsburg@science.doe.gov

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

The Office of Accelerator Research & Development (R&D) and Production (ARDAP) was established in 2020 as part of the SC strategy to ensure a robust pipeline of innovative particle accelerator technology, train an expert and diverse workforce, and reduce significant supply chain risks by reshoring critical accelerator technology.

- The Accelerator R&D subprogram supports broader applications of particle accelerator technology through use-inspired basic R&D, interdisciplinary basic R&D, and by facilitating access to unique SC accelerator R&D capabilities.
- The Accelerator Production subprogram supports technological and manufacturing readiness of accelerator technologies that support multiple Science Programs.

More than 5 million cancer patients and \$500B of goods are treated each year with particle accelerators, and at least 42,000 accelerator systems are currently in use worldwide. Of those:

- 65% are used industrially for ion implantation, electron-beam processing, electron-beam irradiation, ion beam analysis, and non-destructive testing,
- 30% are used in medicine for cancer therapy and production of 200 different radioisotopes for the diagnosis and treatment of diseases, such as cancer, in millions of patients, and
- 5% are used for basic research

Topics funded through the ARDAP program include, but are not limited to:

- Superconducting accelerator systems—both radiofrequency accelerators and high-field magnets—including research on superconducting materials, engineering, and cryogenic techniques.
- Particle beam physics and high-fidelity computer modeling, including theory and simulation to accurately model the next generation of particle accelerators; faster, higher-resolution charged-particle and x-ray beam diagnostics, more sophisticated and automated control systems, including AI/ML; and advances in particle-collider-specific beam physics including final focusing and advanced cooling techniques.
- Very-high-brightness and high-current electron sources, high-intensity proton and ion sources, and more robust megawatt-class targets for secondary beam production.

- High-average-power radiofrequency systems, including improvements in power-handling devices such as waveguide windows and couplers.
- High-average-power ultrafast laser sources, high-power optics and coatings for laser systems.
- High-impact advances in accelerator science and technology which will lead to improved performance and/or reduced cost, including novel particle sources, advanced beam dynamics, new acceleration techniques, novel magnet designs, compact accelerator technologies, and new materials and coatings for accelerator components.

Workshop reports defining accelerator research in support of applications of accelerators are available at: <https://science.osti.gov/hep/Research/Accelerator-Stewardship/Workshop-Reports>

The ARDAP FAIR program seeks to develop strong college or university programs that conduct basic research which advances accelerator science and technology, with a strong emphasis on diversifying the institutions which have been historically funded in this area and building mutually beneficial relationships with institutions that have existing capacity.

Limitation on Number of Submissions per PI and Program

Applicant institutions are limited to no more than one pre-application and one application for each PI at the applicant institution. Applicant institutions are also limited to three pre-applications and three applications for each program (ASCR, BES, BER, FES, HEP, NP, DOE IP, and ARDAP) listed in Section I.

Teaming Requirements

All applications must be submitted on behalf of a lead institution and include a single partnering team member. There may be more than one investigator at either the lead institution or the partnering institution. The lead institution must be a non-R1 minority-serving institution (MSI)^{4,5} or a non-R1 emerging research institution (ERI).⁶ The lead institution must partner with a team member in one of the following categories: a DOE National Laboratory (<https://www.energy.gov/national-laboratories>), an SC Scientific User Facility (<https://science.osti.gov/User-Facilities>), or an R1 MSI/ERI. The lead institution should show clear scientific leadership. The partner is limited to between 15 and 25% of the total funding.

⁴ The Carnegie Classification of Institutions of Higher Education can be found at <https://carnegieclassifications.acenet.edu>. A list of institutions with very high research activity (R1 institutions) is available at https://carnegieclassifications.acenet.edu/institutions/?basic2021_du%5B%5D=15.

⁵ MSI designations are based on the Department of Education eligibility matrix (<https://www2.ed.gov/about/offices/list/ope/itudes/eligibility.html>). Eligible MSIs are listed as Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs), Alaska Native and Native Hawaiian Serving Institutions (AANHs), Hispanic Serving Institutions (HSIs), Native American Serving Non-Tribal Institutions (NASNTI), Predominantly Black Institutions (PBIs), Historically Black Colleges and Universities (HBCUs), and Tribally Controlled Colleges and Universities (TCCUs). For the purposes of this FOA, institutions marked in the eligibility matrix as either being eligible to receive funding or as receiving funding will be considered an MSI.

⁶ Emerging research institution was defined in the CHIPS and Science Act of 2022. Federal research expenditures are based on the National Science Foundation's Higher Education Research and Development Survey: Fiscal Year 2021 (<https://nces.nsf.gov/surveys/higher-education-research-development/2021>).

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 research narrative) will not be accepted under this FOA.

SUBAWARDS⁷

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

The team must include a DOE/National Nuclear Security Administration (NNSA) National Laboratory⁸, an SC Scientific User Facility, or an R1 MSI/ERI. DOE/NNSA National Laboratories, SC Scientific User Facilities, and RI MSI/ERIs must be proposed as subrecipients.

Note that the value of any such proposed subaward to a National Laboratory or to a Scientific User Facility at a National Laboratory may be removed from any such prime award: DOE may make separate awards to Federally-affiliated institutions.

Identifying a DOE National Laboratory or User Facility Partner

Applicants may contact the National Laboratory or User Facility points of contact (POCs) to explore partnership opportunities. When doing so, include a short description of the proposed research and potential partner investigator(s), if known. A list of POCs is available at <https://science.osti.gov/Initiatives/FAIR/Funding-Opportunities>.

Annual Meetings

The selected awardees will be asked to attend an annual PI meeting related to the topic of the research proposed or SC-wide professional development and collaborator events. Applicants should anticipate a need for travel to attend an annual PI meeting and request appropriate funding in their budgets.

Informational Webinar

SC plans to hold an informational webinar about this FOA on Wednesday, March 20, 2024 at 3:00 pm ET. SC also plans to hold office hours on April 9, April 17, July 2, and July 10, 2024, at 2:00 pm ET for administrative questions related to the FOA. Registration instructions and other details will be posted at <https://science.osti.gov/Initiatives/FAIR/Funding-Opportunities>. Frequently asked questions (FAQ) will also be posted at <https://science.osti.gov/Initiatives/FAIR>.

⁷ Subawards are made to subrecipients. Both terms are defined in 2 CFR 200.1 (<https://www.ecfr.gov>)

⁸ The phrase “National Laboratories” is used broadly to encompass DOE/NNSA laboratories and sites capable of performing the work described in this FOA and capable of receiving funds through the DOE Field Work 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.

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.

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), and
- 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 \$5,000) 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.

All entities submitting applications to this FOA 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.export.gov>.

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 FOA 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.

Section II – AWARD INFORMATION

II.A. TYPE OF AWARD INSTRUMENT

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

All applications must be submitted as multi-institutional teams using a prime and subaward model with one application submitted by the lead institution.

II.B. ESTIMATED FUNDING

DOE anticipates that up to \$35 million in current fiscal year funds will be used to support awards under this FOA.

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 FOA.

II.C. MAXIMUM AND MINIMUM AWARD SIZE

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

The award ceiling and floor below represent the total budget for the applicant institution and the partner combined. The partner is limited to between 15% and 25% of total funding.

Ceiling

\$800,000 total (three years)

Floor

\$300,000 total (three years)

II.D. EXPECTED NUMBER OF AWARDS

Approximately 45 to 100 awards are expected. The exact number of awards will depend on the number of meritorious applications and the availability of appropriated funds. SC expects most awards to be made at or near the ceiling.

II.E. ANTICIPATED AWARD SIZE

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

II.F. PERIOD OF PERFORMANCE

DOE anticipates making awards with a project period of three 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.

II.G. TYPE OF APPLICATION

DOE will only accept new applications under this FOA.

Section III – ELIGIBILITY INFORMATION

III.A. ELIGIBLE APPLICANTS

To advance programmatic objectives, in accordance with 2 CFR 910.126, Competition, eligibility for award is restricted to domestic applicants except nonprofit organizations described in section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995, that must be either:

1. Classified as an MSI⁹ and NOT listed as an R1 Research Institution,¹⁰ or
2. An emerging research institution (ERI), defined as an institution of higher education with an established undergraduate or graduate program that has less than \$50,000,000 in annual Federal research expenditures, and NOT listed as an R1 Research Institution.¹¹

A list of institutions and their designations is provided at <https://science.osti.gov/grants/Applicant-and-Awardee-Resources/Institution-Designations>. An applicant institution is eligible if they are designated as a non-R1 MSI or non-R1 ERI at any time between the FOA issue date and the submission deadline for pre-applications. An institution that meets these criteria but is not on this list of eligible institutions is welcome to submit a pre-application identifying whether the institution is a non-R1 MSI or non-R1 ERI. Eligibility will be assessed at that time.

This FOA aims to increase participation of underrepresented groups in SC's research portfolio. SC is fully committed to advancing a diverse, equitable, and inclusive research community which is key to providing the scientific and technical expertise for U.S. scientific leadership. This FOA is intended to build research capacity across the SC research portfolio and leverage ongoing DOE efforts and capabilities.

Federally affiliated¹² entities must adhere to the eligibility standards below:

⁹ MSI designations are based on the Department of Education eligibility matrix (<https://www2.ed.gov/about/offices/list/ope/ides/eligibility.html>). Eligible MSIs are listed as Asian American and Native American Pacific Islander Serving Institutions (AANAPISIs), Alaska Native and Native Hawaiian Serving Institutions (AANHs), Hispanic Serving Institutions (HSIs), Native American Serving Non-Tribal Institutions (NASNTI), Predominantly Black Institutions (PBIs), Historically Black Colleges and Universities (HBCUs), and Tribally Controlled Colleges and Universities (TCCUs). For the purposes of this FOA, institutions marked in the eligibility matrix as either being eligible to receive funding or as receiving funding will be considered an MSI.

¹⁰ The Carnegie Classification of Institutions of Higher Education can be found at <https://carnegieclassifications.acenet.edu>. A list of institutions with very high research activity (R1 institutions) is available at https://carnegieclassifications.acenet.edu/institutions/?basic2021__du%5B%5D=15.

¹¹ Emerging research institution was defined in the CHIPS and Science Act of 2022. Federal research expenditures are based on the National Science Foundation's Higher Education Research and Development Survey: Fiscal Year 2021 (<https://nces.nsf.gov/surveys/higher-education-research-development/2021>).

¹² Institutions that are not DOE/NNSA National Laboratories, a non-DOE/NNSA FFRDC, or another Federal agency are not Federally affiliated, even if they receive Federal funds or perform work under a Federal award or contract.

III.A.1. DOE/NNSA National Laboratories

DOE/NNSA National Laboratories are not eligible to submit applications under this FOA but may be proposed as subrecipients under another organization's application. If recommended for funding as a proposed subrecipient, 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 and work will be conducted under the laboratory's contract with DOE. No administrative provisions of this FOA will apply to the laboratory or any laboratory subcontractor. Additional instructions for securing authorization from the cognizant Contracting Officer are found in [Section VIII](#) of this FOA.

III.A.2. Non-DOE/NNSA FFRDCs

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

III.A.3. Other Federal Agencies

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

Notes for applicants of all types:

This FOA 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.

Applications that are submitted by applicants that have not submitted a required pre-application may be declined without further review.

III.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.

III.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. Individuals from underrepresented groups as well as individuals with disabilities

are always encouraged to apply.

III.D. LIMITATIONS ON SUBMISSIONS

Applicant institutions are limited to no more than one pre-application and one application for each PI at the applicant institution. Applicant institutions are also limited to three pre-applications and three applications for each program (ASCR, BES, BER, FES, HEP, NP, DOE IP, ARDAP) listed in [Section I](#). If multiple submissions are received for the same work, DOE will consider the latest received submissions to be the institution's intended submissions. Pre-applications in excess of the limited number of submissions may be subject to follow-up with the lead institution.

An individual may be named as the PI on only one pre-application and one application, regardless of the submitting institution. The PI on a pre-application and application may also be listed as a senior or key personnel on an unlimited number of separate submissions.

Awards made under this FOA must support activities at eligible applicant institutions. If the PI of an award made under this FOA were to accept a position at an institution that is not eligible to receive an award under this FOA, SC is under no obligation to support a new award at the PI's new institution.

Section IV – APPLICATION AND SUBMISSION INFORMATION

IV.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 Catalog of Federal Domestic Assistance (CFDA) number (81.049) and/or the FOA number shown on the cover of this FOA. Select the “Apply” button to access the application package.

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

IV.B. LETTER OF INTENT (LOI) AND PRE-APPLICATION

IV.B.1. Letter of Intent (LOI)

Not applicable.

IV.B.2. Pre-application

PRE-APPLICATION DUE DATE

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

ENCOURAGE/DISOURAGE DATE

Pre-applications will be reviewed for responsiveness of the proposed work to the research topics identified in this FOA. 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 FOA. 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. The title page must include the following information:

Title of Pre-application
Principal Investigator Name, Job Title
Institution
PI Phone Number, PI Email Address
Partner Name, Partner Job Title
Partner Institution
Partner Phone Number, Partner Email Address
FOA Number: Include the FOA Number indicated on the cover of this FOA

Program and Subprogram from Section I of the FOA

This information must be followed by a clear and concise description of the objectives and technical approach of the proposed research. The pre-application may not exceed two pages, excluding the title page, 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 two-page limit.

The pre-application must include a letter of collaboration from the partnering investigator, which does not count toward the pre-application page limit. The letter of collaboration should state the intention to participate, but it must not be written as a recommendation or endorsement letter. The letter of collaboration may contain two and only two sentences and must use the following format:

Dear <Principal Investigator Name>:

If your proposal entitled, “<Proposal Name>,” is selected for funding under the SC FAIR FOA, 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,

<Partner Investigator’s Name and Signature Block>

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 VIII](#) of this FOA. **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 program or subprogram.

Any review will be based on the following criteria:

1. Responsiveness to the objectives of the FOA as stated in Section I;
2. Scientific and technical merit;
3. Appropriateness of the proposed research approaches; and

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
- Ensuring a distribution of supported researchers at various career stages
- Promoting the diversity of supported investigators and institutions

Any such review will be conducted by no less than three DOE-affiliated personnel, under the direction of Federal program managers, chosen for their topical knowledge and diversity of perspective.

Reviews within a program or subprogram 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. SC aims to encourage a diverse pool of applicants to submit applications.

Written feedback about pre-applications will be provided upon request after award selections have been announced.

Programs or subprograms with comparatively few pre-applications may not make use of such pre-application reviews. The ratio of encourage/discourage results will differ between programs and subprograms.

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.

Applicants are strongly encouraged to inform their DOE Program Manager if teaming arrangements, proposed personnel, topics, or the anticipated title change between submitting the pre-application and when an application is submitted, to ensure that their application is properly linked to their pre-application and that reviewers are properly assigned to the application.

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

IV.C. GRANTS.GOV APPLICATION SUBMISSION AND RECEIPT PROCEDURES

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

IV.D. CONTENT AND APPLICATION FORMS

LETTERS OF COLLABORATION OR ACCESS

Letters of recommendation are not allowed. Applications that include recommendation 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. Letters of collaboration or access should be placed in Appendix 6 (Other Attachment).

The letter of collaboration submitted with the pre-application must also be submitted with the application.

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 SC FAIR FOA, 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>

IV.D.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 Assurances¹³. 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.”

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 accepted under this FOA.

SC does not make use of the Resubmission or Continuation options.

Please answer “yes” to the question “Is this application being submitted to other agencies?” if

¹³ No separate form or submission is required for the Certifications and Assurances.

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.

IV.D.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.). Should the applicant have any uncertainty, they should check “yes.”

DOE understands the phrase in field 4.a., “potential impact ... negative” to apply if the work described in the application could potentially have any of the impacts listed in (1) through (5) of 10 CFR 1021, Appendix B, Conditions that Are Integral Elements of the Classes of Action in Appendix B. (<https://www.ecfr.gov>)

Additionally, for actions which could have any other 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, 1) if there would be extraordinary circumstances (i.e., factor or circumstance that could increase the level of significance of environmental effects normally associated with the proposed action) (10 CFR 1021.410 (b)(2)), 2) if the work is connected to other actions with potentially significant impacts (10 CFR 1021.410 (b)(3), or 3) if the work is related to other nearby actions with the potential for cumulatively significant impacts (10 CFR 1021.410 (b)(3)), applicants should indicate a “negative” impact on the environment.

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 be comprised of:

- The project title, the PI name and the PI's institutional affiliation, and any coinvestigators and their institutional affiliations.
- 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:

- FOA Number: Include the FOA number printed on the cover of this FOA.
- DOE/SC Program Office:
- DOE/SC Program Office Technical Contact:
- PAMS Pre-application tracking number:
- Subprogram as identified in [Section I](#) of this FOA:

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 12 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 FOA.

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 VIII](#) of this FOA 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 methods to be used. It should also include a timeline for the major activities of the proposed project, indicate which project personnel will be responsible for

which activities, and include a concise statement on how the proposed research will build research capacity at the institution. 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 Requirement for Infrastructure Projects

Awards funded through this FOA 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 [Section VIII](#) of this FOA to determine whether the Buy America Requirement applies and if they should consider the application of the Buy America Requirement 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 VIII](#) of this FOA for applicable definitions and other information regarding Infrastructure Projects and the Buy America Requirement.

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 in Grants.gov. Follow the below instructions 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 PLAN

Provide a Data Management Plan (DMP) as an appendix to the project narrative. Subject to the applicable cost principles, applications may request costs necessary for implementing the DMP.

- This appendix should not exceed a page limit of two 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 VIII](#) of this FOA. In addition, the DMP should specifically address:

- How FAIR (Findable, Accessible, Interoperable, and Reusable)¹⁴ principles will apply to the anticipated data sets, software¹⁵, and models¹⁶ 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: PROMOTING INCLUSIVE AND EQUITABLE RESEARCH (PIER) PLAN

All new and renewal applications that are not for conference support must provide a Promoting Inclusive and Equitable Research (PIER) Plan as an appendix to the project narrative. The PIER plan should describe the activities and strategies of the applicant to promote equity and inclusion as an intrinsic element to advancing scientific excellence in the research project within the context of the proposing institution and any associated research group(s). Plans may include, but are not limited to: strategies of your institution (and collaborating institutions, if applicable) for enhanced recruitment of undergraduate students, graduate students, and early-stage investigators (postdoctoral researchers, and others), including individuals from diverse backgrounds and groups historically underrepresented in the research community; strategies for creating and sustaining a positive, inclusive, safe, and professional research and training environment that fosters a sense of belonging among all research personnel; and/or training, mentoring, and

¹⁴ 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>

¹⁵ Chue Hong, N. P., Katz, D. S., Barker, M., Lamprecht, A-L, Martinez, C., Psoomopoulos, 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>

¹⁶ 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>

professional development opportunities.¹⁷ Plans may incorporate or build upon existing diversity, equity, accessibility, and inclusion efforts of the project key personnel or applicant institution(s), but should not be a re-statement of standard institutional policies or broad principles. The complexity and detail of a PIER plan is expected to increase with the size of the research team and the number of personnel to be supported. Resources about PIER plans are available at <https://science.osti.gov/grants/Applicant-and-Awardee-Resources/PIER-Plans>. Subject to the applicable cost principles, applications may request costs necessary for implementing the PIER Plan.

- Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.
- This appendix should not exceed a page limit of 3 pages when printed using standard letter-size (8.5-inch x 11-inch) paper with 1-inch margins (top, bottom, left, and right). This appendix will not count in the project narrative page limitation.

APPENDIX 6: OTHER ATTACHMENT

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.**

IV.D.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

¹⁷ Please see additional information at <https://science.osti.gov/SW-DEI/DOE-Diversity-Equity-and-Inclusion-Policies/Q-and-As#definitions>.

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 in instructions in [Section VIII](#) of this FOA for crafting a biographical sketch.
- Attach the person’s current and pending support, following the instructions in [Section VIII](#) of this FOA 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.

IV.D.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 FOA.

Additional information is found in [Section VIII](#) of this FOA.

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.

Additional information is found in [Section VIII](#) of this FOA.

IV.D.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: If an application proposes subawards to a DOE/NNSA National Laboratory, a Federal agency, or another Federal agency’s FFRDC, the value of such proposed subawards may be deducted from any resulting award: Those classes of organizations may be paid directly by SC. However, the details of such proposed budgets are an essential for understanding and analyzing the proposed research.

IV.D.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.

IV.D.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.

IV.D.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 VIII](#) of this FOA. Attach this information to Field 12 of the Research and Related Other Project Information Form.

IV.D.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	Form	N/A

Name of Document	Format	Attach to
Activities, if applicable		

IV.E. SUBMISSIONS FROM SUCCESSFUL APPLICANTS

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

Applicants that are not institutions of higher education, that request indirect costs, and that do not already have an Indirect Cost Rate Agreement with their Cognizant Federal Agency or documentation of rates accepted for estimating purposes by DOE or another Federal agency, are advised to begin preparing an Indirect Cost Rate Proposal for submission, upon request, to the DOE contract specialist/grants management specialist who will evaluate your application if you are selected for award.

IV.F. SUBMISSION DATES AND TIMES

IV.F.1. Letter of Intent Due Date

Not applicable.

IV.F.2. Pre-application Due Date

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

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 FOA and the stated deadline.

IV.F.3. Application Due Date

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

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

IV.F.4. Late Submissions

Delays in submitting pre-applications or 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 contact sc.fair@science.doe.gov to discuss the option of a late submission. Contact 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.

If a clerical error by administrative staff results in an incomplete submission of a pre-application or application, an authorized institutional official may appeal to correct its error by emailing sc.fair@science.doe.gov within 48 business hours of the deadline. This grant of leniency is at DOE's sole discretion.

You may be able to submit your application in response to the currently available SC Annual Solicitation. Please contact the Program Office/Manager listed in this FOA to discuss this option.

Section V - APPLICATION REVIEW INFORMATION

V.A. CRITERIA

V.A.1. Initial Review Criteria

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 FOA, including LOIs or pre-applications, has been submitted; (3) all mandatory requirements are satisfied; (4) the proposed project is responsive to the objectives of the FOA; 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.

V.A.2. Merit 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
- Quality and Efficacy of the Promoting Inclusive and Equitable Research (PIER) Plan.

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:

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?
- 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?

APPROPRIATENESS OF THE PROPOSED METHOD OR APPROACH

- How logical and feasible are the research approaches?
- Does the proposed research employ innovative concepts or methods?
- 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?
- To what extent does the application build research capacity, such as expertise or infrastructure, at the lead institution?

COMPETENCY OF APPLICANT'S PERSONNEL AND ADEQUACY OF PROPOSED RESOURCES

- What is the past performance and potential of the research team?
- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities adequate for performing the research?

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?

QUALITY AND EFFICACY OF THE PROMOTING INCLUSIVE AND EQUITABLE RESEARCH PLAN

- Is the proposed Promoting Inclusive and Equitable Research (PIER) Plan suitable for the size and complexity of the proposed project and an integral component of the proposed project?
- To what extent is the PIER plan likely to lead to participation of individuals from diverse backgrounds, including individuals historically underrepresented in the research community?
- What aspects of the PIER plan are likely to contribute to the goal of creating and maintaining an equitable, inclusive, encouraging, and professional training and research environment and supporting a sense of belonging among project personnel?
- How does the proposed plan include intentional mentorship and are the associated mentoring resources reasonable and appropriate?

V.B. REVIEW AND SELECTION PROCESS

V.B.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/>.

V.B.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
- Ensuring an appropriate balance of activities within SC programs
- Performance under current and past awards
- Alignment with program priorities, including strategic plans
- Ensuring opportunities to investigators not currently supported by DOE
- Ensuring a distribution of supported researchers at various career stages
- Promoting the diversity of supported investigators
- Promoting the diversity of institutions receiving awards
- Increasing participation of institutions historically underrepresented in the SC research portfolio
- Promoting principal investigators that have a commitment to improving diversity, equity, and inclusion in the STEM community

V.B.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.

V.B.4. Review of Risk

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.

DOE may incorporate specific award conditions of a programmatic and/or administrative nature if an applicant exhibits one or more high-risk factors under 2 CFR 200.208.

The result(s) of any pre-award review of risk may supersede the results of merit review under 2 CFR 200.205, preventing DOE from selecting an application for award, requiring DOE to reverse a selection for award, or requiring the disengagement of specific personnel. The results

of any post-award review of risk may result in requiring the disengagement of specific personnel, the imposition of other requirements, or the termination of an award that “no longer effectuates the program goals or agency priorities” under 2 CFR 200.340(a)(2). 2 CFR 200.206(c).

Pursuant to 2 CFR 910.128, the results of any pre-award review of risk are not appealable. Any pre-award decision to not select an application for award, reverse a selection for award, or require the disengagement of specific personnel will be made by the Selection Official or SC Program Official. Pursuant to 2 CFR 910.128, the results of any post-award review of risk may be appealable. Any post-award decision to require the disengagement of specific personnel, the imposition of other requirements, or the termination of an award will be made by the Contracting Officer.

DOE may conduct a review, through Government resources, of the applicant and project personnel with a connection to a foreign country. This includes, but is not limited to, (1) performance of work in, (2) travel to, and (3) awardee personnel’s higher education in a foreign Country, as well as (4) partnerships with international collaborators. 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.

V.B.5. 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.

V.C. ANTICIPATED NOTICE OF SELECTION AND AWARD DATES

It is anticipated that the award selection will be completed by the first quarter of Fiscal Year 2025 (October-December 2024). It is anticipated that awards will be made by January 1, 2025.

Section VI – AWARD ADMINISTRATION INFORMATION

VI.A. AWARD NOTICES

VI.A.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.

VI.A.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/rtrtcoverlay_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.

VI.B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

Additional policy provisions applicable to this FOA are included in the list below. Awards made under this FOA are subject to the respective Administrative and National Policy Requirements.

The full text of each provision is in [Section VIII](#) of this FOA and may be accessed by navigating to the hyperlinks below:

- [1. Administrative Requirements](#)
- [2. Availability of Funds](#)
- [3. Buy America Requirement 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. Environmental, Safety and Health \(ES&H\) Performance of Work at DOE Facilities](#)
- [8. Evaluation and Administration by Non-Federal Personnel](#)
- [9. Federal, State, and Local Requirements](#)
- [10. Funding Restrictions](#)
- [11. Government Right to Reject or Negotiate](#)
- [12. Intergovernmental Review](#)
- [13. Logos and Wordmarks](#)
- [14. Modifications](#)
- [15. National Environmental Policy Act \(NEPA\) Compliance](#)
- [16. Nondisclosure and Confidentiality Agreements Representations \(June 2015\)](#)
- [17. Notice Regarding Eligible/Ineligible Activities](#)
- [18. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment](#)
- [19. Prohibition on Discrimination and Harassment](#)
- [20. Prohibition on Lobbying Activity](#)
- [21. Prohibition Related to Foreign Government-Sponsored Talent Recruitment Programs](#)
- [22. Proprietary Application Information](#)
- [23. Publications](#)
- [24. Registration Requirements](#)
- [25. Research Misconduct](#)
- [26. Rights in Technical Data](#)
- [27. Subaward and Executive Reporting](#)
- [28. Title to Subject Inventions](#)
- [29. U.S. Competitiveness](#)

VI.C. 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.

VI.D. 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.

VI.E. INTERIM CONFLICT OF INTEREST POLICY FOR FINANCIAL ASSISTANCE

VI.E.1. Policy

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy) can be found at <https://www.energy.gov/management/department-energy-interim-conflict-interest-policy-requirements-financial-assistance>. This policy is applicable to all non-Federal entities applying for, or that receive, DOE funding by means of a financial assistance award (e.g., a grant, cooperative agreement, or technology investment 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. DOE's interim COI Policy establishes standards that provide a reasonable expectation that the design, conduct, and reporting of projects funded wholly or in part under DOE financial assistance awards will be free from bias resulting from financial conflicts of interest or organizational conflicts of interest. The applicant is subject to the requirements of the interim COI Policy and within each application for financial assistance, the applicant must certify that it is, or will be by the time of receiving any financial assistance award, compliant with all requirements in the interim COI Policy. The applicant must flow down the requirements of the interim COI Policy to any subrecipient non-Federal entities.

VI.E.2. SC Implementation

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

Section VII - QUESTIONS/AGENCY CONTACTS

VII.A. QUESTIONS

Questions relating to the Grants.gov registration process, system requirements, how an application form works, or the submittal process must be directed to Grants.gov at 1-800-518-4726 or support@Grants.gov. DOE is not allowed to address/answer these questions under any circumstances. Please only contact the Grants.gov help desk for questions related to Grants.gov.

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, 9:00 AM – 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 FOA should reference the FOA number on the cover of this Announcement. Please contact the PAMS help desk for technological issues with the PAMS system.

Questions regarding the specific program areas and technical requirements may be directed to the technical contacts listed for each program within the FOA or below. Please contact the program staff with all questions not directly related to the Grants.gov or PAMS systems.

VII.B. AGENCY CONTACTS

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
Program Manager Scientific Contact	sc.fair@science.doe.gov

Section VIII – SUPPLEMENTARY MATERIAL

VIII.A. 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 FOA, every application, or every applicant.

VIII.A.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.

VIII.A.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.

VIII.A.3. How Federally Affiliated Organizations May Apply

DOE/NNSA NATIONAL LABORATORIES

DOE/NNSA 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/NNSA Contracting Officer provides written authorization. This authorization should 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 FOA 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.

VIII.A.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 FOA, submit collaborative applications with each institution submitting its own application with an identical project narrative, resulting in multiple awards to the collaborating institutions.

VIII.A.5. How to Submit Letters of Intent

Do not submit an LOI unless an FOA 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 FOA 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 edit a previously submitted LOI in the time between your submission and the deadline. If you choose to edit, doing so will remove your previously submitted version from consideration. If you are still editing 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.

VIII.A.6. How to Submit a Pre-Application

Do not submit a pre-application unless an FOA 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 FOA 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 edit a previously submitted pre-application in the time between your submission and the deadline. If you choose to edit, doing so will remove your previously submitted

version from consideration. If you are still editing 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.

VIII.A.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.

Complete organization registration instructions can be found on Grants.gov here:
<https://www.Grants.gov/web/grants/applicants/organization-registration.html>

- 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/web/grants/applicants/organization-registration.html>
- 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/web/grants/applicants/registration/add-profile.html>

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)¹⁸. 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/web/grants/applicants/registration/authorize-roles.html>

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

<https://www.Grants.gov/web/grants/applicants/registration/track-role-status.html>

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 FOA, you can create individual instances of a workspace.

Below is an overview of applying on Grants.gov. For access to complete instructions on how to apply for opportunities, refer to:

<https://www.Grants.gov/web/grants/applicants/apply-for-grants.html>

¹⁸ 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.

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

VIII.A.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 in [7. 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 FOA. 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 FOA 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 FOA to request that it be withdrawn.

After an application is withdrawn, it may be resubmitted, if this FOA is still open for the submission of applications. Such resubmissions will only count as one submission if this FOA 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 FOA 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 FOA to permit the transfer of the award to a new institution, the new institution must apply under the then-available SC “annual” or “open” FOA.

VIII.A.9. How to Prepare a Biographical Sketch

A biographical sketch is to provide information that can be used by reviewers to evaluate the PI’s potential for leadership within the scientific community. Examples of information of interest are invited and/or public lectures, awards received, scientific program committees, conference or workshop organization, professional society activities, special international or industrial partnerships, reviewing or editorship activities, or other scientific leadership experiences.

SC requires the use of the format approved by the National Science Foundation (NSF), 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. When interagency common formats and instructions are promulgated, their use will be required. See <https://new.nsf.gov/funding/senior-personnel-documents> for more information. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

The biographical information (curriculum vitae) must include the following items within its page limit:

- **Education and Training:** Undergraduate, graduate and postdoctoral training, provide institution, major/area, degree and year.
- **Research and Professional Experience:** Beginning with the current position, list

professional/academic positions in chronological order with a brief description. List all current academic, professional or institutional appointments, foreign or domestic, at the applicant institution or elsewhere, whether remuneration is received, and, whether full-time, part-time, or voluntary.

- **Publications:** Provide a list of up to 10 publications 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 only the first author) may be used for publications with more than 10 authors.
- **Synergistic Activities:** List no more than five professional and scholarly activities related to the effort proposed.

Requested information may be appended to a biographical sketch, whether produced from a fillable PDF or in SciENcv.

Do not attach a listing of individuals who should not be used as merit reviewers: This information is no longer collected as part of a biographical sketch.

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). 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.

VIII.A.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 FOA 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

VIII.A.11. How to Prepare Current and Pending Support

<p>WARNING: These instructions have been significantly revised to require disclosure of a variety of potential conflicts of interest or commitment, including participation in foreign government-sponsored talent recruitment programs.</p>

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 foreign government-sponsored talent recruitment programs must be identified in current and pending support.

SC requires the use of the format approved by the National Science Foundation (NSF), 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. When interagency common formats and instructions are promulgated, their use will be required. See <https://new.nsf.gov/funding/senior-personnel-documents> for more information. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

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.

Requested information may be appended to current and pending support, whether produced from a fillable PDF or in SciENCv.

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). 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.

VIII.A.12. How to Prepare a Data Management Plan

In general, a DMP should address the following requirements:

1. DMPs should describe whether and how data generated in the course of the proposed research will be shared and preserved. If the plan is not to share and/or preserve certain data, then the plan must explain the basis of the decision (for example, cost/benefit considerations, other parameters of feasibility, scientific appropriateness, or limitations discussed in #4). At a minimum, DMPs must describe how data sharing and preservation will enable validation of results, or how results could be validated if data are not shared or preserved.
2. DMPs should provide a plan for making all research data displayed in 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 research data used to generate the displayed data should be made as accessible as possible to the public in accordance with the principles stated in the Office of Science Statement on Digital Data Management (<https://science.osti.gov/funding-opportunities/digital-data-management>). This requirement could be met by including the data as supplementary information to the published article, or through other means. The published article should indicate how these data can be accessed.
3. DMPs should consult and reference available information about data management resources to be used in the course of the proposed research. In particular, DMPs that explicitly or implicitly commit data management 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 at Office of Science User Facilities, researchers should consult the published description of data management resources and practices at that facility and reference it in the DMP. Information about other Office of Science facilities can be found at <https://science.osti.gov/user-facilities/>.
4. DMPs must protect confidentiality, personal privacy, Personally Identifiable Information, and U.S. national, homeland, and economic security; recognize proprietary interests, business confidential information, and intellectual property rights; avoid significant negative impact on innovation, and U.S. competitiveness; and otherwise, be consistent with all applicable laws, and regulations. There is no requirement to share proprietary data.

DMPs will be reviewed as part of the overall SC research proposal merit review process.

Applicants are encouraged to consult the SC website for further information and suggestions for how to structure a DMP: <https://science.osti.gov/funding-opportunities/digital-data-management>

VIII.A.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/>.

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.
Section C Equipment	For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of \$5,000 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.
Section D Travel	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

	<p>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.</p> <p>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 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). • 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

	<p>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).</p> <ul style="list-style-type: none"> • 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. • 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.

VIII.A.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 FOA should reference the FOA number printed on the cover page.

VIII.A.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.

VIII.A.16. How to Register in Other Systems Before Submitting an Application

SYSTEMS TO REGISTER IN

Applicants must complete a series of registrations and enrollments to submit applications in response to this FOA. Applicants not currently registered with SAM and Grants.gov should allow **at least four weeks** to complete these requirements. Applicants refers 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 www.SAM.gov. An applicant’s TIN is an EIN assigned by the Internal Revenue Service (IRS). In limited circumstances, a Social Security Number (SSN) assigned by the Social Security Administration (SSA) may be used as a TIN. 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 entity service 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.

Applicants must register with FedConnect at www.FedConnect.net. The full, binding version of assistance agreements will be posted to FedConnect.

Recipients must register with the Federal Funding Accountability and Transparency Act Subaward Reporting System at <https://www.fhrs.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/web/grants/applicants/registration.html> 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.

VIII.B. ADMINISTRATIVE AND NATIONAL POLICY REQUIREMENTS

VIII.B.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).

VIII.B.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.

VIII.B.3. Buy America Requirement for Infrastructure Projects

Required use of Iron, Steel, Manufacture Products, and Construction Materials Produced in the United States

A. DEFINITIONS

For purposes of the Buy America Requirement, the following definitions apply:

Components are defined as the articles, materials, or supplies incorporated directly into the end manufactured product(s).

Construction Materials are an article, material, or supply—other than an item primarily of iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is used in an infrastructure project and is or consists primarily of non-ferrous metals, plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables), glass (including optic glass), lumber, drywall, coatings (paints and stains), optical fiber, clay brick; composite building materials; or engineered wood products.

Domestic Content Procurement Preference Requirement – means a requirement that no amounts made available through a program for federal financial assistance may be obligated for an infrastructure project unless—

- (A) all iron and steel used in the project are produced in the United States;
- (B) the manufactured products used in the project are produced in the United States; or
- (C) the construction materials used in the project are produced in the United States.

Also referred to as the **Buy America Requirement**.

Infrastructure includes, at a minimum, the structures, facilities, and equipment located in the United States, 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; and buildings and real property; and generation, transportation, and distribution of energy—including electric vehicle (EV) charging.

The term “infrastructure” should be interpreted broadly, and the definition provided above should be considered as illustrative and not exhaustive.

Manufactured Products are items used for an infrastructure project made up of components that are not primarily of iron or steel; construction materials; cement and cementitious materials’ aggregates such as stone, sand, or gravel; or aggregate binding agents or additives.

Primarily of iron or steel means greater than 50% iron or steel, measured by cost.

Project – means the construction, alteration, maintenance, or repair of infrastructure in the United States.

Public – The Buy America Requirement does not apply to non-public infrastructure projects. For purposes of this guidance, infrastructure should be considered “public” if it is: (1) publicly owned or (2) privately owned but utilized primarily for a public purpose. Infrastructure should be considered to be “utilized primarily for a public purpose” if it is privately operated on behalf of the public or is a place of public accommodation.

B. BUY AMERICA REQUIREMENT FOR INFRASTRUCTURE PROJECTS (BUY AMERICA REQUIREMENT)

None of the award funds (includes federal share and Recipient cost share) may be used for a public infrastructure project unless:

- (1) 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;
- (2) 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; and
- (3) all construction materials¹⁹ are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America Requirement only apply to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools,

¹⁹ Excludes cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.

equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does the Buy America Requirement apply 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.

The Buy America Requirement does not statutorily apply to Prime Recipients that are For-Profit Entities. However, the Buy America Requirement is applicable to a For-Profit Entity if: (1) it is a sub-recipient or sub-awardee under an award that contains the Buy America Requirement term and condition, or (2) it is the Prime Recipient that voluntarily chooses to use domestically sourced iron, steel, manufactured products, and construction materials by stating so in its proposed application containing an infrastructure project. If the For-Profit Entity specifically states that it will comply with the Buy America Requirements in its application and it is selected for award, its award will contain a Buy America Requirement for Infrastructure Projects term and condition.

The Prime Recipient is responsible for flowing the Buy America Requirement down to all sub-awards, all contracts, subcontracts, and purchase orders for work performed under the proposed infrastructure project, including to For-Profit Entities when the For-Profit Entity is a sub-recipient or sub-awardee.

Recipients must certify or provide equivalent documentation for proof of compliance that a good faith effort was made to solicit bids for domestic products used in the infrastructure project under this award.

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 subrecipients, 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.

C. DOE SUBMISSION REQUIREMENTS FOR FULL APPLICATION

Within the first two pages of the workplan or project description, applicants must provide a short statement on whether the project will involve the construction, alteration, maintenance and/or repair of infrastructure in the United States. The ultimate determination about whether a project includes infrastructure remains with DOE, but the applicant's statement will assist project planning and integration of the Buy America Requirement, which may impact the project's proposed budget and/or schedule.

D. WAIVERS

In limited circumstances, DOE may waive the application of the Buy America Requirement in an

award where DOE determines that:

- (1) applying the Buy America requirements would be inconsistent with the public interest (Public Interest);
- (2) 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 (Non-Availability); or
- (3) 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 (Unreasonable Cost).

DOE will only process waiver requests after an award has been made and for which the requests have been submitted in accordance with the term and conditions of the award. Waiver requests must be reviewed by DOE and the Office of Management and Budget's Made in America Office and are subject to a public comment period of no less than 15 calendar days.

DOE or OMB may request additional information for consideration of the waiver. DOE may reject or grant waivers in whole or in part depending on its review, analysis, and/or feedback from OMB or the public. DOE's final determination regarding approval or rejection of the waiver request may not be appealed by a Recipient.

Requests to waive the Buy America Requirement must include the following:

- Waiver type (Public Interest, Non-Availability, or Unreasonable Cost);
- Recipient name and Unique Entity Identifier (UEI);
- Award information (Federal Award Identification Number, Assistance Listing number);
- A brief description of the project, its location, and the specific infrastructure involved;
- Total estimated project cost, with estimated federal share and recipient cost share breakdowns;
- Total estimated infrastructure costs, with estimated federal share and recipient cost share breakdowns;
- List and description of iron or steel item(s), manufactured goods, and/or construction material(s) the recipient seeks to waive from the Buy America Requirement, including name, cost, quantity(ies), country(ies) of origin, and relevant Product Service Codes (PSC) and North American Industry Classification System (NAICS) codes for each;
- A detailed justification as to how the non-domestic item(s) is/are essential to the project;
- A certification that the recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and non-proprietary communications with potential suppliers;
- A justification statement—based on one of the applicable justifications outlined above—as to why the listed items cannot be procured domestically, including the due diligence performed (e.g., market research, industry outreach, cost analysis, cost-benefit analysis) by the recipient to attempt to avoid the need for a waiver. This justification may cite, if applicable, the absence of any Buy America-compliant bids received for domestic products in response to a solicitation; and
- Anticipated impact to the project if no waiver is issued.

The following principles should be incorporated as minimum requirements in waiver request:

- Time-limited: Consider a waiver constrained principally by a length of time, rather than by the specific project/award to which it applies. Waivers of this type may be appropriate, for example, when an item that is “non-available” is widely used in the project. When requesting such a waiver, the recipient should identify a reasonable, definite time frame (e.g., no more than one to two years) designed so that the waiver is reviewed to ensure the condition for the waiver (“non-availability”) has not changed (e.g., domestic supplies have become more available).
- Targeted: Waiver requests should apply only to the item(s), product(s), or material(s) or category(ies) of item(s), product(s), or material(s) as necessary and justified. Waivers should not be overly broad as this will undermine domestic preference policies.
- Conditional: The recipient may request a waiver with specific conditions that support the policies of IIJA/BABA and Executive Order 14017.

VIII.B.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.

VIII.B.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.

VIII.B.6. Corporate Felony Conviction and Federal Tax Liability Representations (March 2014)

In submitting an application in response to this FOA 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.

VIII.B.7. 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.

VIII.B.8. 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.

VIII.B.9. 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.

VIII.B.10. 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 FOA 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.

VIII.B.11. Government Right to Reject or Negotiate

DOE reserves the right, without qualification, to reject any or all applications received in response to this FOA and to select any application, in whole or in part, as a basis for negotiation and/or award.

VIII.B.12. Intergovernmental Review

This program is not subject to Executive Order 12372 Intergovernmental Review of Federal Programs.

VIII.B.13. 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/management/doe-logo-seal-and-word-mark>. Information about the SC logo may be found at <https://science.osti.gov/About/Resources/Logos>.

VIII.B.14. Modifications

Notices of any modifications to this FOA will be posted on Grants.gov and the FedConnect portal. You can receive an email when a modification or an FOA message is posted by registering with FedConnect as an interested party for this FOA. It is recommended that you register as soon after release of the FOA as possible to ensure you receive timely notice of any modifications or other FOAs. More information is available at www.FedConnect.net.

VIII.B.15. National Environmental Policy Act (NEPA) Compliance

If the question 4.a. on the “Research and Related Other Project Information” disclosure indicates “potential impact on the environment, negative”, or if DOE’s own review indicates it, DOE may ask the applicant to provide additional information on those impacts in order to prepare an environmental critique/synopsis per 10 CFR 1021.216. Note that this pre-award environmental critique/synopsis process would be separate from the preparation of a NEPA document such as an environmental impact statement (EIS) or an environmental assessment (EA). If DOE determines that an EIS or EA is necessary, this process would need to be completed, funded by and with the participation of the recipient, prior to them taking any action on the proposed project that could have adverse environmental effects or that could limit the choice of reasonable alternatives. Note that in most cases, even when “Potential Impact to the Environment” is

checked “Yes,” preparation of such NEPA documents is rarely necessary, but DOE has the expectation that the recipient will disclose the potential, which would serve to initiate dialog with DOE if necessary. The inability to satisfy the NEPA requirements after an award would result in cancellation of the award.

VIII.B.16. Nondisclosure and Confidentiality Agreements Representations (June 2015)

By submitting an application in response to this FOA, 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.

VIII.B.17. 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.

VIII.B.18. 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.

VIII.B.19. 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 FOA 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 (<https://www.energy.gov/diversity/title-ix>). 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).

VIII.B.20. 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.

VIII.B.21. Prohibition Related to Foreign Government-Sponsored Talent Recruitment Programs

a. Prohibition

Persons participating in a Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk are prohibited from participating in projects selected for federal funding

under this FOA. Should an award result from this FOA, the recipient must exercise ongoing due diligence to reasonably ensure that no individuals participating on the DOE-funded project are participating in a Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk. 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 foreign government talent recruitment program of a foreign country of risk. DOE may modify and add requirements related to this prohibition to the extent required by law.

b. Definitions

1. Foreign Government-Sponsored Talent Recruitment Program. An effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to relocate physically to the foreign state for the above purpose. Some programs allow for or encourage continued employment at United States research facilities or receipt of federal research funds while concurrently working at and/or receiving compensation from a foreign institution, and some direct participants not to disclose their participation to U.S. entities. Compensation could take many forms including cash, research funding, complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

2. Foreign Country of Risk. DOE has designated the following countries as foreign countries of risk: Iran, North Korea, Russia, and China. This list is subject to change.

VIII.B.22. 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 FOA. 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 title page 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.

VIII.B.23. Publications

The recipient is expected to publish or otherwise make publicly available the results of the work conducted under any award resulting from this FOA. Publications and other methods of public communication describing any work based on or developed under an award resulting from this FOA 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 FOA are subject to DOE's [Public Access Plan](#). Full-text versions of scientific publications must be made publicly accessible at no charge to readers.

VIII.B.24. 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.

VIII.B.25. 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 FOA 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>.

VIII.B.26. 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.

VIII.B.27. 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 FSRS database at <https://www.fsrs.gov> and report the required data on their first tier subrecipients. Prime recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

VIII.B.28. 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 FOA 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 FOA,

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 FOA shall include the U.S. Competitiveness Provision in accordance with [Section VIII](#) of this FOA. 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 FOA. 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 FOA 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 FOA shall include the U.S. Competitiveness Provision in accordance with [Section VIII](#) of this FOA. 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 FOA for any domestic large business that is a recipient, or subrecipient at any tier to this FOA 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).

VIII.B.29. 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 VIII](#).

VIII.C. 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: <ul style="list-style-type: none"> • 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: <ol style="list-style-type: none"> (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 \$5,000. 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.
Funding opportunity announcement (FOA)	<i>Funding opportunity announcement (FOA)</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. FOAs 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. FOAs can be found at www.Grants.gov . An FOA may also be known as a solicitation.
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> <ol style="list-style-type: none"> (1) Direct United States Government cash assistance to an individual; (2) A subsidy; (3) A loan; (4) A loan guarantee; or (5) Insurance.
Grant-supported project or activity	<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.
Grants.gov	<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.
Indirect costs (facilities & administrative)	<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.
Institutional base salary	<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.
Matching or cost sharing	<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.
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, equitable, 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.
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: <ul style="list-style-type: none"> • 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	<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.) 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.
Program Manager	<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.
Progress report	<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.
Project/performance site	<i>Project/ performance site</i> means location(s) of where the work described in the research plan will be conducted.
Project period	<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.
Proposal	See application.
Re-budgeting	<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.
Real Property	<i>Real property</i> means land, including land improvements, structures and appurtenances thereto, but excludes moveable machinery and equipment.
Recipient	<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.
Renewal application	<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.
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.