Department of Energy (DOE)
Office of Science (SC)
Fusion Energy Sciences (FES)

Private Facility Research Program

Notice of Funding Opportunity (NOFO) Number:
DE-FOA-0003516

NOFO Type: Amendment 000001
CFDA Number: 81.049

Amendment 000001 is issued to remove references to diversity, equity, and inclusion; to remove references to PIER plans; to update regulatory requirements from Title 2 CFR; and to update research, technology, and economic security provisions.

NOFO Issue Date:	January 8, 2025
Submission Deadline for Pre-Applications:	February 19,2025 at 5 pm ET A Pre-Application is required. Pre-Applications must be submitted by an authorized institutional representative.
Pre-Application Response Date:	March 5, 2025 at 11:59 pm ET
Submission Deadline for Applications:	April 23, 2025 at 11:59 pm ET

Table of Contents

I. Basic Information

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

Executive Summary

The objective of the Private Facility Research (PFR) program is to support public research utilizing world leading experimental capabilities owned by private companies. Along the path to constructing Fusion Pilot Plants (FPPs), many private fusion companies are constructing interim small-to-large scale research facilities to establish the scientific and/or technological basis for their chosen fusion concepts. Since the research on these interim facilities is largely foundational in nature, the mission overlap between the public and private sectors is large. The PFR program serves as a bridge from boldly delivered private sector hardware back to foundational research expertise residing in the public sector. Through the program, public researchers will conduct open peer-reviewed science at private facilities, to enhance the scientific rigor and breadth of the existing private efforts for the mutual benefit of all involved. As with all thriving high-tech industries, a strong connection to foundational research is essential.

Funding Details

Expected total available funding	$23 million
Expected number of awards	1 to 8
Expected dollar amount of individual awards	Public Research Award, Standard: $2 – $21 million Public Research Award, Novel Diagnostic Development: $25,000 – $3 million Data Mirroring Award: $25,000 – $500,000
Expected award project period	3 to 5 years

Key Facts

NOFO Title	Private Facility Research Program
NOFO Number	DE-FOA-0003516
Announcement Type	Amendment 000001
Assistance Listing	81.049
Statutory Authority	The programmatic authorizing statutes are: Section 646 of Public Law 95-91, U.S. Department of Energy Organization Act Section 901, et seq. of Public Law 109-58, Energy Policy Act of 2005
Governing Regulations	Uniform Administrative Requirements, Cost Principles, and Audit Requirements for Federal Awards, codified at 2 CFR 200 U.S. Department of Energy Financial Assistance Rules, codified at 2 CFR 910 U.S. Department of Energy, Office of Science Financial Assistance Program Rule, codified at 10 CFR 605

Key Dates

Key dates are printed on the cover of this NOFO.

Agency Contact Information

Grants.gov Customer Support	800-518-4726 (toll-free) support@Grants.gov
PAMS Customer Support	855-818-1846 (toll-free) 301-903-9610 sc.pams-helpdesk@science.doe.gov
Technical/Scientific Program Contact	Dr. Josh King 240-535-0834 josh.king@science.doe.gov
Administrative Contact	Ms. Marty Carlin 301-903-3287 marty.carlin@science.doe.gov

Informational Webinar / Office Hours

SC plans to hold an informational webinar about this NOFO. Registration instructions and other details will be posted at https://science.osti.gov/fes-Funding-Opportunities.

Recommendation

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

II. Eligibility

A. Eligible Applicants

All types of domestic applicants are eligible to apply, 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.

Federally affiliated[1] entities must adhere to the eligibility standards below:

1. DOE/NNSA National Laboratories

DOE/National Nuclear Security Administration (NNSA) National Laboratories[2] are eligible to submit applications under this NOFO and may be proposed as subrecipients under another organization's application. If recommended for funding as a lead applicant, funding will be provided through the DOE Field-Work Proposal System and work will be conducted under the laboratory's contract with DOE. No administrative provisions of this NOFO will apply to the laboratory or any laboratory subcontractor. 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. Additional instructions for securing authorization from the cognizant Contracting Officer are found in Section IX of this NOFO.

2. Non-DOE/NNSA FFRDCs

Non-DOE/NNSA Federally Funded Research and Development Centers (FFRDCs) [3] are eligible to submit applications under this NOFO and may be proposed as subrecipients under another organization's application. If recommended for funding as a lead applicant, funding will be provided through an interagency agreement to the FFRDC's sponsoring Federal Agency. If recommended for funding as a proposed subrecipient, the value of the proposed subaward may be removed from the prime applicant's award and may be provided through an interagency agreement to the FFRDC's sponsoring Federal Agency. Additional instructions for securing authorization from the cognizant Contracting Officer are found in Section IX of this NOFO.

3. Other Federal Agencies

Other Federal Agencies are eligible to submit applications under this NOFO and may be

---

1 Institutions that are not DOE/NNSA National Laboratories, non-DOE/NNSA FFRDCs, or other Federal agencies are not considered "Federally affiliated," even if they receive Federal funds or perform work under a Federal award or contract.

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

3 An authoritative list of all FFRDCs may be found at https://www.nsf.gov/statistics/ffrdclist/

proposed as subrecipients under another organization's application. If recommended for funding as a lead applicant, funding will be provided through an interagency agreement. If recommended for funding as a proposed subrecipient, the value of the proposed subaward may be removed from the prime applicant's award and may be provided through an interagency agreement. Additional instructions for providing statutory authorization are found in Section IX of this NOFO.

Notes for applicants of all types:

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

[Cost sharing needs to be addressed]

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, other Federal agencies, another Federal agency's FFRDC, or their subcontractors at any tier. DOE/NNSA National Laboratories, other Federal agencies, and another Federal agency's FFRDC may impose cost-sharing requirements on their contractors subject to their policies and procedures.

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

C. Eligible Individuals

Individuals with the skills, knowledge, and resources necessary to carry out the proposed research as a Principal Investigator (PI) are invited to work with their organizations to develop an application. Individuals from underrepresented groups as well as individuals with disabilities are always encouraged to apply.

D. Limitations on Submissions

LIMITATIONS ON INSTITUTIONS

Public Research Award – Standard Award Subcategory

Each application to the Standard subcategory must propose work involving only one private facility. For each private facility, applicant institutions are limited to no more than one pre-application or application as the lead institution or subrecipient in the Standard subcategory. Each applicant institution may apply as either a lead institution or a subrecipient at each private facility. For example, University B may submit a single-institution application for work involving private facility X, a multi-institutional application as the lead institution for work involving private facility Y, and may be listed as a subrecipient on a multi-institutional

application for work involving private facility Z. In short, each institution may submit a single application within the Standard subcategory for each private facility.

Public Research Award – Novel Diagnostic Development Subcategory

There are no limits on the number of submissions per institution in the Novel Diagnostic Development subcategory.

Data Mirroring Award

Applicant institutions are limited to no more than one pre-application or application as the lead institution.

Should DOE receive submissions in excess of the applicable limits, DOE reserves the right, in its sole discretion, to request additional or clarifying information to ascertain the institution's intended submissions. Otherwise, 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 discouraged.
- Applications in excess of the limited number of submissions may be declined without review.

LIMITATIONS ON PI

For each Public Research Award, across both subcategories, a PI may submit multiple pre-applications or applications to the PFR NOFO. However, each PI may submit only one pre-application or application per private facility.

The PI on an application may also be listed as a senior or key personnel, including in any role on a proposed subaward, on only one submission per private facility. For example, a PI may submit a single-institution application involving private facility X, and may also be included on another individual's application as a subrecipient involving private facility Y. However, a PI may not submit a single-institution application involving private facility X, and be included on another individual's application as a subrecipient also involving private facility X.

Individuals in a joint appointment are eligible to be proposed as a PI if work will be performed at the applicant institution and if the PI is a paid employee of the applicant institution.

PIs are not required to be in tenure-track appointments.

III. Program Description

A. Purpose

The DOE SC program in Fusion Energy Sciences (FES) hereby announces its interest in applications for a Private Facility Research (PFR) program to support public research utilizing world leading experimental capabilities owned by private companies. Along the path to constructing Fusion Pilot Plants (FPPs), many private fusion companies are constructing interim small-to-large scale research facilities to establish the scientific and/or technological basis for their chosen fusion concepts. Since the research on these interim facilities is largely foundational in nature, the mission overlap between the public and private sectors is large. Consistent with the FES Building Bridges Vision[4], the PFR program serves as a bridge from boldly delivered private sector hardware back to foundational research expertise residing in the public sector. Through the program, public researchers will conduct open peer-reviewed science at private facilities, to enhance the scientific rigor and breadth of the existing private efforts for the mutual benefit of all involved. As with all thriving high-tech industries, a strong connection to foundational research is essential.

SUPPLEMENTARY INFORMATION

A confluence of recent encouraging developments has motivated the acceleration of fusion energy efforts. In 2021, private investment in fusion research surpassed that of the public sector for the first time. The many companies that have emerged, each pursuing their own distinctive plasma confinement concept or fusion technology, have resulted in a diverse array of privately owned experimental facilities that are either under construction, operational, or in the process of decommissioning[5]. Additionally, major science and technological developments in both the public[6] and private sectors[7], have significantly advanced efforts toward the creation of a fusion energy source. In view of this progress, DOE has announced a plan for realizing commercial fusion energy in partnership with private companies, which is consistent with recent reports[8,9,10]. Importantly, there is now an agency-wide DOE Fusion Energy Strategy 2024[11], in addition to the FES Building Bridges Vision, discussed immediately above. The latter of these two documents will develop a national fusion Science & Technology (S&T) roadmap to address the "how" and "when" of closing critical S&T gaps, and the PFR program will serve as a key bridge from the private sector back to foundational research to address a portion of these gaps.

Through a pilot research project that involved two DOE National Labs and a private fusion company, previously supported through the spherical tokamak general research program, it was

---

4 https://www.energy.gov/sites/default/files/2024-06/fes-building-bridges-vision.pdf
5 The Global Fusion Industry in 2022, Fusion Companies Survey by the Fusion Industry Association.
6 https://www.llnl.gov/news/national-ignition-facility-experiment-puts-researchers-threshold-fusion-ignition
7 https://news.mit.edu/2021/MIT-CFS-major-advance-toward-fusion-energy-0908; https://cfs.energy/news-and-media/cfs-commercial-fusion-power-with-hts-magnet
8 https://science.osti.gov/fes/Community-Resources/Workshop-Reports
9 https://science.osti.gov/-/media/fes/fesac/pdf/2020/202012/FESAC_Report_2020_Powering_the_Future.pdf
10 https://nap.nationalacademies.org/catalog/25991/bringing-fusion-to-the-us-grid
11 https://www.energy.gov/sites/default/files/2024-06/fusion-energy-strategy-2024.pdf

demonstrated that the comprehensive scientific utilization of a world-class private fusion facility can benefit both the public and private sectors[12]. The public sector researchers gain access to FES mission-relevant experimental capabilities beyond those currently supported by public programs, while private companies benefit from government-sponsored expertise, including scientific validation and risk mitigation, which is beyond the scope of private investors' support.

By combining public sector expertise with the agility of private industry, the depth of research conducted across a breadth of private facilities is improved and scientific insights are accelerated. For this reason, FES is establishing the PFR Program to foster public-private partnerships to deliver peer-reviewed open S&T research.

The PFR program offers two distinct types of awards: (1) Support for publicly sponsored researchers to conduct research involving private facilities, referred to as "Public Research Awards" in this NOFO; and (2) Support for private companies to cover the cost of mirroring their data to a Private Facility Data Repository, referred to as "Data Mirroring Awards" in this NOFO.

TECHNICAL DESCRIPTION

Award Type 1 – Public Research Awards

Applications for financial assistance are invited from researchers employed by publicly sponsored universities or national labs to conduct open research using world-class experimental facilities owned by private companies. Applications from publicly sponsored industry researchers may be considered as well, but these researchers should take care to describe how they would address real or perceived conflicts of interest. These Public Research Awards are being offered in the following two subcategories: (1) Standard, and (2) Novel Diagnostic Development.

The Standard and Novel Diagnostic Development subcategories have different award sizes. Standard awards are larger awards with comprehensive scope. Novel Diagnostic Development awards are smaller awards involving targeted efforts to deliver new measurements.

Additionally, applications from private facilities to support the mirroring of data to public repositories are welcome and are described in the "Award Type 2 - Data Mirroring Awards" section of this NOFO.

DATA

Data openness is a fundamental tenet of the PFR program. Although aspects of private companies' research are proprietary, this PFR program only supports nonproprietary research. In the spirit of data openness, public researchers participating in the PFR program must ensure that the data generated through the installation and operation of their diagnostics are made available

12 https://energy.gov/science/fes/articles/small-fusion-experiment-hits-temperatures-hotter-suns-core

to all the PFR program researchers, both public and private. The Digital Data Management policies of the Office of Science[13] and additional FES guidance[14] should be consulted by all PFR participants.

DATA ACCESS PRIOR TO APPLYING

To participate in the PRF program, public researchers must have access to private facility data. To ensure data access does not become an impediment to PFR research execution, public researchers must establish access to private facility data prior to submitting a full application. In some cases, this may involve completing private facility training and/or signing data access agreements. Acknowledgment of the completion of all prerequisite tasks and the establishment of data access at the private facility must be documented as part of the Record of Discussion (see Appendix 6). Record of discussion templates will be available at https://science.osti.gov/fes/Funding-Opportunities and under the "Related Documents" tab with this NOFO in https://www.Grants.gov.

PUBLICATIONS

PFR researchers must have the right to publish scientific results. Internal review processes are anticipated to ensure the accurate reporting of data, the exclusion of proprietary data from manuscripts, and the resolution of any topical overlaps with other researchers. Private facilities aiming to suppress or impede the timely communication of potential undesirable results are not permitted within the PFR program. For this reason, internal private facility reviews of paper submissions should be limited in duration to no longer than 1 month.

STANDARD AWARD SUBCATEGORY

Applications will only be accepted for research on private facilities that are expected to be operational between now and CY2027. The following fusion companies have private facilities that meet the aforementioned criterion and have expressed interest in hosting public researchers as part of the PFR program: Commonwealth Fusion Systems, Ex-Fusion, Focused Energy, General Fusion, Kyoto Fusioneering/Fusion Fuel Cycles, Marathon Fusion, OpenStar Technologies, Pacific Fusion, SHINE Technologies, TAE Technologies, Tokamak Energy, and Type One Energy. Note, this list of participating fusion companies is not exclusive; applications involving other companies with facilities expected to be operational by CY2027 are also welcome.

Only research of mutual interest to both the private company and FES is considered for support through the PFR program. The areas of research overlap between the FES mission and the private facility programs are documented in the Statements of Mutual Interest (SMI). For facilities with SMIs, pre-applications must address topics contained in the statements. Pre-applications for research covering topics outside of those described in the SMI may be

13 https://science.osti.gov/Funding-Opportunities/Digital-Data-Management
14 https://science.osti.gov/fes/Funding-Opportunities/Digital-Data-Management

discouraged from submitting a full application.

As part of the project narrative, applications must offer a specific plan to disseminate their findings in peer reviewed journal publications at a national level. These research deliverables must be documented in the Record of Discussion (see Appendix 6) with the collaborating private institution. Despite the need for this journal publication plan, topical flexibility is necessary to ensure scientific productivity given the rapidly evolving experimental schedules anticipated at private experimental facilities.

Applications that include diagnostic and hardware elements are encouraged. Experience has shown that applying the deep diagnostic and operational expertise of the public sector to private facilities offers synergistic benefits to all parties, rapidly accelerating progress. Therefore, in-person, hands-on involvement of public researchers is required for applications involving diagnostic or hardware implementation, and a plan to ensure the appropriate on-site presence at the private facility must be included in the application.

A goal of the PFR program is to achieve both depth and breadth of research. There are dozens of private fusion companies, each pursuing a different S&T concept, with experiments ranging from first-of-a-kind ideas to tokamaks, and with empirically realized plasma performance separated by roughly 20 orders of magnitude. Similarly, the technologies being pursued span all Technology Readiness Levels (TRL). Given the quantity, uniqueness, and variety of technical maturity levels of private fusion efforts, ensuring breadth and depth of the PFR program is an exciting opportunity. It is understood that the emergent concepts of today may offer engineering advantages to enable the economic fusion energy sources of tomorrow.

Novel Diagnostic Development Subcategory

Applications to the Novel Diagnostic Development subcategory focus on developing novel diagnostic tools required for critical measurements in future Fusion Pilot Plants (FPP), as well as measurement tools used for exploring previously uncharted parameter spaces in emerging plasma confinement concepts. While these diagnostics may be motivated by key scientific and technological questions, the primary deliverables pertain to the development of the measurement techniques themselves, rather than the interpretation of the physical phenomena observed. Preliminary bench testing is expected as part of these awards, but the ultimate goal is the deployment of a diagnostic tool at a private facility. If a measurement technique is too early in its development to be considered for installation at a private facility, it should instead be submitted to the Measurement Innovation program outside of this PFR funding opportunity.

Awards within the Novel Diagnostic Development subcategory may involve diagnostic development targeted at either the exploration of next-step FPP diagnostics relevant to burning plasmas—requiring a fusion-prototypic radiation environment potentially available at a private facility—or the creation of novel diagnostic techniques to support the development of a new fusion confinement concept. These new concepts may involve unique plasma parameter spaces that necessitate innovative measurement approaches.

Applications for Public Research Awards involving the deployment of diagnostic tools can be

submitted to both the Standard and Novel Diagnostic Development subcategories, but the distinction between these two types of awards is critical. If the diagnostic technique is already documented in the literature and has been used in plasma facilities, it should be submitted as a component of a Standard award aimed at using the diagnostic to make a physical inference. If the technique has not yet been documented in instrumentation literature or has only been tested on bench systems without being used to make physical measurements, it qualifies as novel and should be submitted under the Novel Diagnostic Development subcategory. Additionally, a Standard award must not depend on the development of a novel diagnostic technique, as challenges in implementing such techniques could jeopardize the physics objectives of the Standard award.

All information and requirements associated with Public Research Awards in the "Data," "Data access prior to applying," and "Publications" subsections above also apply to the Novel Diagnostic Development subcategory (e.g., Record of Discussion).

Award Type 2 – Data Mirroring Awards

The data generated during the operation of private experimental facilities represents the culmination of millions to billions of dollars of capital investment and tremendous human effort spanning years. This data may prove invaluable to the broader pursuit of a fusion energy source. It is for this reason that the preservation of private facility data is considered an important element of the PFR program.

Although the mirroring of private facility data is not a requirement of the PFR program, private facilities are invited to submit applications for financial assistance to cover the costs associated with mirroring a copy of their scientific data and metadata to the Private Facility Data Repository (PFDR). Each private facility applicant must submit a multi-institutional application with the Princeton Plasma Physics Laboratory (PPPL), the host laboratory of the PFDR, outlining the planned data to be mirrored. For these applications, the private facility will be the lead applicant and PPPL a subrecipient.

The mirrored copy of the private facility data may serve as the primary access point for PFR researchers, or simply preserve the data for future examination and/or protect PFR program researchers from unforeseen changes to data access. Additionally, public collaborators may directly access data stored on private facility servers and use private facility developed analysis tools in much the same way as their private company colleagues.

Data mirroring applications should strive to maximize data openness and sharing. However, any embargo periods or access criteria must be documented in the narrative section of these applications. Adherence to any conditions for data access will be at the discretion of the PFDR national laboratory.

Applications must include a clear plan to ensure the stored data is broadly useful to fusion researchers. These plans should outline the type and volume of data to be stored and detail the creation of websites that provide the necessary metadata and data viewing software, enabling researchers to begin analysis and make physical inferences. While it is encouraged, it is not

mandatory for applications to adopt the principles of Findability, Accessibility, Interoperability, and Reuse (FAIR). Finally, only non-proprietary data may be stored as part of a Data Mirroring Award.

Statements of Mutual Interest

The statements below outline the mutual research interests shared by the FES program and private companies for each eligible facility. While some topics may be of interest only to either FES or the private company, only topics of shared interest are permissible.

These Statements of Mutual Interest (SMIs) were developed with private companies that either registered to attend the first PFR workshop or received a Milestone-Based Fusion Development Program award. Other facilities not listed may also be considered, provided they anticipate operating a private facility by CY2027. If a private company wishes to include an SMI for their facility in a future PFR NOFO, please contact Josh King (Josh.King@science.doe.gov).

This list of participating fusion companies is not exclusive: applications involving other companies with facilities expected to be operational by CY2027 are also welcome. For facilities not included in this list of SMIs, applicants must provide a brief description of the facility in their pre-application, including the expected timeline for experimental operations.

Commonwealth Fusion Systems

Private Facility: SPARC. Located in Devens, MA

Private Facility Point of Contact: Julie Platano (jplatano@cfs.energy)

Facility Description: SPARC will be a high-field (B_0 = 12.2T) compact (R=1.85 m and a = 0.57 m) tokamak capable of operating with deuterium–tritium fuel and designed to achieve up to P_{fus} = 140 MW and Q = 11 in nominal H-mode operation, H_{98}=1.0. The high field and compact size are enabled by novel high temperature superconducting (HTS) magnets jointly developed by CFS and MIT. Though it uses HTS, SPARC remains a pulsed device, with flattop Δt~10 s at 8.7 MA and current ramps of ~1 MA/s. The facility has a design lifetime of 10 years and 13,000 pulses. For auxiliary heating, SPARC will be equipped with ICRH that is expected to deliver up to 25 MW of coupled power. The 120 MHz waves can heat 4He, D, and DT plasmas at 12 T using a 3He minority and at 8 T using a H minority. SPARC will also have a flexible means of injecting fuel and impurities, limited at present to: H, D, T, 3He, 4He, Ne, Ar, Kr, and Xe. SPARC is designed to test pellet fueling and pellet-based ELM pacing, but these capabilities are not planned for the first campaign. A set of 18 low-field side non-axisymmetric coils will be used for error field correction and testing RMP-based ELM-control. SPARC will use an MGI-based disruption mitigation system to start, though this can be modified through port-plug upgrades, and will test a novel n=1, in-vessel runaway electron mitigation coil. Pre/post campaign glow-discharge cleaning and intra-campaign ion cyclotron discharge cleaning, including with deuterated diborane, will be used for wall conditioning. SPARC has up/down symmetric tungsten PFCs and can support a wide range of magnetic configurations, including x-point target, and has cryopumping on the outer divertors. More information can be found in reference 1.

Timeline: SPARC is currently under construction in Devens, Massachusetts and plans to begin commissioning in 2025. Plasma operations will begin near the end of 2026 and rapidly move toward Q>1 in 2027. Going forward, SPARC will operate in roughly 6-month plasma campaigns separated by roughly 4-month maintenance periods. The first campaign will be very focused on achieving Q>1 in a DT L-mode. The second campaign will likely not use tritium, instead focusing on fully commissioning additional tokamak systems as well as plasma scenarios, particularly H-mode operation in deuterium plasmas. Subsequent campaigns will move toward higher fusion power, including Q=11, and answering targeted physics questions supporting the design and operation of ARC, many of which are aligned with the critical gaps identified in the CPP report and FESAC LRP.

Available Measurements: SPARC will be equipped with a comprehensive set of plasma diagnostics, based on techniques demonstrated on tokamaks worldwide. The diagnostic systems for the first campaigns will support basic tokamak operations, high-power and high-current operations, and ensure reliable Q>1 measurements. To achieve these objectives, a targeted set of ~50 plasma diagnostics are being designed and built, and the measurement classes and examples are listed in the table below. High spatial resolution and/or high time resolution are sometimes not supported as diagnostics prioritize plasma observation for real-time control and to inform inter-pulse decision making. More information on the early campaign diagnostics is available in reference 2.

List of SPARC early campaign Diagnostics

Diagnostic	Early Campaign Scope
Magnetic Diagnostics	flux loops, Ip Rogowski, Bx sensors, halo Rogowskis, high frequency Mirnovs
Interferometry and Polarimetry	single chord, two-color interferometer
Neutral Gas Diagnostics	main-chamber + divertor neutral pressure and RGA
UV/Vis/IR Imaging	multiple divertor, main-chamber and antenna imaging views
X-Ray Diagnostics	hard X-ray, soft X-ray imaging, high- and low-resolution crystal spectroscopy
UV/Vis/IR Spectroscopy	filterscopes, bremsstrahlung, H/D/T and $^{3}He/^{4}He$ isotope ratios, divertor and main chamber grating spectroscopy
Vacuum Spectroscopy	core and divertor impurity spectroscopy

Diagnostic	Early Campaign Scope
Bolometers	divertor, core and disruption radiated power
Thermal Sensing	embedded thermocouples, FBGs, surface thermocouples in main-chamber + divertor
Neutron Diagnostics	flux monitors, foil activation, poloidal imaging camera, core magnetic recoil spectrometer
Thomson Scattering	low-resolution core profile measurement
Millimeter Wave Diagnostics	electron cyclotron emission, edge scanning reflectometer
Langmuir Probes	divertor and main-chamber probes, current shunts
Displacement Sensing	vacuum vessel and coil displacement sensors
Strain Sensing	vacuum vessel strain sensors

While access to diagnostic data will be provided to PFR collaborators, rights to use and publish first author work will be limited to topical areas and scope defined in the PFR Record of Discussion.

SPARC will also be making measurements that will not be shared publicly. This includes, but is not limited to, data covering general plant operations, magnet health and operation, including quench detection, as well as engineering data that would enable those outside CFS to intuit proprietary information or trade secrets. Additional details on CFS views on data sharing and availability are available in reference 3.

Research Topics of Interest: The mission of FES includes building the knowledge needed to develop a fusion energy source. To this end, actively engaging public researchers in CFS's mission to achieve Q>1 in SPARC as quickly as possible following the first plasma is mutually beneficial for both parties. Publicly funded researchers will be integrated into the SPARC scientific team for the first campaign, though discovery-driven, long-term projects that may require appreciable SPARC operational time are expected to be pursued after the first campaigns.

PFR teams should possess a broad range of expertise to provide operational support in promptly achieving the Q>1 goal and use this knowledge and experience to enable growth into improved utilization of SPARC. Potential PFR applications are encouraged to reach out to CFS as early as possible to discuss specific topics and modes of interaction that may be of mutual interest. Early engagement can help shape a partnership approach that aligns with the goals and resources of both public and private stakeholders.

Research will be focused on plasma investigation, aiming to advance tokamak science through the use of SPARC. This is distinct from the FIRE collaboratives, where CFS has already committed support with some utilization of SPARC. The FIRE collaboratives will focus primarily on exposure and environmental testing, with the objective of validating a technology.

SPARC experimental data has the potential to advance the understanding of many aspects of tokamak physics, including but not limited to confinement and stability at high field and high density, burning plasma physics, disruption physics, boundary physics, and heat flux management in power plant-relevant conditions. While the primary mission of the SPARC tokamak is to demonstrate Q>1 and to set the stage for construction of the ARC power plant, the SPARC project has and will continue to learn new physics along the way.

The objectives of SPARC PFR projects, beyond the first run campaigns, should align with topics of mutual interest to both FES and CFS, with potential for broader exploration as public researchers become more familiar with SPARC's capabilities. In subsequent campaigns, PFR researchers are anticipated to have a greater role in guiding SPARC's scientific direction, as their deep integration within the team will likely yield insights that inform future research.

These awards may involve developing physics software tools to enhance SPARC data interpretation or to plan pulse sequences more effectively for future operations. This could include making predictions prior to specific experiments and then comparing them to actual data from the experimental runs. Diagnostic and/or hardware contributions to the SPARC facility are also anticipated, as described in further detail in subsequent sections. Overall, it is expected that PFR researchers will be participating in experiments that push the limits of SPARC's fusion power output.

Desired Measurements: SPARC was designed with upgradability in mind: Up to 32 port plugs on SPARC can be exchanged, space and utility capacity in the Tokamak Hall have been set aside for new programs, and the shielding wall between the tokamak and the Diagnostic Labs can be reconfigured. To ensure personnel and equipment safety, CFS will need to maintain oversight and likely need to lead engineering design activities for partner-provided diagnostics, and the detailed division of responsibilities and ownership will be documented in the Record of Discussion prior to partner application submission.

There is mutual interest in diagnostic enhancements that would improve back-end analysis equipment in the Diagnostic Labs, or expanding diagnostics that use existing design concepts. Hardware examples include increasing the number of core X-ray spectroscopy lines of sight, fielding additional types of sensors on neutron/gamma camera beamlines, enhancing the

resolution and sensitivity of the MPR spectrometer hodoscope, increasing resolution for core Thomson scattering, expanding the bandwidth of reflectometry, and installing additional cameras and spectrometers on existing UV/vis/IR beamlines. Software contributions improving the pulse-planning, real-time control or post-shot analysis of existing diagnostics would also be of interest.

There is also mutual interest in making SPARC more robust to physics and control uncertainties. This would add back-end analysis upgrades leveraging existing optical, microwave and laser beamlines for turbulence studies, such as fast framing cameras, correlation ECE, reflectometry and high-frequency interrogation of interferometry. PFR efforts could also enable enhancements that require fielding Tokamak Hall equipment leveraging existing port-plug capabilities that deferred ex-vessel design. This includes instruments such as a divertor-viewing IRVB and spectrometers for outer-divertor viewing VUV beamlines.

PFR researchers provided measurements that require a change to the facility layout may also be considered if they are sufficiently compelling. This could mean deploying new port plugs, adding a new type of beamline, or adding equipment in the Diagnostic Labs that requires significant space or utilities. Some examples of equipment include Doppler Backscattering, pedestal Thomson scattering, collective Thomson scattering, expanded high-frequency Mirnov coverage or adding a neutral particle analyzer. SPARC has been designed conservatively and after demonstration of disruption loads, new near-LCFS measurements may be allowable such as scanning Langmuir probes, fast-ion loss detectors, gas-puff imaging and material exposure/exchange facilities.

Additional Opportunities: In addition to the desired measurements above, enhancements to SPARC auxiliary systems will be considered. These include pellet injectors for fueling and ELM-control, integration of direct internal recycling systems to study compatibility with D-T tokamak operations, a laser blow-off system, non-MGI mass injection approaches for disruption mitigation and power supply enhancements for 2D/3D copper coils. Heating and current drive enhancements may also be of interest, but would require more engineering development as well as observations from early SPARC operations to prioritize need. At this time SPARC does not have neutral beams for H&CD, which eliminates beam-based diagnostic concepts from the desired measurements, near-term.

References:

1) Creely, A.J., *et al*. SPARC as a platform to advance tokamak science. *Physics of Plasmas*, 30 090601 (2023).
2) Reinke, M.L. *et al.* Overview of the Early Campaign Diagnostics for the SPARC Tokamak. *Review of Scientific Instruments,* 95, 103518 (2024)
3) Reinke, M.L. *et al.* The role of peer review in the pursuit of commercial fusion energy. *Physics of Plasmas,* 30 100603 (2023)

EX-Fusion

Private Facility: eX-Fusion Continuous Operation Laser Reactor (XF-COLR), Hamamatsu, Japan

Private Facility Point of Contact: US: Max Monange (US Operations Manager), max_monange@ex-fusion.com**, Japan:** Yoshitaka Mori (CTO), yoshitaka_mori@ex-fusion.com

Facility Description: The facility integrates key components of Inertial Fusion Energy (IFE) research. It includes two laser systems designed to mimic different aspects of fusion reactions:

1. Implosion-Mimic Laser: A four-beam, 0.53 μm wavelength laser capable of delivering 4 J per 10 ns pulse at 10 Hz.
2. Heating-Mimic Laser: A two-beam system with a 0.8 μm wavelength, delivering 2TW: 0.2J per 100 fs pulse at 10 Hz. Upgrades are planned to achieve 10 TW (0.6 J/60 fs).
3. The facility also houses a repetitive-target delivery system, which features a 10 Hz free-fall bead pellet injector and a laser illumination chamber to support high-energy density experiments.

These capabilities are geared toward advancing plasma physics and fusion energy research by enabling precise, repetitive experiments.

Timeline: The facility is currently operational with the following systems:

- Implosion-Mimic Laser: 0.53 μm wavelength, 0.7 J, 9 ns, 10 Hz, four-beam configuration.
- Heating-Mimic Laser: 0.8 μm wavelength, 0.2 J, 100 fs, 10 Hz, two-beam configuration.
- Pellet Injector: 10 Hz free-fall system for φ1 mm SUS beads.

An upgrade to the laser systems is planned for FY2025:

- Implosion-Mimic Laser: Increase to 4 J, 7 ns, 10 Hz.
- Heating-Mimic Laser: Increase to 10 TW (0.6 J/60 fs, 10 Hz).

The experimental schedule is flexible and can be discussed with potential collaborators.

Available Measurements: X-ray Pinhole Imaging: Capable of measuring the plasma temperature of laser-illuminated pellets.

Research Topics of Interest: High Energy Density Physics: Focusing on plasma dynamics, shockwave propagation, and fusion-relevant material interactions under extreme conditions.

Desired Measurements: PFR collaborators are welcome to contribute additional diagnostics to the illumination chamber.

Focused Energy

Private Facility: IFE Laser Demonstration Facility, Alameda, CA

Private Facility Point of Contact: Pravesh Patel, Chief Technology Officer, pravesh.patel@focused-energy.world

Facility Description: The IFE Laser Demonstration Facility will house a minimum of two kilojoule (kJ) class, enhanced shot-rate (shot/min) laser systems – one long-pulse (ns) and one short-pulse (ps), enabling studies of a broad range of inertial fusion energy (IFE) concepts, including direct-drive central hotspot, shock ignition, and fast ignition. Two unique capabilities of this facility will be (1) the first kJ-class broadband, 3w long-pulse laser specifically designed to study laser-plasma instability (LPI) mitigation – a critical requirement for laser-based IFE, and (2) an enhanced shot-rate of a shot/min at high laser energy, providing a capability to collect large experimental datasets suitable for parametric studies and statistical analysis. Targetry, diagnostic, control, and data analysis systems able to operate at this enhanced shot-rate will need to be developed. Focused Energy envisions providing access to the facility to collaborators and potentially external users.

Timeline:
01/2025: Facility acquisition
05/2026: Construction complete
06/2026: First light at low energy
03/2027: Long-pulse laser system installed and commissioning
06/2027: Long-pulse laser operations
07/2027: Short-pulse laser system installed and commissioning
10/2027: Combined long-pulse and short-pulse laser operations

Available Measurements: Standard suite of optical, x-ray, and nuclear diagnostics for both long-pulse and short-pulse laser-irradiation of solid target experiments (i.e., VISAR/SOP, optical probing, backscatter, XUV and x-ray imaging and spectroscopy, proton magnetic spectrometers and imagers).

Research Topics of Interest: Laser-plasma instability (LPI) measurement and mitigation using broadband 3w laser pulses, proton acceleration and focusing studies relevant to proton fast ignition, diagnostic development for high-repetition rate IFE implosion facility

Desired Measurements: Numerous diagnostics and measurement techniques developed for OMEGA, NIF, and small-scale facilities (e.g., LaserNetUS facilities) would be valuable to field at this facility. Of particular interest would be the development of a new generation of diagnostics operating at enhanced shot rates (e.g., shot/min). This requires the replacement of existing film, image plate, radiochromic film, or CR-39 track detectors with fully electronic detectors.

General Fusion

Private Facility: Lawson Machine 26 (LM26), Richmond, BC Canada

Private Facility Point of Contact:

Patrick Ellis, Strategic Partnerships Manager,
Patrick.Ellis@GeneralFusion.com

Facility Description:

General Fusion's LM26 will electromagnetically compress a solid lithium cylinder around a plasma to achieve 10 keV plasma temperatures by 2025 and the Lawson criterion by 2026. The core components of the machine are a plasma injector that forms a spherical tokamak, the solid lithium cylinder, and an electromagnetic theta pinch compression system.

Plasmas are formed via coaxial helicity injection into a compression vessel. The plasma injector for LM26 has been operational since 2017. Some parameters of the injector are shown in Table 1.

Electrical current conducted to the theta pinch coils drives the liner inwards, collapsing the plasma against a conical center section compressing the plasma, thus increasing its density, temperature, and magnetic field. The plasma injector and compression system both use large capacitor banks with 5 MJ and 18 MJ of energy, respectively. The compression experiments last about 5 ms and will be conducted once per week. In the final configuration, density will increase from 5x1020 m-3 to 5x1023 m-3, core temperature from 300 eV to 10-20 keV and core magnetic field from 0.5 T to 30-100 T

Parameter		Value Range
Major Radius	R	0.6-0.7 m
Minor Radius	a	0.3-0.4 m
Poloidal Flux	Y_{ct}	0.12 – 0.25 Wb
Plasma Current	I_P	0.3-0.6 MA
Shaft Current	I_s	1.0-1.2 MA
Plasma Density	n_e	$1x10^{19}$-$4x10^{19}$ m^{-3}
Temperature	$T_e \sim T_i$	100-450 eV
Thermal Confinement Time	τ_E	5-15 ms

Table 1 – GF Plasma Injector Parameters

Although LM26 is a unique MTF demonstration, it features components common to both MCF and ICF concepts including pulse power design, plasma formation, plasma-wall interactions, and extensive diagnostics for both plasma and solid compression geometry.

Timeline:

The LM26 machine assembly is nearing completion. Operations are expected to begin in early 2025. General Fusion anticipates weekly compression experiments will be conducted on LM26 throughout 2025 and 2026.

Available Measurements:

Measurement	Diagnostic	Quantity
Magnetics	Mirnov coils	20 probes on shaft
n_e	Interferometer	5 chords
	AXUV (multi-filter AXUV diodes)	4 chords
T_i	Visible-UV ion Doppler spectrometer	1 chord
Neutrons	Scintillators	To be determined
	Activation foils, ^{3}He detectors	To be determined
Impurities, Z_{eff}	Survey spectrometer	4 chords
	Filterscopes	4 chords
Radiated power	Unfiltered AXUV diodes (bolometer)	6 chords

Research Topics of Interest:

Lithium-Plasma interactions, plasma stability modelling, beta limit modelling, neutron measurement and validation, dynamic plasma modelling and simulation, plasma compression, pulsed power design and optimization

Desired Measurements:

Measurement	Diagnostic	Quantity
Faraday Rotation	Polarimeter	TBD
Edge Profile	Reflectometer	TBD
T_e	Thomson scattering (including n_e)	1 laser line up to 8 temporal points
Edge	Langmuir Probe	TBD
	Pulse Height Analyzer	TBD
	X-ray imaging crystal spectrometer	1 chord
T_i	Neutron Particle Analyzer	TBD
	Neutron emission spectrometer	1

Kyoto Fusioneering Ltd.

Private Facility #1: Kyoto FLiBe Loop (KFL), Kyoto, Japan

Private Facility Point of Contact: Yushi Daito, Program Lead, y.daito@kyotofusioneering.com
CC: Carli Smith, US-based Technical Point of Contact, c.smith@kyotofusioneering.com

Facility Description:

The Kyoto FLiBe Loop (KFL) is a lab-scale test facility owned and operated by Kyoto Fusioneering Ltd. (KF) and located at Kyoto University. It is a forced convection molten salt loop equipped with a FLiBe refining system, enabling a variety of research activities. KFL is designed to operate at temperatures of up to 650°C with a total FLiBe inventory of 8 kg, supporting investigations into the topics outlined in the "Research Topics of Interest" section.

Table 1 contains a list of the key facility attributes.

Parameter	Value
Footprint	2.8 m x 3.0 m
Pipe Size	½-inch
Heating Power	500 W
Coolant	FLiBe ($Li_2[BeF_4]$)
Inventory	0.4 L (dump tank), 0.7 L (pipe volume)
Capacity of Test Cell	No.1: 0.1 L No.2: 0.3 L No. 3: 0.4 L
Temperature	500-600 °C
Flow Rate	0.04 L/min
Design Pressure	0.4 MPa (gauge)
Materials	Inconel 600 (piping) SS304 and SS316 (pump)
Pump Specification	Vertical centrifugal pump (modified water pump), 2.2kW
Impurity Control	Vapor trap

Table 1: Facility Attributes

Timeline: KFL has been constructed and installed at Kyoto University, and FLiBe procurement is underway. The following timeline outlines the steps to achieve full operation:

2025 – 2026: Basic testing for scale-up: Fill the Loop with FLiBe for test run to check pump flow performance, material corrosion behavior, hydrogen isotope extraction, and purification.

2027 – 2028: Scale-up (tentative based on results up to that point).

Available Measurements:

KFL is equipped with a thermometer, a liquid level gauge, and a pressure gauge, and can measure the following parameters:

- Temperature of molten FLiBe
- Surface temperature of material (piping, flanges, test cell, pump, valve)
- Liquid level (tank, test cell)
- Cover gas pressure
- Pump speed

There is no flowmeter; however, it is possible to estimate the flow rate from the heater input work and the resulting temperature change in FLiBe.

Research Topics of Interest:

Areas of interest where public expertise will be beneficial are:

- FLiBe safety
- FLiBe purification techniques
- Thermal hydraulics and chemical properties of FLiBe
- Corrosion under flowing conditions
- Compatibility of SiC composites with FLiBe
- Development of technologies for tritium extraction, accountability, and permeation
- Development of novel coating techniques for materials
- Development of heat exchanger materials, and
- Corrosion product analysis.

Using deuterium as a surrogate for tritium, these experiments will complement those conducted at Kyoto Lithium Loop (KL3) and UNITY-1 (refer to KF-UPJ-PS-B-90001 for KL3 SMI and KF-UPJ-PS-B-90002 for UNITY-1 SMI). Comparative analysis of these experiments will provide valuable insights into the development of various blanket and coolant systems. The primary goal is to optimize both the tritium breeding ratio and heat capture efficiency for different fusion device concepts. This research is essential for enhancing fusion reactor performance, achieving tritium self-sufficiency, and maximizing energy capture.

Desired Measurements:

The following measurements are desired for the purpose of analyzing the composition of FLiBe:

- LECO oxygen analyzer
- Inductively Coupled Plasma (ICP) analyzer
- Absorption cell for in-loop absorption spectroscopy of FLiBe
- Mass spectrometer and pumping system for analyzing the extracted deuterium stream

References

[1] Kyoto Fusioneering. “Advancing Fusion Technology: Kyoto Fusioneering’s Approach to Accelerating Commercial Viability.” 2024. p. 55. WHITE PAPER | Kyoto Fusioneering
[2]https://conferences.iaea.org/event/345/contributions/29909/attachments/15871/26696/Holmes_paper.pdf
[3] (PDF) FLiBe Molten Salt as a Tritium Breeder/Coolant for Fusion: Fostering Collaboration for Breakthrough Progress (researchgate.net)
[4] (PDF) Safety Considerations Associated with FLiBe as an Advanced Breeder-Coolant for Fusion Tritium Breeding Blankets (researchgate.net)

Desired Measurements:

Kyoto Fusioneering Ltd.

Private Facility #2: Liquid Lithium Coolant Loop, Kyoto, Japan

Private Facility Point of Contact:
Satoshi Ogawa, Program Lead, s.ogawa@kyotofusioneering.com
Naoki Seki, Engineering Lead, n.seki@kyotofusioneering.com
CC: Carli Smith, US-based Technical Point of Contact, c.smith@kyotofusioneering.com

Facility Description:

The Kyoto Liquid Lithium Loop (KL3) is a lab-scale forced convection liquid lithium loop with an inventory of 3.7 kg of molten lithium. It is being constructed from 9Cr-1Mo ferritic steel and nickel- free steel (SS430), which will allow for relatively high operating temperatures compared to previous loop operations. Impurity levels in the loop will be controlled via a series of cold traps. Flow rates through the corrosion test sections of KL3 are expected to be approximately 10 L/min.

Table 1 contains a list of the key facility attributes.

Parameter	Value
Footprint	2.1 m x 1.7 m
Pipe Size	½-inch
Heating Power	3.1 kW
Coolant	Li
Inventory	7 L (dump tank), 0.7 L (pipe volume)
Temperature	600 C
Flow Rate	10 L/min
Design Pressure	0.4 MPa
Materials	9Cr-1Mo (pipes), SS430 (small pipes), SS316 and SS304 (other components)
Pump Specification	EMP, 2.6 kVA
Impurity Control	Vapor trap

Table 1: Facility Attributes

Timeline: KL3 is currently in production and is anticipated to be commissioned between Q3 and Q4 in 2025. A more detailed timeline will be finalized in the coming months.

Available Measurements:
KL3 is equipped with a thermometer, level gauge, pressure gauge, and electromagnetic flow meter, and can measure the following parameters:

- Temperature of molten Li
- Surface temperature of material (piping, test cell, pump, drain tank)

- Liquid level (test cell, drain tank)
- Cover gas pressure
- Li flow rate

Research Topics of Interest:

- Material compatibility with liquid Li
- Corrosion studies under flowing conditions
- Corrosion product analysis
- Impurity removal in liquid Li
- Development of novel coating techniques
- Hydrogen extraction
- Cavity protection for pumps
- High-temperature vanadium alloy test section
- High-temperature vanadium blanket module flow channel

Using deuterium as a surrogate for tritium, these experiments will complement those conducted at Kyoto FLiBe Loop (KFL) and UNITY-1 (refer to KF-FLB-PS-B-10001 for KFL SMI and KF-UPJ-PS-B-90002 for UNITY-1 SMI). Comparative analysis of these experiments will provide valuable insights for the development of various blanket and coolant systems. The goal is to optimize both the tritium breeding ratio and heat capture efficiency across different fusion device concepts. This work will be crucial for improving the performance of fusion reactors, ensuring higher tritium self-sufficiency, and enhancing overall energy capture. The evaluation of electrolysis-based tritium extraction processes is also of interest. Further experiments within the KL3 will help assess the long-term viability of electrode materials under flowing lithium conditions, advancing the development of efficient tritium extraction methods crucial for future fusion reactors. Learn more about research of interest in reference [1].

Desired Measurements:

The following measurements/diagnostics are desired for KL3:

- Li leak detector in the system from the risk of high reactivity with air/water.
- Corrosion measurement for metal components such as piping.
- Temperature control inside Li glovebox is due to high thermal conductivity of Li.

References:

[1] Kyoto Fusioneering. “Advancing Fusion Technology: Kyoto Fusioneering’s Approach to Accelerating Commercial Viability.” 2024. p. 55. WHITE PAPER | Kyoto Fusioneering
[2] KYOTO FUSIONEERING: MATERIALS COMPATIBILITY TESTING
[3] "Evaluating Lithium Compatibility for Electrode Materials Used in an Electrolysis-Based Tritium Extraction Process". https://infuse.ornl.gov/news/fy2023-awards-announced-by-doe/

Kyoto Fusioneering Ltd.

Private Facility #3: Unique Integrated Testing Facility 1 (UNITY-1), Kyoto Research Center (KRC), Kumiyama, Kyoto, Japan

Private Facility Point of Contact:

Satoshi Ogawa1, Program Lead, s.ogawa@kyotofusioneering.com, CC: Carli Smith, US-based Technical Point of Contact, c.smith@kyotofusioneering.com

Facility Description:

UNITY-1 is a non-radiological blanket component test facility that will elevate the technology readiness level of fusion blanket and power generation technologies, and perform non-nuclear qualification to close technology gaps and enable a risk-reduced path to a Fusion Pilot Plant on a decadal timeframe.

UNITY-1 will demonstrate the following:

- Containment and circulation of high temperature and pressure prototypic breeder and coolant fluids (LiPb) coupled to first wall and blanket prototypes. Blanket modules to be tested are in the range of full-scale for those planned in many of the magnetic confinement plasma devices such as tokamaks and stellarators. Typically, 1 m^2 at the relevant heat extraction from 1 MW/module energy density.
- High temperature heat extraction and power generation from a ~1000°C circulating LiPb loop for high thermal efficiency and to demonstrate driving other high-temperature processes using this thermal energy. Intermediate heat exchangers will also be developed and tested to meet the specifications of the blankets and fluids. Heat extraction from wet-wall chambers typically considered for inertial confinement concepts can also be tested with adequate interface.
- Structural integrity and longevity of components under FPP-relevant conditions, including stability under 4 T magnetic fields, MHD pressure drop caused by a flow of conductive fluid, mechanical stresses, and temperature gradients, as well as demonstrating material compatibility with coolants.
- Performance of blanket components and safety systems across accident scenarios, such as loss of flow, coolant loss, and blackout. Actual operation experience and possible off-normal events and deviations will be facilitated to identify the operational risks and their mitigations, which will be essential for safety analysis and licensing processes.

Table 1 contains a list of the key facility attributes. Additional information about the facility can be found in [1].

Parameter	Value
Footprint	12 m x 25 m
Piping size	1½ inch
Coolant	Li17-Pb83
Inventory	450 L
Magnetic field	4 T
Temperature	300 – 1000°C
Flow rate	50 L/min
Design pressure	0.5 MPa
Piping materials	SS316 (up to 500°C), SiC_f/SiC (up to 1000°C)
Other materials	SiC_f/SiC, Mo
Pump specification	EMP, 91 kVA, ~0.5% efficiency
Impurity control	Cold trap

Table 1: Facility Attributes

Timeline: As the UNITY-1 facility is not yet fully operational, we have provided an anticipated timeline for construction, commissioning, and start of operations for different subsystems in Figure 2.

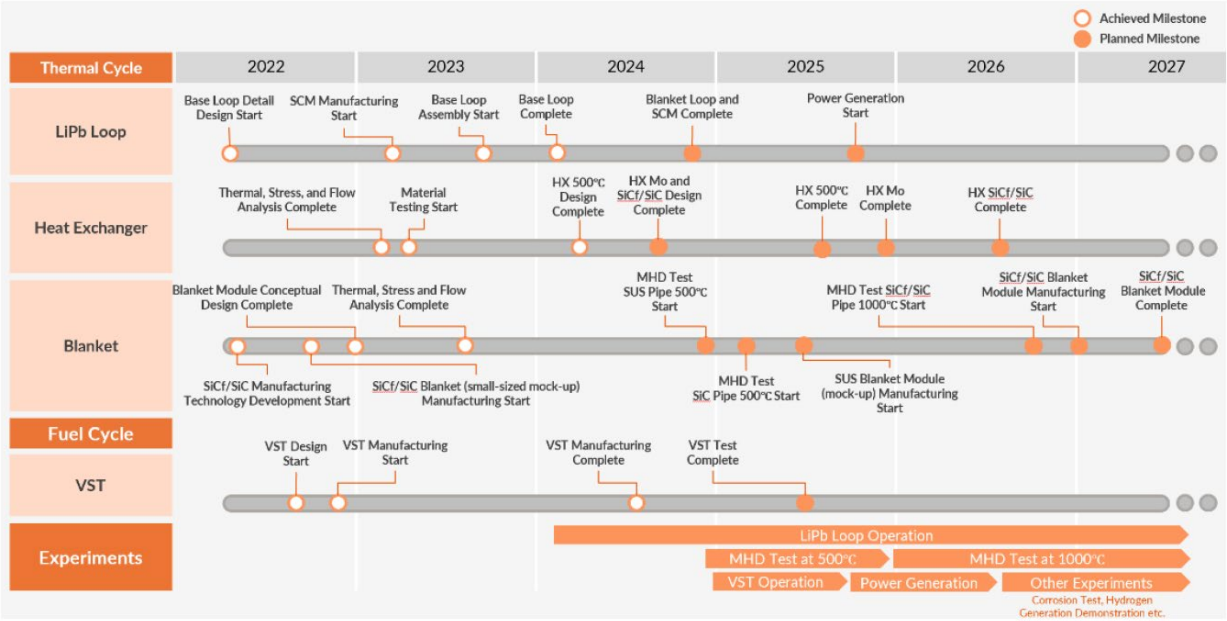


Figure 2: Current UNITY-1 timeline

Available Measurements: KF's diagnostic technologies will be integrated in the LiPb loop. These include: a ceramic hydrogen sensor for analysis of hydrogen concentrations in LiPb, pressure indicators for indirect pressure measurements at high temperature, temperature

measurement techniques for piping and components, and continuous measurements of LiPb using level indicators.

Research Topics of Interest: Public sector expertise will be beneficial in the realms of:

- Material compatibility in liquid blanket systems
- MHD studies and multiphysics interactions of various fusion blanket conditions along with thermal hydraulic validation
- Hydrogen extraction
- Coolant loop operational procedures
- Pump development

Using deuterium as a surrogate for tritium, these experiments will complement those conducted at Kyoto FLiBe Loop (KFL) and Kyoto Liquid Lithium Loop (KL3) (refer to **KF-FLB-PS-B-10001** for KFL SMI and **KF-UPJ-PS-B-90001** for KL3 SMI). Comparative analysis of these experiments will provide valuable insights into the development of blanket and coolant systems, with a particular focus on optimizing tritium breeding ratio and heat capture efficiency across different fusion device concepts. This research will be essential for improving fusion reactor performance, ensuring greater tritium self-sufficiency, and enhancing overall energy capture.

Desired Measurements: If supplied by a PFR collaborator, KF is interested in integrating diagnostics/sensors that can measure:

- Tritium inventory/hydrogen concentrations
- MHD pressure drops
- Volumetric heating for liquid metal blanket mockups

References

[1] Kyoto Fusioneering. "Advancing Fusion Technology: Kyoto Fusioneering's Approach to Accelerating Commercial Viability." 2024. pp. 22-30. WHITE PAPER | Kyoto Fusioneering
[2] Takeda, S., Ogawa, S., Tabuchi, M., Kume, Y., Pearson, R., … Baus, C. (2023). UNITY: Kyoto Fusioneering's Unique Integrated Testing Facility for Fusion Power Generation. Fusion Science and Technology, 79(8), 1059–1064. https://doi.org/10.1080/15361055.2023.2176689

Kyoto Fusioneering Ltd./Fusion Fuel Cycles Inc.

Private Facility: Unique Integrated Testing Facility 2 (UNITY-2), Building 215, 286 Plant Rd, Chalk River, ON K0J 1J0, Canada

Private Facility Point of Contact: Ian Castillo ian.castillo@cnl.ca; cc: info@ffc.inc

Facility Description:

UNITY-2 is a radiological fuel cycle test and user facility to be constructed in a tritium-licensed building at Chalk River Laboratories, a 9,100-acre nuclear site in Ontario, Canada. It is being developed by Fusion Fuel Cycles Inc, a joint venture between Kyoto Fusioneering (KF) and Canadian Nuclear Laboratories (CNL). The asset owner is the Atomic Energy of Canada Limited (AECL). Fusion Fuel Cycles (FFC) has been granted the sole license to direct all operations and strategy.

Fusion Fuel Cycles Inc. (FFC) is a private Canadian joint venture that combines Canadian Nuclear Laboratories' (CNL) expertise in tritium processing and handling with Kyoto Fusioneering's (KF) fusion fuel cycle plant technology. Together, they aim to deliver safe and efficient tritium fuel cycle systems for fusion programs worldwide. Based in Chalk River, Ontario, Canada, FFC will build and operate UNITY-2, addressing critical tritium processing science and technology gaps to support the development of a fusion pilot plant (FPP) within a decade.

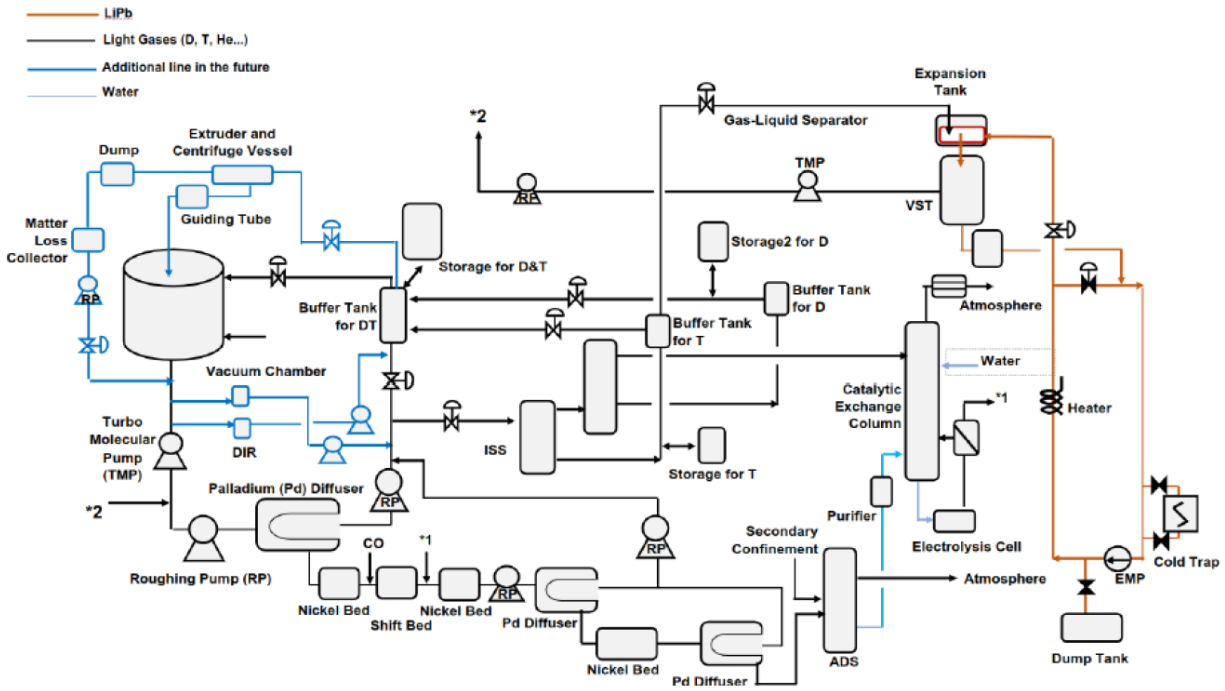
UNITY-2 plays a pivotal role in fusion energy research by establishing operation schemes of the complete tritium fuel cycle under simulated conditions of the gas management in a fusion plasma devise. The Facility achieves vacuum condition with a steady-state fueling rate of 2.5 $Pa \cdot m^3/s$ of D-T gas. This allows for continuous operation of the fuel cycle system at a pilot scale, making it an essential platform for advancing
tritium-handling technologies.

The following is a list of key facility capabilities:

- **Fueling and Pumping:** UNITY-2 operates with a vacuum vessel designed to mimic the vacuum conditions of steady-state fusion pilot plants, equipped with a tritium-compatible continuously working exhaust pumping system (vacuum < 1 Pa) comprising high vacuum and connected backing pumps.
- **Direct Internal Recycling and Pellet Injection:** The facility features an advanced Direct Internal Recycling system that extracts hydrogen isotopes from the exhaust stream, recycling up to 80% of the fuel directly back into the system. This reduces the tritium inventory and processing times. Recovered isotopes are supplied to the Pellet Injection System, which is capable of maintaining a steady-state pellet injection rate of 2.3 $Pa \cdot m^3/s$ and peak rates of up to 27.5 $Pa \cdot m^3/s$ to ensure effective plasma penetration.

- **Inner and Outer Cycle Loops:** UNITY-2's inner cycle processes the exhaust gases, separating remaining hydrogen isotopes and converting tritiated gases such as CQ4 and NQ3 into usable Q2. The outer cycle handles gases that could not be processed by the inner cycle, utilizing an Air Detritiation System, Water Detritiation System, and Isotope Separation System to purify and recycle gases. The outer cycle ensures that tritium releases are kept below 200 GBq per year.
- **Fuel Management:** UNITY-2 includes secure hydrogen isotope storage systems with metal hydride beds (uranium and zirconium-cobalt), which provide safe storage of tritium. The combined storage capacity exceeds the 30 g tritium inventory limit, with systems in place to rebalance D-T fuel mixtures.
- **Lithium-Lead (LiPb) Loop and Tritium Extraction:** UNITY-2 features a LiPb loop that mimics the breeder cycle, for understanding tritium-LiPb interaction and testing tritium extraction technologies.
- **Diagnostics, Monitoring and Inventory Tracking:** UNITY-2 incorporates advanced tritium diagnostics like Raman spectroscopy, quadrupole mass spectrometry, and micro-gas chromatography, providing continuous online analysis of tritium concentration for operational safety and measuring fuel cycle efficiency. This is to support ongoing tritium accountability measures.

Figure 1: UNITY-2 Process Diagram



Timeline: The conceptual design phase of UNITY-2 was completed at the beginning of 2024 and the detailed design phase will be completed in 2025, with the procurement of key components

and systems beginning immediately thereafter. Testing of some of the key components such as tritium compatible vacuum pumps has already started. Integration of these systems is expected to be achieved along with inactive and active commissioning. UNITY-2 will start with an inactive phase and then smoothly transition into active commissioning by stepwise increasing tritium concentrations in the facility with testing operations expected to be available in late 2026.

Available Measurements:

FFC diagnostic technologies will be integrated throughout UNITY-2. These include:

- Raman Spectroscopy for tritium concentration
- Gas composition analysis via:
  - Quadrupole Mass Spectrometry
  - Gas Chromatography
- Hydrogen Isotope concentrations, flows, pressures and temperatures through a full closed tritium fuel cycle
- LiPb tritium extraction measurements from vacuum sieve tray technology
- Tritium accountability (transfer rates and inventory) throughout the system in the form of experimental data and modeled simulations

Research Topics of Interest:

- Tritium tracking in steady and dynamic state conditions towards real-time inline and online accountancy for the different loops
- Deuterium-tritium fuel cycle performance for fuel utilization, confinement, extraction, and separation across all unit operations
- Validation and verification of individual and combined unit operation performance characteristics for internal recycling, tritium balancing during storage, and environmental exhausts
- Tritium permeation throughout a full cycle with liquid breeder material, including extraction efficiencies
- Limits for upset and safe operating conditions in a closed fuel cycle, with simulated pure and impure streams
- Material degradation of breeder and coolant streams

Desired Measurements:

- Tritium extraction, inventories and accountancy in pure lithium or solid breeder loops if supplied by PFR collaborator
- Integration and testing of alternative advanced technologies for unit operations if supplied by collaborators

Marathon Energy

Private Facility: Advanced Fuel Cycle Technologies Testbed, 747 Clementina Street
San Francisco, CA 94103

Private Facility Point of Contact: Adam Rutkowski, adam@marathonfusion.com

Facility Description:

The Advanced Fuel Cycle Technologies Testbed will be a state-of-the-art facility designed to facilitate research and experimentation in critical domains of fusion fuel cycle technology. This facility will concentrate on the development, evaluation, and characterization of components essential for advanced fusion fuel handling systems, including:

,

- **Superpermeable Pumps:** Evaluation of advanced superpermeable pumps for efficient tritium management, with an emphasis on enhancing permeability performance, reliability, and integration within fusion systems.
- **Plasma Centrifuge-Based Pumping and Separation Systems:** Development of plasma centrifuge technologies that enable efficient separation and pumping for fuel processing, thereby contributing to the effective recycling of fusion fuels.
- **Fuel Injection Technologies:** Investigation of innovative fuel injection methods aimed at optimizing the delivery of hydrogen isotopes into the fusion plasma, thereby enhancing plasma fueling efficiency.

These capabilities will provide an essential platform for researchers to advance innovative technologies and evaluate fuel cycle components under conditions that approximate those of future fusion reactors. The primary goal of this facility is to investigate currently early-stage (TRL 1-5) concepts specific to the requirements of fusion systems, rather than characterizing more mature technologies, such as tritium-compatible versions of existing pumping systems.

Timeline: A superpermeable pump test stand and a plasma centrifuge test stand have already been constructed. Expansion of the existing facility to include additional testbeds will proceed in 2025, with a more complete facility available for collaborative work by 2027.

Available Measurements: Existing diagnostic capabilities include the following:

- Gas composition and isotope analysis for monitoring of protium and deuterium flows and vacuum system characterization
- High-resolution pressure and flow rate measurements for evaluating pumping systems
- Plasma diagnostics to assess the performance of superpermeable pumps, plasma centrifuges, and fuel injection systems, including optical emission spectroscopy, Langmuir probes, atomic neutral probes, and interferometric velocity measurements
- Auger electron spectroscopy for surface composition analysis of materials used in fusion systems

Research Topics of Interest: The facility aims to address several research areas where public science and technology expertise can provide significant contributions.

- Optimization of fuel cycle efficiency, encompassing advanced pumping and separation techniques
- Development of high-throughput, low-loss plasma fuel handling systems
- Characterization of the performance of fuel injection technologies

Desired Measurements: The facility is interested in acquiring additional diagnostics to further augment research capabilities. These diagnostics include:

- X-ray Photoelectron Spectroscopy (XPS): To analyze surface chemistry and composition of superpermeable pump materials, helping to characterize contamination sources and improve long term performance.
- Inductively Coupled Plasma Mass Spectroscopy (ICP-MS): To characterize outputs of isotope separators, including for lithium isotope separation.
- Infrared Thermography: For thermal imaging of components to monitor heat loads, material responses, and identify hotspots that could affect component longevity and performance.
- High-Resolution Quadrupole Mass Spectrometry: For precise isotope separation analysis, essential for evaluating plasma centrifuge efficiency and optimizing separation processes.

OpenStar Technologies

Private Facility #1: "Junior", Wellington, New Zealand

Private Facility Point of Contact: Thomas Berry: thomas@openstar.nz

Facility Description: OpenStar Technologies have constructed a levitated dipole experiment, "Junior", comprising a 5.6 Tesla, REBCO high-temperature superconducting magnet housed inside a 5.2-metre diameter vacuum vessel. Plasma formation and heating is achieved with < 50 kW of multi-frequency ECH ranging from 2.45 to 10.5 GHz. Junior provides an ideal platform for investigations of planetary magnetospheres and space plasmas, as well as the research and development of prototype fusion technologies.

Plasma dynamics in a levitated dipole resemble planetary magnetospheres and are uniquely simple for a laboratory confinement device due to the lack of toroidal magnetic field. The magnetic topology does not evolve in time, and the absence of parallel currents eliminates current-driven instabilities, density limits, and beta limits. These properties make plasma dynamics relatively easy to model. Bounce-averaged models with reduced dimensionally and complexity can be employed for low frequency turbulent dynamics, and access to high beta allows direct comparison to related eXorts to understand turbulence in planetary magnetospheres and to simulate space weather.

The large vacuum vessel and lack of interlocking coils in the levitated dipole make it a flexible platform as a user facility. Additional diagnostics and instrumentation are easily facilitated on the vessel allowing it to be used for a wide-range of investigations. As a testbed for fusion technologies, Junior could be used to investigate plasma heating methods, diagnostics development, and long-pulse real-time control and data acquisition systems.

Timeline:

Facility currently undergoing final stages of commissioning. Full-magnetic field and full-power operations commencing early 2025. Plan to run in two-month campaigns, with month-long machine upgrades in between.

Available Measurements:

- Microwave interferometry
- Magnetics: flux loops, Bp coils, Mirnov coils
- Photons: cameras, x-ray detectors (hard and soft), UV-vis spectroscopy, photodiode arrays
- Probes: saturation, floating potential, edge fluctuation, Langmuir (single, double, triple)

Research Topics of Interest:

- Plasma heating methods (ICRF, charged ion beams, transit time magnetic pumping)

- Spin polarized fuels (pellet injection / beam injection)
- Turbulent transport in magnetized plasmas

Desired Measurements:

- Thomson scattering
- Phase contrast imaging
- Bolometry
- High-resolution x-ray spectroscopy for plasma rotation

OpenStar Technologies

Private Facility #2: "Tahi", location TBD

Private Facility Point of Contact: Thomas Berry: thomas@openstar.nz

Facility Description: OpenStar Technologies is building an experiment, "Tahi", to investigate the plasma physics of levitated dipole reactors at fusion relevant densities and temperatures. Previous experiments have investigated the good confinement properties of dipole plasmas but lacked the plasma heating power to achieve high densities and high ion temperatures. Tahi will provide a platform to investigate both fusion-relevant plasma physics and engineering.

Regarding plasma physics, understanding turbulent transport and energy cascades in magnetized plasma requires understanding both mode-mode coupling and the kinetic effects that couple fluctuations to particle phase-space flows. Nonlinear simulation, based on gyrokinetic theory, has become a promising approach to understand turbulence in fusion devices. However, when these models of turbulence are quantitatively compared to observations, at multiple scales and physical conditions, uncertainties and questions arise involving complex nonlinearities, dissipation processes, and the proper formulations of predictive modes. Levitated dipoles provide a platform to study turbulence in a steady-state regime across an extreme range of scales, helping to develop a predictive understanding of magnetized plasma turbulence, as well as turbulence effects in burning plasmas such as the coupling between zonal flow formation and the production of energetic ions. Furthermore, levitated dipoles have a simple magnetic geometry with no toroidal field or shear flow, allowing for experimental validation of modelling tools in a simplified geometry. In particular, the shear-free edge of a dipole plasma can be used to validate edge physics models, helping to understand the complex dynamics of scrape off layer physics and pedestal formation in magnetic confinement devices.

Regarding engineering, Tahi will consist of a 6-metre diameter vacuum vessel, a ~20 Tesla (peak field) magnet, and employ megawatt-scale auxiliary heating systems comprised of ECH and direct ion heating such as ICF and/or NBI. The exact specification and combination of heating systems is yet to be finalized. The large vacuum vessel surface area and low operational cost makes levitated dipoles desirable as user facilities, enabling the development and testing of fusion technologies such as:

- Plasma diagnostics
- Plasma heating systems
- Materials/plasma facing component/divertor power handling testing

Timeline: Design, planning, and site scoping process currently underway. Planned for construction and commissioning completed by end of 2026. Operational as user facility 2027.

Available Measurements:

- Thomson scattering
- Neutron spectroscopy

- Phase contrast imaging
- Charge exchange recombination spectroscopy
- Bolometry
- Interferometry
- Magnetics: flux loops, Bp coils, Mirnov coils
- Photons: cameras, x-ray detectors (hard & soft), UV-vis spectroscopy, photodiode arrays
- Probes: saturation, floating potential, edge fluctuation, Langmuir (single, double, triple)

Research Topics of Interest:

Being the first levitated dipole capable of achieving fusion-relevant conditions, Tahi will be the singular reference point for the design of future levitated dipole reactors. Therefore, there is interest in utilizing public S&T expertise for the development and understating of breakeven-class devices. Specifically:

- Integrated modelling
- Energetic ion physics
- Spin polarized fuels
- MW-scale plasma heating methods
- Diagnostics development

Desired Measurements:

- Alkali beam emission spectroscopy
- Heavy ion beam probe
- Turbulence measurements

Pacific Fusion

Private Facility #1: Demonstration System 1. Location: Fremont, CA

Private Facility Point of Contact: Alex Zylstra, Experiments Lead, alex@pacificfusion.com

Facility Description: Our first Demonstration System will be a single Impedance-Matched Marx Generator (IMG) pulser 'module', with an output power >1 TW. Our fusion energy facility will consist of many modules. Pacific Fusion is building this facility to develop our pulser technology.

Timeline: Mid 2025

Available Measurements: Electromagnetic probes

Research Topics of Interest: Pulser technology development, IFE reactor technology development, high-repetition-rate pulsed magnetic fusion energy systems, x-ray source generation.

Desired Measurements: X-ray emission power, spectroscopy, and imaging.

Pacific Fusion

Private Facility #2: Demonstration System 2 & 3. Location: San Francisco Bay Area

Private Facility Point of Contact: Alex Zylstra, Experiments Lead, alex@pacificfusion.com

Facility Description: Our Demonstration System (DS) will be the largest pulser facility in the world with the goal of achieving facility gain, i.e. more fusion yield than energy stored in the capacitors, and thereby demonstrating pulsed magnetic fusion (PMF). The DS will be based on the Impedance-Matched Marx Generator (IMG) technology and deliver >60 MA of current, when complete, to PMF targets with ~100-1000 ns pulse durations. Fusion yields per shot will be ~ 100 MJ. Additional key capabilities will include a high-energy laser for x-ray backlighting and preheating MagLIF-style targets, tritium fuel handling, cryogenic target capabilities, and a full suite of scientific diagnostics. Target fabrication will support our fusion capabilities; the facility will accommodate a range of targets relevant to fusion, high-energy-density physics, and other fields. Initial experiments will be conducted at lower current delivery ("DS2") with a ramp up to full capabilities ("DS3").

Timeline: Experiments expected as early as November 2027.

Available Measurements: Neutron diagnostics:

- Multiple orthogonal neutron time of flight
- Neutron activation
- Two equatorial orthogonal neutron imaging systems
- Nuclear burn history via Cherenkov and recoil particle methods
- Magnetic recoil neutron spectrometer

X-ray diagnostics:

- Two orthogonal x-ray self-emission imaging systems
- X-ray radiography
- X-ray burn history via filtered diodes and streak camera

Optical diagnostics:

- Interferometry
- Velocimetry

Research Topics of Interest: Diagnostic development, including the above instruments and additional systems; inertial fusion and high-energy-density physics experiments; computational modeling of experiments; high-yield facility modeling and systems engineering; fusion materials development and testing; reactor systems R&D including tritium breeding, chamber environment, and balance of plant.

Desired Measurements: The DS target chamber includes multiple 'spare' ports for additional instrumentation. Measurements that can improve our capabilities beyond the above in support of our fusion energy mission are most impactful.

SHINE Technologies, LLC.

Private Facility: FLARE, Location: Janesville, WI

Private Facility Point of Contact: Steve Burger, Vice President, Business Development
steveburger@shinefusion.com, (301) 461-2652

Facility Description:

SHINE is a global leader in design and development of high yield accelerator-based neutron generators and is currently operating a commercial irradiation facility in Janesville, WI. The facility, FLARE, provides a steady state deuterium-tritium neutron output with fluences that allow unique neutron and other fusion product-related research to be carried out. The neutron generator continuously creates a deuterium (D+) ion beam which is then accelerated to ~300 kV and magnetically focused into a target gas chamber filled with a mixture of gaseous deuterium and tritium (T2), thereby producing 14 MeV DT neutrons over the length of the gas target. A tritium purification system continuously recovers mixed D2 and T2 gas, chemically purifies and isotopically separates it, and supplies purified tritium back to the neutron generator to maintain the pressure of the target gas chamber. This allows for long duration, steady state operation. FLARE routinely generates fast of fluxes up to 4×10^{9} n/cm^{2}s (~1×10^{14} n/cm^{2} over one operating day), with 70% of the neutrons over 10MeV.

The relatively high flux, steady-state operation, and the DT fusion spectrum of FLARE make it a unique and powerful facility within neutron effects testing sites and ideal to address Science & Technology (S&T) gaps related to fusion neutronics. Studies can include neutron and gamma related degradation of diagnostic components; fusion product monitoring; and tritium breeding, handling, and accountancy. In addition, since FLARE is fundamentally steady state, it can also be used as a platform for developing non-invasive, fusion-relevant measurements for control and feedback in the presence of a relatively high neutron environment.

Timeline: Operating. FLARE is currently operational and is scheduling customers from the DoD, DOE laboratories, and commercial entities, subject to outages for pre-planned maintenance and facility upgrades. We anticipate that experimental research campaigns, modifications to the system, and maintenance periods will be established during contracting discussions and in collaboration with FLARE Business Operations.

Available Measurements: Currently we offer thermal, fast, and total neutron fluence measurements via multi-spectrum activation foils counted on a NIST-calibrated HPGe detector, as well as real-time neutron flux measured via calibrated Domino detectors. The

irradiation cavity has access ports such that other desired diagnostics can be installed by the User.

Research Topics of Interest: The areas of research and development at SHINE that would benefit from public S&T expertise can be broken into two general categories: Those that directly advance the mission of FES by helping to close identified gaps and those that help indirectly by increasing the output or efficiency of SHINE's FLARE technology.

Topics that directly address FES S&T gaps:

- Tritium Breeding: Experiments into tritium breeding ratios for various materials and prototype blanket technology will help to close gaps in blanket design.
- Tritium handling: Our steady-state tritium handling system is a good test bed for developing fuel cycle solutions.
- Fusion product diagnostics: Real-time, steady state monitoring of fusion products particularly ones that can distinguish between photons, fast neutrons, and thermal neutrons.
- Development and/or testing of radiation hardened diagnostics and sensors
- Development of minimally invasive integrated sensors and feedback control schemes.

Topics that indirectly address FES S&T gaps by increasing FLARE's neutron output are more open ended and can include research on the gaseous target such as incorporating a plasma window to decrease the amount of tritium that escapes the target chamber, as well as research into improving beam output or transport efficiency. Beam transport research could involve research into the ion source, beam optics, machine learning, remote sensing and automated control, and better beam characteristics measurements.

Desired Measurements: Fielding fusion product measurements, particularly such diagnostics that offer real-time, steady state monitoring of the various fusion products. The development of novel, minimally invasive diagnostics for the system as a whole. Some examples include tritium monitoring or accountancy diagnostics, non-invasive beam diagnostics, and other control related measurement techniques.

TAE Technologies, Inc., Foothill Ranch, CA

Private Facility #1: Norman
Private Facility #2: Neutral Beam Test Platform
Private Facility #3: Biasing Test Stand (BTS)
Private Facility #4: Copernicus

Private Facility Point of Contact: Hiroshi Gota, hgota@tae.com, Richard Magee, rmagee@tae.com

Facility Descriptions:

Norman/C-2W is TAE's fifth generation fusion reactor prototype, and the world's largest compact-toroid (CT) device. It creates a large volume, steady state, macroscopically stable FRC plasma embedded in a linear magnetic-mirror like external magnetic field [1]. Currently equipped with eight neutral beams (NBs) with total power up to 20 MW and with edge biasing, the FRC can be sustained for up to 40ms. All magnets and biasing electrodes can be operated with active feedback using a real-time plasma control system (RTPCS). Pellet injection and CT injector capabilities are available on the machine for fueling. Norman may also provide a unique and versatile platform to address some of the gap in the development of High Harmonic Fast Wave (HHFW) for plasma heating and Electron Cyclotron Resonance Heating (ECRH).

Neutral Beam Test Platforms are a set of facilities to test and characterize a neutral beam (NB) system and its parts, including ion source, beam line components, beam dumps, diagnostics, and power supplies. It can help with design validation and manufacturing demonstration, particularly with additive manufacturing.

Biasing Test Stand (BTS) is a dedicated facility to understand the issues related to the high voltage biasing of edge plasma for fusion devices. The BTS is designed to probe the main physics processes in the expander divertor and near electrode/target surfaces. It uses an RF system to create plasma and provides for a quicker vent cycle than conventional systems to exchange and test plasma facing components, including electrodes.

Copernicus will be TAE's sixth generation fusion platform with the goal to demonstrate plasma performance with hydrogen (protium isotope) that would make net-energy production in deuterium-tritium (D-T) isotope fuels feasible. Higher NB power, higher magnetic field, and better biasing and control capabilities will allow Copernicus to achieve higher plasma temperature and elevated plasma parameters for FRC fusion research.

Timelines:

Norman: Operating. The best time to pursue research on Norman will be in Q4 2024 and Q1-Q2 2025. Research may continue on Norman beyond that time in some form, but there is currently some uncertainty about machine availability beyond the first half of 2025.

Neutral Beam Test Platforms: Operating in a limited capacity. TAE will continue to build out and improve these capabilities to 2027 and beyond.

Biasing Test Stand (BTS): Operating. It will be available in the coming years — out to the end of 2027 and possibly beyond.

Copernicus: Under construction. It is not yet clear when it will be accessible to public researchers. Applications that would make use of its capabilities (including before the end of 2027) that can take place in parallel with TAE's bringing up the machine and performing initial experiments are welcome.

Available Measurements:

Norman: The diagnostic configuration of Norman comprises more than 75 operational systems. In addition to many magnetic probes, some other basics diagnostics on Norman are Thomson scattering, interferometers, and spectroscopy. A full list with details is available [2,3]. The thousands of signal channels produce a significant amount of data for every Norman shot, a large part of which it processes immediately after the shot for analysis.

Neutral Beam Test platforms: Other than offering the basic device and plasma diagnostics, these systems may have secondary electron emission (SEE) detectors, spectroscopy, electrical probes, energy analyzers, and wire calorimeters.

Biasing Test Stand (BTS): BTS has measurements of key plasma parameters and electrode conditions. This includes magnetic and electrical probe measurements, interferometers, fast
filter cameras, spectroscopy, etc.

Copernicus: Copernicus will have the full diagnostics suite available on Norman, albeit with significant upgrades and better coverage of the plasma.

Research Topics of Interest:

RF Heating: HHFW based plasma heating system has known challenges of coupling power across the scrape-ob-layer (SOL) to the core, which is also of interest to conventional toroidal devices (especially NSTX-U). ECRH heating in an FRC plasma would be of special interest to the fusion community as a way to stress-test models and develop novel launchers.

Fueling:

(a) The active pellet R&D program on Norman could be of interest to a broader fusion community, including for tokamaks. Large fast ion population in Norman's FRC plasmas, compared to the thermal population, can serve as a stand-in for fusion alphas to further the understanding of pellet ablation in the presence of energetic particles.

(b) TAE has developed an alternative fueling system known as Compact Toroid (CT) injection. This technique offers the attractive feature of core refueling, and a possibility of core refluxing. This platform obers the opportunity to both further develop this alternative fueling technique and to synergistically study the basic plasma physics of magnetic reconnection.
(c) Additionally, the neutral beam facilities provide numerous synergistic opportunities to develop novel beam-diagnostics or modes of beam operation.

Additive Manufacturing (AM): AM for fusion promises efficient, unibody design, reduced manufacturing costs, and faster production and iteration, but reliability and performance remain to be proven and require *in situ* testing. TAE's suite of NB Injectors on the Norman device and on the NB test platforms offer opportunities for the broader community to test AM produced internal NB components (e.g., grids, drivers, etc.) and NB dumps under high neutral particle fluxes. The plasma-facing component (PFC) material research on the BTS, focusing especially on the impact of high-energy plasma flows in the presence of large electric and magnetic fields, could advance the development of engineering solutions for first wall by allowing rapid iteration of PFC designs and diagnostics.

Magnet Systems: Advanced, high magnetic field systems are of wider interest and there is an opportunity to test these in operational facilities. These magnet systems might be copper, conventional LTS, HTS based or hybrid.

Diagnostics and Control: The synergistic development of diagnostics and new control methods (e.g., RTPCS), spurred on by the unique character of the FRC plasma, could lend itself to applications elsewhere.

Desired Measurements:

Norman: Internal magnetic field, turbulence/fluctuations, fast ion diagnostics, diagnostics using diagnostics NB. etc.

Neutral Beam Test Platforms: TBD

Biasing Test Stand (BTS): TBD

Copernicus: Upgraded Norman diagnostics suite

References:

[1] H. Gota *et al.*, Nucl. Fusion **64**, 112014 (2024).
[2] M. C. Thompson *et al.*, Rev. Sci. Instrum. **89**, 10K114 (2018).
[3] T. Roche *et al.*, Rev. Sci. Instrum. **92**, 033548 (2021).

Tokamak Energy Ltd.

Private Facility: ST40, 173 Brook Drive Milton Park, Abingdon OX14 4SD GB

Private Facility Point of Contact: Otto Asunta, otto.asunta@tokamakenergy.com

Facility Description: ST40 is a compact, high-field, spherical tokamak with copper magnets, designed, built and operated by Tokamak Energy. The main parameters of ST40 are: major radius Rgeo = 0.4 - 0.5 m, aspect ratios in the range A = 1.6 - 1.9, elongations and triangularities up to 2 and 0.6 respectively, plasma currents ranging from IP = 0.25 - 0.8 MA and on-axis toroidal magnetic fields of BT = 0.9 - 2.1 T. The maximum toroidal field value is over twice that of any other ST, and ST40 is uniquely placed to advance the ST physics basis. Plasma heating is provided by two neutral beams injected tangentially in the co-current direction that deliver approximately 0.9 MW at 55 kV and 0.7 MW at 24 kV when operated in deuterium. A 1 MW dual-frequency (104/137 GHz) gyrotron has been ordered and is due to be installed and work is on-going to extend the duration of the 24kV neutral beam to up to 140 ms.

Timeline: Operating. Planned maintenance outage in 2025 for upgrades to enable higher power ECRH and a lithium campaign. In the beginning of FY25, there will be a lithium powder dropper campaign followed by a year long scheduled maintenance period for most of FY26. The end of FY26 will incorporate a commissioning phase of all the upgrades installed during the maintenance period. The first half of FY27 will be dedicated to an RF campaign followed by a tentative 3-month maintenance period to prepare for the lithium evaporation campaign which will start at the end of FY27 and will span for ~1 year ending in FY28.

Available Measurements: PFR collaborators will be granted access to a number of diagnostics that are either currently available or will be available after the maintenance period. These include two visible-UV spectrometers, four impurity spectrometers, and an x-ray crystal spectrometer. Multiple radiated power diagnostics are available on ST40 such as two AXUV diode pinhole cameras and four foil bolometers. Electron temperature and density measurements are made by a sub-millimeter interferometer, a near-infrared interferometer, near-infrared dispersion interferometer, Thomson scattering system, and microwave radiometer. ST40's camera suite includes a fast-camera for visible light, balmer-alpha camera, and three high-resolution infrared cameras. Magnetic diagnostics installed are 23 Rogowski coils, 44 saddle loops, 48 flux loops, 70 poloidal field probes, 8 toroidal field probes, and 4 diamagnetic loops. Fast particles are measured by a neutral particle analyzer and fast ion loss detector. Neutrons are measured by a diamond detector, neutron camera and neutron spectrometer. A Lyman-alpha and balmer-alpha filtered diode array are being installed in the maintenance period for neutral density measurements. In addition to all this, there are thermocouples, Langmuir probes, pressure gauges, RGAs, fast ion gauges and quartz crystal microbalances throughout ST40.

Research Topics of Interest: Demonstration of low edge recycling and improved performance (nTtauE) in a high-field spherical tokamak plasma via use of solid lithium coatings applied to PFCs. Study and evaluation of the effectiveness and evolution of lithium coated PFCs in a Tokamak with diverted plasma scenarios, in combination with NBI, electron cyclotron resonance

heating and current drive. Investigation of the impact of lithium wall coatings on edge plasma parameters (e.g. SOL/pedestal and divertor heat loads), core transport & confinement, MHD and particle confinement time. Study of electron wave heating (ECRH, ECCD, EBW) for plasma heating and non-inductive current drive in low-recycling, lithiumized plasmas. Study and optimization of pellet injection for fueling, density control and impurity accumulation control in low-recycling ST plasmas. Validation of modelling codes (e.g. DEGAS2) to estimate recycling coefficients in these plasma conditions. Development, testing and deployment of lithium evaporators as the means for depositing lithium coatings on PFCs. Scoping and installation of a diagnostic set (e.g. Lyman-α detector arrays) to enable studying and measurement of the edge recycling coefficient, core/edge temperature profiles and other parameters of interest to support the scientific objectives. Study of plasma start-up and establishment of reference scenarios in an ST with all metal plasma facing surfaces. Development of the operational and maintenance/cleaning processes and procedures to enable safe and reliable lithium operations on ST40.

Desired Measurements: Collaborations that bring new and novel diagnostics to enhance ST40's data collection capabilities are welcome. Efforts to implement novel diagnostics that supplement the research topics of interest will be made if a PFR collaborator is able to supply a novel diagnostic. Upgrades to current diagnostic systems and novel measurement capabilities are highly desirable. This could include the following: increase of the time and/or spatial resolution of the Thomson Scattering diagnostic; support to perform an absolute calibration of the neutron diagnostics; adding new channels to the divertor Langmuir probe array; installation of fast, diagnostic pressure gauges below the divertor carriers; passive VUV spectroscopy for core impurity monitoring; upgrade of visible and H-alpha cameras.

Type One Energy Group, Inc.

Private Facility: Infinity One Advanced Stellarator, 1265 Edgemoor Rd, Clinton, TN 37716

Private Facility Point of Contact:

Technical Contact: Walter Guttenfelder – walter.guttenfelder@typeoneenergy.com
Commercial Contact: Matt Miles – matt.miles@typeoneenergy.com

Facility Description:

Infinity One will be constructed at Tennessee Valley Authority's (TVA) retired Bull Run Fossil Plant in East Tennessee, US, located ~10 miles from Oak Ridge National Lab (ORNL). The multi-$100M device will be the world's most advanced stellarator when completed, as will be described in more detail in peer reviewed publications expected late March 2025. The purpose of Infinity One is to verify by test design choices for Type One Energy's first commercial power plant, Infinity Two. Infinity One will demonstrate the efficacy of High-Temperature Superconductors (HTS) and be able to operate continuously for 24 hours with Protium fuel. Deuterium fuel can be used for shorter durations.

Parameter	Value	Unit
Major radius	2-3	m
Minor radius	0.3-0.5	m
Average toroidal field on axis	3	T
Continuous operations duration	24	hours
ECH heating power	8	MW
Fuel	Deuterium / Protium	

Table 1: Infinity Parameters

The primary science-related objectives of Infinity One are to:

- Prove the efficacy of modular HTS magnet systems for stellarators.
- Evaluate stellarator performance in the presence of a reactor-relevant metallic first wall.
- Verify and quantify plasma turbulence reduction.
- Confirm improved divertor exhaust efficiency.

In pursuit of the above, Infinity One will:

- Access Infinity Two-relevant MHD ($b \sim nT/B^2$) and density up to Sudo limit $n_{sudo}=0.25(PB/Ra^2)^{0.5}$
- Access Infinity Two-relevant neoclassical & turbulence transport regimes (set by $n^* \sim n/T^2$, Te/Ti, Qe/Qi)
- Demonstrate improved exhaust efficiency via novel divertor with metallic first wall, integrated with high-performance core (i.e., demonstrate core-edge integration).

Infinity One will demonstrate Fusion Triple Products comparable to or surpassing the current state of the art, with plasma durations orders of magnitude higher than what has been achieved previously. 24-hour plasma duration is orders of magnitude higher than what is currently available globally.

Figure 1 shows the fusion triple product (y-axis) and plasma duration (x-axis) for existing and planned fusion devices.

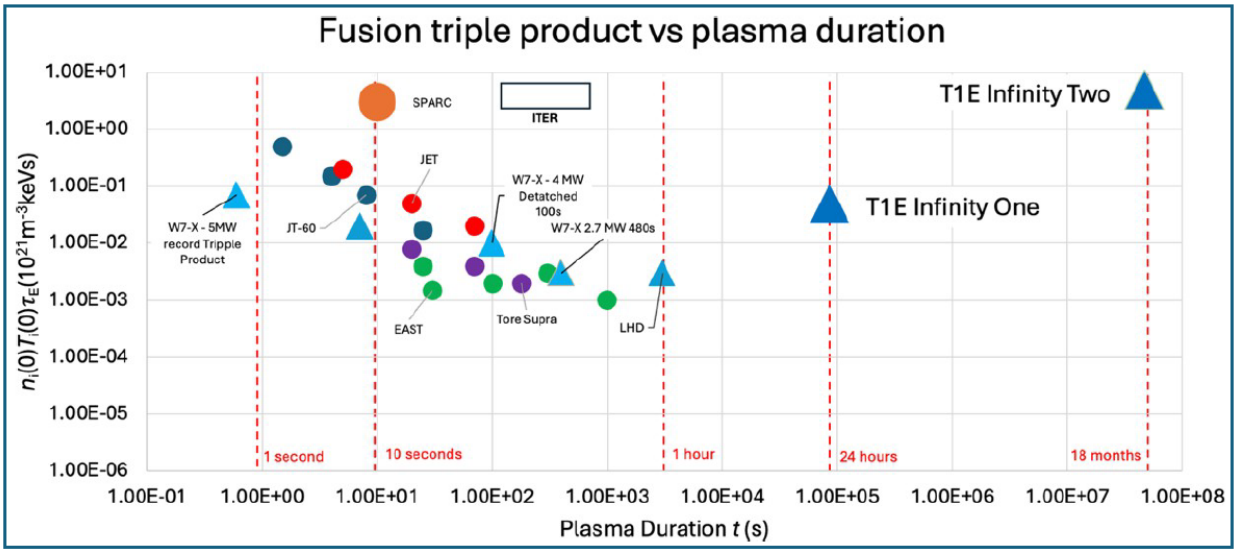


Figure 1. Fusion Triple Product vs Plasma Duration

Infinity One will provide a demonstration platform to address technical priorities identified by the Fusion Energy Science Advisory Committee (FESAC) Long Range Plan.
In alignment with FESAC and DOE SC priorities, Infinity One allows experimentation validation and verification of the following:

- Validation of turbulence optimization, impurity transport, and density limits.
- Validation of energetic particle dynamics and instabilities.
- Validation of global MHD equilibrium robustness and stability limits.
- Scenario development, testing Power Plant relevant instrumentation and control.
- Developing enhanced performance regimes via additional actuators & control techniques.
- Additional research and validation of boundary and exhaust physics and control.
- Research program in plasma material interaction (PMI) & plasma-facing components (PFCs).

These key priorities address both fundamental science priorities, as well as provide data to support highly available, commercially attractive fusion power plants. These key priorities are not addressed by any other existing User Facility.

Timeline: Infinity One Stellarator Core Conceptual Design will be completed in October 2024. Type One will construct and operate a large (4M diameter x 3M tall) cryostat able to support 5000kg in weight and cooling to 20K in 2025 and 4.5K in 2026. Additional plans for procuring, installing and operating a High Heat Flux E-beam facility to test plasma facing components is in development that ideally will be housed at the existing Bull Run Fossil Plant and available in 2026. The final design of the Stellarator Core will be completed in mid-2026, with the final design of other supporting systems completed before the end of 2026. Construction will start in late 2026 and be complete in early 2028, and commissioning will be completed in 2029.

Available Measurements: Type One Energy will provide millimeter wave stray detectors, thermocouples, neutral pressure gauges, residual gas analyzers, magnetic flux surface mapping probes, video cameras, interferometer, infrared cameras, diamagnetic loops, neutron detectors, Thomson scattering, crystal x-ray spectrometer, and bolometers that are required for machine protection and to achieve priority company milestones.

Research Topics of Interest: Public S&T expertise would provide benefit to, and would benefit from, the Infinity One project in many topical research areas, including:

- Transport: Explore and validate predictions of neoclassical and turbulent transport and confinement physics in a modern optimized stellarator; explore and validate particle transport and fueling, impurity transport, radiation physics, and associated density limits; explore and validate ways to further optimize turbulence with availability machine flexibility; etc.
- MHD equilibrium and stability: Explore and validate predictions of MHD stability and equilibrium robustness, beta limits, etc.
- Energetic particles: Explore and validate predictions of energetic particle losses and energetic particle mode activity through the addition of new actuators (ICRH, NBI) to directly generate populations of fast ions (ECRH will baseline heating).
- Scenario development: Explore and validate FPP-relevant instrumentation and control required for current and thermal profiles, first wall particle and thermal loads, etc.
- Develop enhanced performance regimes: Identify and develop potentially more favorable innovative confinement regimes through additional actuators and control techniques.
- Boundary: Explore and validate predictions of boundary and exhaust physics, detachment, sputtering, SOL impurity transport, etc.
- Plasma material interaction/plasma facing components (PMI/PFC): Explore and validate predictions of the impact of high heat and particle fluxes at long time scales relevant to fusion reactor PMI/PFC issues e.g., erosion, migration, redeposition, fuzz generation, and fuel retention.

Desired Measurements: Type One Energy will be interested in established and novel developmental measurements and measurement actuators that will best contribute to world-leading science in the above-mentioned research topics of interest. Examples of desirable measurement and measurement actuators include visible spectroscopy, vacuum ultraviolet spectroscopy, electron cyclotron emission, reflectometry, Rogowski coils, fixed and retractable Langmuir probes, plasma material interaction probes or coupons, laser blowoff injection, isotropic tungsten tracer tiles, supersonic molecular beam injection, diagnostic neutral beam injection, in-situ partial pressure gauges, micro-electrical-mechanical sensors, fast ion loss detectors, charge exchange recombination spectroscopy, beam emission spectroscopy, saddle coils, and Mirnov coils.

Multi-Institutional Teams

Applications for multi-institutional teams for a Public Research Award must ensure that the lead institution requests more funding from FES than any other team member. Requests to change the institution receiving the greatest funding after an application is submitted will result in the application being declined unless the request is the result of the lead PI's death, incapacitation, or relocation.

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

Collaborative Applications

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

Subawards[15]

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

DOE/ NNSA National Laboratories, other Federal agencies, and another Federal agency's FFRDCs, if participating in a team led by another institution, may be proposed as subrecipients, noting the 'per private facility' exclusions in the Eligibility section.

Note that the value of any such proposed subaward may be removed from any such prime award: DOE may make separate awards to Federally affiliated institutions

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.

> All entities submitting applications to this NOFO must recognize the moral and legal obligations to comply with export controls and policies that limit the transfer of technologies with potential dual use. Applicants are reminded that international

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

activities must comply with nonproliferation, sanction, and other protocols described at https://www.trade.gov/export-solutions.

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

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

B. Program Goals, Objectives, and Priorities

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

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

C. Award Contribution to Goals and Objectives

Awards resulting from this NOFO are intended to increase our understanding of scientific phenomena.

D. Performance Goals

You will be expected to demonstrate progress toward increasing knowledge in periodic progress reports.

E. Substantial Involvement

Either a grant or cooperative agreement may be awarded under this NOFO. If the award is a cooperative agreement, the DOE contract specialist/grants management specialist and DOE program manager will negotiate a Statement of Substantial Involvement prior to award.

F. Program Unallowable Costs

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

G. Citations to Statute and Regulations

The programmatic authorizing statutes and governing regulations are:

Section 646 of Public Law 95-91, U.S. Department of Energy Organization Act

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

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

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

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

H. Program History

You can learn about SC's history at https://science.osti.gov/About/History. You can read about our achievements at https://science.osti.gov/Science-Features/Science-Highlights. You can find information about all of our awards at https://pamspublic.science.energy.gov/WebPAMSExternal/interface/awards/AwardSearchExternal.aspx.

I. Other Information

ANTICIPATED AWARD SIZE

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

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

Ceiling

For Public Research Awards in the Standard subcategory, the ceiling award request is $7,000,000 per year or $21,000,000 total.

For Public Research Awards in the Novel Diagnostic Development subcategory, the ceiling award request is $3,000,000 total.

For Data Mirroring Awards, the ceiling award request is $500,000 total.

Applications requesting more than this amount of support may be declined without further review.

Floor

For Public Research Awards within the Standard subcategory, applications from a single institution must have a total budget that exceeds $2,000,000. Similarly, within the Standard subcategory, applications from multi-institutional teams must have a total budget for the prime award that exceeds $2,000,000.

For Data Mirroring Awards and Public Research Awards in the Novel Diagnostic Development subcategory, the floor request is $25,000 total.

Applications requesting less than these amounts of support may be declined without further review.

PERIOD OF PERFORMANCE

DOE anticipates making awards with a project period of 3 to 5 years.

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

AWARD BUDGET PERIODS

SC is committed to distributing workloads (internally and externally) across as much of the calendar as is practical. Accordingly, awards made under this NOFO will generally be made with budget periods that end between December 1 and June 30. New awards may be made with a first

budget period of more than 12 months. Renewal awards may be made with first budget periods that may be longer or shorter than 12 months.

Applicants should prepare budgets with 12-month budget periods. Actual start dates and cycle dates will be negotiated if an application is recommended for award. Budget periods will generally not be made for less than 9 months or more than 18 months.

IV. Application Contents and Format

A. Preliminary Submissions

1. Letter of Intent (LOI)

Not applicable.

2. Pre-application

PRE-APPLICATION DUE DATE

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

ENCOURAGE/DISCOURAGE DATE

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

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

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

If a multi-institutional team is submitting an application that contains a subaward, only the lead institution may submit a pre-application.

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

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

Title of Pre-application
PI Name, Job Title
[Lead] Institution
PI Phone Number, PI Email Address
NOFO Number: Include the NOFO Number indicated on the cover of this NOFO
List Subrecipients [if applicable]
Application Type: Public Research Award – Standard subcategory, Public Research Award – Novel Diagnostic Development subcategory, or Data Mirroring Award

The material listed here defines the minimum acceptable information on a title page. Additional information may be provided at the applicant's discretion.

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, 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.

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

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

PRE-APPLICATION REVIEW

Those pre-applications that are encouraged will be used to help SC begin planning for the application peer review process. SC's intent in discouraging submission of certain applications is to save the time and effort of applicants in preparing and submitting applications not responsive to this NOFO.

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 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 be submitted by a PI or by other users at the PI's institution with the "Submit to DOE" privilege in PAMS.

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 IX of this NOFO.

B. Application

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

C. Component Pieces of the Application

Letters of Collaboration or Access

Letters of collaboration, access, or recommendation are not allowed in applications under this NOFO. Instead, a Record of Discussion is required for each application (see Appendix 6).

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 Assurances[16]. 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.

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

- 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.

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 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.

DOE will accept only new applications under this NOFO. Applications for the renewal of or of a supplement to an existing award will not be accepted.

Note that DOE/NNSA National Laboratories may only submit new applications under this NOFO.

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:

Project Title

A. Smith, Lead Institution (Principal Investigator)
A. Brown, Institution 2 (Co-Investigator)
A. Jones, Institution 3 (Co-Investigator)

Text of abstract (no more than one page, excluding Project Title and list of investigators)

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. The title page must include the following items:

- The project title:
- Applicant/Institution:
- Street Address/City/State/ZIP:
- Postal Address:
- Lead PI name, telephone number, email:
- Administrative Point of Contact name, telephone number, email:
- NOFO Number: Include the NOFO number printed on the cover of this NOFO.
- DOE/SC Program Office:
- DOE/SC Program Office Technical Contact:
- PAMS Pre-application tracking number:

Senior/Key Personnel

- Senior/Key Personnel Name, Institution
- Senior/Key Personnel Name, Institution
- Senior/Key Personnel Name, Institution
- **…**

Institution	**Year 1 Budget**	**Year 2 Budget**	**Year … Budget**	**Total Budget**

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

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

PROJECT NARRATIVE (FIELD 8 ON THE FORM)

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

The following organization of the Project Narrative is suggested:

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

Buy America Requirement for Infrastructure Projects

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

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

Applicants should consult 2 CFR 184 and Section IX of this NOFO to determine whether the Buy America 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 IX of this NOFO 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.

- 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.

- 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.

- 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. Data management plans are not required for applications that only request support for a conference, workshop, or scientific meeting. Subject to the applicable cost principles, applications may request costs necessary for implementing the DMP.

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

The standard requirements for a DMP may be found in Section IX of this NOFO.

APPENDIX 5: RECORD OF DISCUSSION

The primary purpose of this Record of Discussion (RoD) is to confirm a mutual interest between the Public Researcher and the Private Facility partner in carrying out the proposed work of a PFR

program Public Research Award (both Standard and Novel Diagnostic Development subcategories). Private Facility partners are not required to sign a RoD for proposed work that they do not consider beneficial to their objectives.

For convenience, a version of the RoD will be posted with this NOFO in Grants.gov and at https://science.osti.gov/fes/Funding-Opportunities.

The RoD includes the following three essential elements:

1. An outline of the approximate scope of work and timeline for the research, agreed upon by both the Public Researcher and the Private Facility Technical Contact.
2. An acknowledgment by both the Public Researcher and the Private Facility Data Steward that the Public Researcher has been granted access to the facility's data.
3. A preliminary publication plan that identifies the general area of intellectual pursuit for the Public Researcher.

All three elements of the RoD must receive final approval from the Private Facility Leader for the RoD to be considered complete.

Applications for the PFR program Public Researcher Award that lack a completed and signed RoD will be considered incomplete and will not undergo merit review.

While discussions for the RoD should be initiated early, the RoD itself is not required prior to submitting a pre-application. It is expected that the RoD will be developed and signed either before or in conjunction with the preparation of a full application submission. Please submit completed and signed RoD forms to the respective Research Facility Leader well in advance of the application deadline. If electronic signatures are not feasible, hand-signed and scanned signatures are acceptable.

<table>
<tr><td colspan="2">Title of Research Activities:</td><td>Collaboration began (mm/yy) or New:</td></tr>
<tr><td colspan="2">Collaborator Institution:</td><td>Discussion Dates
Initiated on:
Completed on:</td></tr>
<tr><td>Public Researcher:
Name:
Email:
Tel:

Signature:

Date:</td><td colspan="2">Private Facility Technical Contact:
Name:
Email:
Tel:

Signature:

Date:</td></tr>
</table>

Public Researcher Data Access Acknowledgement I, [Insert Public Researcher Name], acknowledge that I have completed all data access agreements required by the host private facility, and have successfully accessed data at the facility [Insert Facility Name]. Furthermore, I attest that all data resulting from analysis, modeling, diagnostic installations, or hardware implementations supported through this PFR award are non-proprietary. Signature: Date:	**Private Facility Data Access Acknowledgement** I, [Insert Private Facility Data Steward], acknowledge that I have granted [Insert Public Researcher Name] access to [Insert Facility Name] data. The Digital Data Management policies of the Office of Science and additional FES guidance have been consulted and are acceptable. Name: Email: Tel: Signature: Date:
Research Goals:	
Public Researcher Tasks:	
Private Facility Research Support Tasks: **1)** **2)** **Estimated Research Effort Required (Man-Months):**	
Private Facility Engineering Support Tasks: **1)** **2)** **Engineering Effort Required (Man-Months):** **Estimated Hardware Cost Required ($k):**	
Collaboration Researcher Questions and Issues: **1)** **2)** **etc.**	

Responses by Research Facility Technical Contact and Task Manager:
1)
2)

etc.

Additional Collaboration Researcher's Comments (if any):
1)
2)

etc.

Additional Research Facility Technical Contact and Task Manager Comments (if any):
1)
2)

etc.

Publication Plan
The Public Researcher and/or the technical staff supported under this grant intend to notionally publish the following first author peer reviewed journal publications as part of this award. This national publication plan isn't intended to be restrictive, but provides an outline of the approximate areas of intellectual pursuit. It is hoped that the Public Researcher will also co-author papers with private facility lead authors, but these notional publications do not need to be documented here.

1) [National journal title], [Journal type (e.g., Physics, Diagnostic, Engineering)]
2)

etc.

Review and Comment:

Private Facility Leader, Concurrence

Electronic signature

Date: Month XX, YYYY

- Do not attach a separate file to Field 12 of the Research and Related Other Project Information form.

APPENDIX 6: SYNERGISTIC ACTIVITIES (OPTIONAL)

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

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

APPENDIX 7: 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.

APPENDIX 8: TRANSPARENCY OF FOREIGN CONNECTIONS

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

Disclosure exceptions by entity type:

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

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

Disclosure Information	
***Entity Name**	Complete legal name of the lead organization.
***Website Address**	Link to the entity's website address.
***Mailing Address**	Complete mailing address for the entity to include zip code.

Disclosure Information	
***Project Participants Party to ANY Malign Foreign Talent Recruitment Program**	The identity of all owners, principal investigators, project managers, and covered individuals who are a party to any Malign Foreign Talent Recruitment Program. As part of this requirement, the entity must also certify that each covered individual has been made aware of the Malign Foreign Talent Recruitment Program prohibition and complied with the certification requirement via the Current and Pending Support disclosure;
Country of Risk Joint Venture or Subsidiary	The existence of any joint venture or subsidiary that is based in, funded by, or has a foreign affiliation with any foreign country of risk (i.e., the People's Republic of China, Iran, North Korea, and Russia);
Current or Pending Foreign Contractual or Financial Obligation	Any current or pending contractual or financial obligation or other agreement specific to a business arrangement, or joint venture-like arrangement with an enterprise owned by a foreign state or any foreign entity;
Percentage Foreign Ownership or Control	Percentage, if any, that the proposed recipient or subrecipient has foreign ownership or control;
Percentage Country of Risk Ownership	Percentage, if any, that the proposed recipient or subrecipient is wholly or partially owned, directly or indirectly, by an entity incorporated or otherwise formed in a foreign country of risk or foreign state-owned entity;
Percentage Country of Risk Investment	Percentage, if any, of venture capital or institutional investment by an entity that has a general partner or individual holding a leadership role in such entity who has a foreign affiliation with any foreign country of risk;
***Country of Risk Technology Licensing of Intellectual Property Sales**	Any technology licensing, transfer, or intellectual property sales to a foreign country of risk, in effect during the 5-year period preceding submission of the proposal within the same technology area as the application (e.g., batteries, biotechnology, grid, energy generation and storage, advanced computing);
***Foreign Equipment**	Any of the following foreign equipment proposed for use on the project: i. Unmanned aircraft, control, and communications components originally made or manufactured in a foreign country of risk (including relabeled or rebranded equipment). ii. Coded equipment where the source code is written in a foreign country of risk. iii. Equipment from a foreign country of risk that will be connected to the internet or other remote communication system.

Disclosure Information	
	iv. Any entity from a foreign country of risk that will have physical or remote access to any part of the equipment used on the project after delivery.
Foreign Entity Relationships	Any foreign business entity, offshore entity, or entity outside the United States related to the proposed recipient or subrecipient;
List of Company Directors (and Board Observers)	Complete list of all directors (and board observers), including their full name, citizenship and shareholder affiliation, date of appointment, duration of term, as well as a description of observer rights as applicable;
Complete Capitalization Table	Complete capitalization table for your entity, including all equity interests (including LLC and partnership interests, as well as derivative securities). Include both the number of shares issued to each equity holder, as well as the percentage of that series and all equity on a fully diluted basis. Identify the principal place of incorporation (or organization) for each equity holder. If the equity holder is a natural person, identify the citizenship(s). If the recipient or subrecipient is a publicly traded company, provide the above information for shareholders with an interest greater than 5%;
Principal Place of Incorporation	Identify the principal place of incorporation (or organization) for each equity holder. If the equity holder is a natural person, identify the citizenship(s). If the recipient or subrecipient is a publicly traded company, provide the above information for shareholders with an interest greater than 5%;
Rounds of Financing Table	A summary table identifying all rounds of financing, the purchase dates, the investors for each round, and all the associated governance and information rights obtained by investors during each round of financing; and
Organization Chart	An organization chart to illustrate the relationship between your entity and the immediate parent, ultimate parent, and any intermediate parent, as well as any subsidiary or affiliates. Identify where each entity is incorporated.

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

REMINDERS REGARDING ALL APPENDICES

- **Follow the above instructions to include the information as appendices to the project narrative file.**
- **Do not attach any appendices to Fields 9, 10, 11, or 12.**

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

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

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

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

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

4. Research And Related Budget

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

Additional information is found in Section IX of this NOFO.

BUDGET JUSTIFICATION (FIELD L ON THE FORM)

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

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

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

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

Additional information is found in Section IX of this NOFO.

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 essential for understanding and analyzing the proposed research.

6. Project/Performance Site Location(s)

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

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

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

7. Disclosure of Lobbying Activities (SF-LLL)

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

8. Identification of Merit Reviewer Conflicts

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

9. Summary of Required Forms/Files

Your application must include the following items:

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

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

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

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

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.

V. Submission Requirements and Deadlines

A. Address to Request Application Package

Application forms and instructions are available at Grants.gov. To access these materials, go to https://www.Grants.gov, select "Search Grants", and then enter the Catalog of Federal Domestic Assistance (CFDA)[17] number (81.049) and/or the NOFO number shown on the cover of this NOFO. Select the "Apply" button to access the application package.

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

Detailed instructions for registering in and using Grants.gov are in Section IX of this NOFO.

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

Applicants must complete a series of registrations and enrollments to submit applications in response to this NOFO. Applicants not currently registered with SAM and Grants.gov should allow **at least four weeks** to complete these requirements. Applicants 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). 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.

---

17 The Catalog of Federal Domestic Assistance has been replaced by the Assistance Listings in the System for Award Management at https://www.SAM.gov. They are still listed as CFDA in Grants.gov at https://www.grants.gov.

Do not use a SSN as a TIN.

Obtain a TIN from the IRS using the website listed above.

1. Requirement for System for Award Management

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

2. Requirement for Unique Entity Identifier (UEI)

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

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

C. Submission Instructions

Pre-applications must be submitted in PAMS at https://pamspublic.science.energy.gov. Detailed instructions for pre-applications are in Section IX of this NOFO.

Applications must be submitted in Grants.gov at https://www.grants.gov. Detailed instructions are in Section IX of this NOFO.

D. Submission Dates and Times

1. Pre-application Due Date

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

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

2. Application Due Date

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

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

3. Late Submissions

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

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

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

Applicants must contact the Program Manager, Josh King (josh.king@science.doe.gov), to discuss the option of a late submission. Contacting the Program Manager after the deadline may reduce the likelihood that a request will be granted.

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

VI. Application Review Information

A. Responsiveness Review

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

B. Review Criteria

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

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

The review criteria are listed in decreasing order of significance, though all criteria will be considered.

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

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

1. Scientific and/or Technical Merit of the Project

- Ignoring the likelihood of achieving the proposed goals, how might the results of the proposed work impact fusion energy research?
- Is the Data Management Plan suitable for the proposed research?

2. Appropriateness of the Proposed Method or Approach

- How logical and feasible are the research approaches?
- Is the proposed method and approach likely to lead to scientifically valid conclusions?

- Does the applicant recognize significant potential problems and consider alternative strategies?

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

- How well qualified is the research team to carry out the proposed research?
- Are the research environment and facilities at both the private facility and the public researchers home institution adequate for performing the research?

4. Reasonableness and Appropriateness of the Proposed Budget

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

C. Review and Selection Process

1. Merit Review

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

2. Program Policy Factors

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

- Availability of funds
- Relevance of the proposed activity to SC priorities
- Ensuring an appropriate balance of activities within SC programs
- Performance under current awards
- Ensuring a distribution of supported researchers at various career stages
- Training the next generation of researchers
- Commitment to sharing the results of research

3. Selection

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

4. Discussions and Award

The Government may enter into discussions with a selected applicant for any reason deemed

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

5. Risk Review

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

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

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

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

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

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

As DOE invests in critical infrastructure and funds critical and emerging technology areas,[18] DOE considers possible threats to United States research, technology, and economic security from undue foreign government influence when evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant. As part of the research, technology, and economic security risk review, DOE may contact the applicant and/or proposed project team members for additional information to inform the review. This risk review is conducted separately from the technical merit review.

The due diligence review of covered individuals includes but is not limited to the review of resumes and disclosures, as required in the NOFO. DOE reserves the right to ask for disclosures on project participants not defined as covered individuals. The Applicant need not submit any additional information on non-covered individuals, unless requested by DOE. The volume and type of information collected may depend on various factors associated with the award.

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

---

18 See Critical and Emerging Technologies List Update (whitehouse.gov).

VII. Award Notices

A. Type of Award Instrument

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

Multi-institutional teams must apply using a prime and subaward model with one application submitted by the lead institution.

B. Anticipated Timeline for Notice of Selection for Award Negotiation

It is expected that awards will be made in Fiscal Year 2025.

1. Notice of Selection for Award Negotiation

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

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

2. Notice of Award

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

TERMS AND CONDITIONS

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

The standard DOE financial assistance intellectual property provisions applicable to various types of recipients are located at:
https://energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards

NATIONAL POLICY ASSURANCES

The National Policy Assurances To Be Incorporated As Award Terms are located at https://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms under Award Terms.

VIII. Post-Award Requirements and Administration

A. Administrative and National Policy Requirements

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

38. U.S. Competitiveness
39. Updating Your Portfolio Analysis and Management System (PAMS) Profile

B. Reporting

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

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

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

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

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

D. Interim Conflict of Interest Policy for Financial Assistance

1. Policy

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy) 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.

2. SC Implementation

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

IX. Other Information

A. Checklist for Avoiding Common Errors

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

Item	Issue
Applications	Submitted in Grants.gov. Do not submit applications in PAMS or FedConnect.
Grants.gov Submission	Ensure that applications are submitted under the correct Opportunity Number. Standard Form (SF)-424 Research and Related (R&R): - Attach nothing to Field 20 - Attach nothing to Field 21 SF-424 Research and Related Other Project Information form: - Attach the abstract to Field 7 - Attach the Project Narrative, with all appendices, to Field 8 - Attach nothing to Field 9 - Attach nothing to Field 10 - Attach nothing to Field 11 - Attach the list of individuals who should not serve as merit reviewers (Collaborator Template) to Field 12 - Do not attach other files to Field 12 - NOTE: Files attached to Field 12 will not be shared with merit reviewers.
Letters of Intent (LOIs)	- Submit your LOI in PAMS. - Do not submit your LOI in Grants.gov. - Do not attach your LOI to the SF-424 Research and Related (R&R) form. - Follow the instructions in Section IV for the preparation of an LOI.
Pre-Applications	- Submit your pre-application in PAMS. - Do not submit your pre-application in Grants.gov. - Do not attach your pre-application to the SF-424 Research and Related (R&R) form. - Follow the instructions in Section IV for the preparation of a pre-application.

Item	Issue
Page Limits	Strictly followed throughout application, including particular attention to: - Project Narrative and appendices - Biographical sketches - Data Management Plans (DMPs) - Letter(s) of Collaboration or Access, if any
Personally Identifiable Information	None present in the application
Project Narrative	Composed of one PDF file including all appendices (bibliography, facilities, equipment, DMP)
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)	- If referring to an experiment's DMP, describe the relationship to the proposed research. - Include a DMP even if no experimental data is expected.
Institutions capable of being funded through the DOE Field Work System	If National Laboratories and/or DOE sites are permitted to submit under this NOFO: - Do not create new institutions in the PAMS website. - Submit applications in Grants.gov using the name of the laboratory or site in Field 5 of the SF-424(R&R) application form, not the contractor operating the laboratory or site.

Item	Issue
	Submissions under this NOFO will be evaluated for technical merit, but any resulting funding, work, or awards will be made under the laboratory or site's contract with DOE. No separate financial assistance awards will be made. No administrative provisions of this NOFO will apply to the laboratory or any laboratory subcontractor.

B. How-To Guides

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

1. How to Distinguish Between a New and Renewal Application

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

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

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

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

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

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

2. How Federally Affiliated Organizations May Participate and Be Funded

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

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

RESPONSIBILITY

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

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

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

3. How Federally Affiliated Organizations May Apply

DOE/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 NOFO number on the cover page>> by the following statutory authority (insert statute name, citation, and section)."

(End of acceptable authorization)

OTHER FEDERAL AGENCIES

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

4. How Consortia May be Used

INCORPORATED CONSORTIA

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

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

UNINCORPORATED CONSORTIA

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

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

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

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

5. How to Submit Letters of Intent

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

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

Submit Your Letter of Intent:

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

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

WARNING: The PAMS website at https://pamspublic.science.energy.gov/ will permit you to revise a previously submitted LOI in the time between your submission and the

deadline. Doing so will remove your previously submitted version from consideration. If you have not submitted the revision at the time of the deadline, you will not have a valid submission. Please pay attention to the deadline.

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

6. How to Submit a Pre-Application

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

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

Submit Your Pre-Application:

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

- To upload the preproposal file into PAMS, click the "Attach File" button at the far-right side of the screen. Click the "Browse" (or "Choose File" depending on your browser) button to search for your file. You may enter an optional description of the file you are attaching. Click the "Upload" button to upload the file.
- At the bottom of the screen, click the "Submit to DOE" button to save and submit the preproposal to DOE.
- Upon submission, the PI will receive an email from the PAMS system <PAMS.Autoreply@science.doe.gov> acknowledging receipt of the preproposal.
- If this NOFO requires that pre-applications be submitted only by an authorized institutional official, the PI (or the PI's delegate) will only be able to send the pre-application to a user at the PI's institution with the institutional "submit to DOE" privilege. That user will then apply an institutional countersignature to the pre-application when it is sent to DOE.

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

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

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

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

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

ELECTRONIC DELIVERY

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

HOW TO REGISTER TO APPLY THROUGH GRANTS.GOV

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

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

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

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

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

3) *Add a Profile to a Grants.gov Account*: A profile in Grants.gov corresponds to a single applicant organization the user represents (i.e., an applicant) or an individual applicant. If you work for or consult with multiple organizations and have a profile for each, you may log in to one Grants.gov account to access all of your grant applications. To add an organizational profile to your Grants.gov account, enter the UEI (Unique Entity Identifier) for the organization in the UEI field. If you are an individual applicant submitting on your own behalf, you do not need a UEI to add the profile. For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.grants.gov/applicants/applicant-registration/add-profile

4) *EBiz POC Authorized Profile Roles*: After you register with Grants.gov and create an Organization Applicant Profile, the organization applicant's request for Grants.gov roles and access is sent to the Electronic Business Point of Contact (EBiz POC)[19]. The EBiz POC will then log in to Grants.gov and authorize the appropriate roles, which may include the Authorized Organization Representative (AOR) role, thereby giving you permission to complete and submit applications on behalf of the organization. You will be able to submit your application online any time after you have been assigned the AOR role. For more detailed instructions about creating a profile on Grants.gov, refer to: https://www.grants.gov/applicants/applicant-registration/ebiz-poc-authorizes-profile-roles

19 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.

5) *Track Role Status*: To track your role request, refer to: https://www.grants.gov/applicants/applicant-registration/track-profile-role-status

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

HOW TO APPLY TO SC VIA GRANTS.GOV

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

For an overview of applying on Grants.gov using Workspaces, refer to: https://www.grants.gov/applicants/workspace-overview/

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

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.

8. How to Prepare an Application

Application Preparation

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

You are required to use the compatible version of Adobe Reader software to complete a Grants.gov Adobe application package. To ensure you have the Grants.gov compatible version of Adobe Reader, visit the software compatibility page at https://www.Grants.gov/web/grants/applicants/adobe-software-compatibility.html.

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

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

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

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

Renewal Applications

For renewal applications only, the PI is required to submit a Renewal Proposal Products section through the PAMS website at https://pamspublic.science.energy.gov. The PI must enter into PAMS each product created during the course of the previous project period. Types of products include publications, intellectual property, technologies or techniques, and other products such as databases or software. As soon as the renewal application is assigned to a DOE Program

Manager, the PI will receive an automated email from PAMS (<PAMS.Autoreply@science.doe.gov>) instructing him or her to navigate to the PAMS Task tab to complete and submit the Renewal Proposal Products. The submitted product list will be sent for merit review as part of the application. The application will not be considered complete and cannot be sent for review until the product list has been submitted.

Resubmission of Applications

Applications submitted under this NOFO may be withdrawn from consideration by using the PAMS website at https://pamspublic.science.energy.gov. Applications may be withdrawn at any time between when the applicant submits the application and when DOE makes the application available to merit reviewers. Such withdrawals take effect immediately and cannot be reversed. Please exercise due caution. After the application is made available to merit reviewers, the applicant may contact the DOE program office identified in this NOFO to request that it be withdrawn.

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

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

Improper Contents of Applications

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

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

Change of Recipient Institution

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

9. How to Prepare a Biographical Sketch

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. SciENcv has been updated to meet the interagency common format biographical sketches.

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.

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 Contributer ID (ORCiD).

If not using SciENcv, append the following signed and dated certification to a biographical sketch:

> I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Current and Pending Support Disclosure Statement is true, complete, and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3733 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to DOE's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

Biographical sketches must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

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

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

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

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

Do not identify any personnel at the applicant institution or any proposed subrecipient or team institution: Those personnel are prohibited from serving as merit reviewers.

Large collaborations of 10 or more researchers do not require that all collaborators be identified: rather, only list the researchers with whom the senior/key person collaborated.

For all identified individuals, provide the following information:

- The senior/key person to whom the individual was an advisee, advisor, close associate, co-author, co-editor, co-investigator, or collaborator, identified by first name and last name
- The individual's first (given) name
- The individual's last (family) name

- The individual's Open Researcher and Contributor ID (ORCiD), if known
- The individual's institutional affiliation spelling out acronyms (For joint appointments, separate each institution with a slash ("/"). Do not list departmental affiliations.)
- The reason for listing the individual (advisee, advisor, close associate, co-author, co-editor, co-investigator, collaborator)
- The year when the individual last was a close associate, co-author, co-editor, co-investigator, or collaborator

You may also provide a list of all senior/key personnel who are planned to be or are identified in Section A of the R&R Budget for the applicant and any proposed subrecipients.

The lists do not need to be sorted in any method.

The lists must be submitted in tabular format, preferably as Microsoft Excel (.xls or .xlsx) files.

For your convenience, a Collaborator Template is available at https://science.osti.gov/grants/Policy-and-Guidance/Agreement-Forms. The template may also be posted with this NOFO in Grants.gov. If using the template:

- Do not add tabs to the spreadsheet
- Do not merge the existing tabs
- Do not remove headers
- Fill out the requested headers on both tabs with the same information
- Ensure that given and family names are presented in the correct columns

11. How to Prepare Current and Pending Support

> **WARNING**: These instructions have been significantly revised to require disclosure of a variety of potential conflicts of interest or commitment, including participation in malign foreign talent recruitment programs.

Current and Pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. The PI and each senior/key person at the prime applicant and any proposed subaward must provide a list of all sponsored activities, awards, and appointments, whether paid or unpaid; provided as a gift with terms or conditions or provided as a gift without terms or conditions; full-time, part-time, or voluntary; faculty, visiting, adjunct, or honorary; cash or in-kind; foreign or domestic; governmental or private-sector; directly supporting the individual's research or indirectly supporting the individual by supporting students, research staff, space, equipment, or other research expenses. Include the current application and any application submitted to any source of funding in a list of current and pending support. All sources of support must be disclosed, but for work that is subject to government classification or enforceable non-disclosure agreements, the general area of the research should be described without disclosing sensitive details and the sponsor should be listed as "Government Agency" or "private sponsor." All connections with malign foreign talent recruitment programs must be identified in current and

pending support.

SC requires the use of the 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. SciENcv has been updated to meet the interagency common format for current and pending support.

For every activity, list the following items:

- The sponsor of the activity or the source of funding.
- The award or other identifying number.
- The title of the award or activity. If the title of the award or activity is not descriptive, add a brief description of the research being performed that would identify any overlaps or synergies with the proposed research.
- The total cost or value of the award or activity, including direct and indirect costs. For pending proposals, provide the total amount of requested funding.
- The award period (start date – end date).
- The person-months of effort per year being dedicated to the award or activity.

If required to identify overlap, duplication of effort, or synergistic efforts, append a description of the other award or activity to the current and pending support.

SC strongly recommends the use of SciENcv to reduce administrative burden by allowing the use of digital persistent identifiers, including the Open Researcher and Contributer ID (ORCiD). If not using SciENcv, append the following signed and dated certification to current and pending support:

> I, [Full Name and Title], certify to the best of my knowledge and belief that the information contained in this Current and Pending Support Disclosure Statement is true, complete, and accurate. I understand that any false, fictitious, or fraudulent information, misrepresentations, half-truths, or omissions of any material fact, may subject me to criminal, civil or administrative penalties for fraud, false statements, false claims or otherwise. (18 U.S.C. §§ 1001 and 287, and 31 U.S.C. 3729-3733 and 3801-3812). I further understand and agree that (1) the statements and representations made herein are material to DOE's funding decision, and (2) I have a responsibility to update the disclosures during the period of performance of the award should circumstances change which impact the responses provided above.

Current and pending support must be attached to the Research and Related Senior/Key Person Profile (Expanded) form in an application.

Details of any obligations, contractual or otherwise, to any program, entity, or organization sponsored by a foreign government must be provided on request to either the applicant institution or DOE.

Submission of current and pending support constitutes the individual's certification that they have complied with the Research Security Training requirement.

12. How to Prepare a Data Management 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

13. How to Prepare a Research and Related Budget and Justification

The following advice will improve the accuracy of your budget request:

- Funds requested for personnel (senior, key, and other) must be justified as the product of their effort on the project and their institutional base salary.

- Funds requested for fringe benefits must be calculated as the product of the requested salary and, if present, the negotiated fringe benefit rate contained in an institution's negotiated indirect cost rate agreement.
- Funds requested for indirect costs must be calculated using the correct indirect cost base and the negotiated indirect cost rate.
- If a field is required (indicated with either an asterisk or a differently-colored background) and no funds are being requested, enter a zero "0."
- You are encouraged to include the rate agreement used in preparing a budget as a part of the budget justification.
- Do not prepare a budget justification using the expired DOE form F4260.1.

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

For your convenience in preparing an Indirect Cost Rate proposal, a link to applicant resources, including indirect rate model templates, has been provided below: https://science.osti.gov/sbir/applicant-resources/grant-application/.

Institutions of higher education must either include their negotiated Indirect Cost Rate Agreement or a Uniform Resource Locator (URL, commonly referred to as a web link) where their agreement can be found in their budget justifications.

Budget Fields

Section A Senior/Key Person	For each Senior/Key Person, enter the requested information. List personnel, base salary, the number of months that person will be allocated to the project, requested salary, fringe benefits, and the total funds requested for each person. The requested salary must be the product of the base salary and the effort. Include a written narrative in the budget justification that justifies the need for requested personnel. Within the justification, explain the fringe benefit rate used if it is not the standard faculty rate.
Section B Other Personnel	List personnel, the number of months that person will be allocated to the project, requested salary fringe benefits, and the total funds requested for each person. Include a written narrative in the budget justification that fully justifies the need for requested personnel. Within the justification, provide the number of positions being filled in each category of other personnel.
Section C Equipment	For the purpose of this budget, equipment is designated as an item of property that has an acquisition cost of $10,000 or more and an expected service life of more than one year, unless a different threshold

	is specified in a negotiated Facilities and Administrative Cost Rate. (Note that this designation applies for proposal budgeting only and differs from the DOE definition of capital equipment.) List **each** item of equipment separately and justify each in the budget justification section. Do not aggregate items of equipment. Allowable items ordinarily will be limited to research equipment and apparatus not already available for the conduct of the work. General-purpose office equipment is not eligible for support unless primarily or exclusively used in the actual conduct of scientific research.
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 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.
Section E Participant/Trainee Support Costs	If applicable, submit training support costs. Educational projects that intend to support trainees (precollege, college, graduate and postgraduate) must list each trainee cost that includes stipend levels and amounts, cost of tuition for each trainee, cost of any travel (provide the same information as needed under the regular travel category), and costs for any related training expenses. Participant costs are those costs associated with conferences, workshops, symposia or institutes and breakout items should indicate the number of participants, cost for each participant, purpose of the conference, dates and places of meetings and any related administrative expenses. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis).
Section F Other Direct Costs	• **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 information may be requested. In the budget justification, include the established computer service rates at the proposing organization if applicable. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Subawards/Consortium/Contractual Costs:** Enter total costs for all subawards/consortium organizations and other contractual costs proposed for the project. In the budget justification, justify the details. • **Equipment or Facility Rental/User Fees:** Enter total funds requested for Equipment or Facility Rental/User Fees. In the budget justification, identify each rental/user fee and justify. Indicate the basis for the cost estimate (quotes from vendors or suppliers, past experience of similar items, or some other basis). • **Alterations and Renovations:** Enter total funds requested for Alterations and Renovations. In the budget justification, itemize by category and justify the costs of alterations and renovations, including repairs, painting, removal or installation of partitions, shielding, or air conditioning. Where applicable, provide the square footage and costs. • **Other:** Add text to describe any other Direct Costs not requested above. Enter costs associated with "Other" item(s). Use the budget justification to further itemize and justify.
Section G Direct Costs	This represents Total Direct Costs (Sections A through F).
Section H Other Indirect Costs	Enter the Indirect Cost information, including the rates and bases being used, for each field. Only four general categories of indirect costs are allowed/requested on this form, so please consolidate if needed. Include the cognizant Federal agency and contact information if using a

	negotiated rate agreement. Within the budget justification, explain the use of multiple rates, if multiple rates are used.
Section I Total Direct and Indirect Costs	This is the total of Sections G and H.

GUIDANCE FOR APPLICATION BUDGETS AND COSTS

All costs requested in a budget must adhere to standard requirements for all Federal awards:

- Costs must be reasonable, using a prudent-person standard. (2 CFR 200.404),
- Costs must be allocable, related to the particular Federal award. (2 CFR 200.405),
- Costs must be allowable under the relevant Federal cost principles. (See 2 CFR 200.420 and following),
- Costs must be consistently treated, whether they are paid for with Federal funds or institutional funds. (2 CFR 200.403(c))

Allowable costs may include, but are not limited to, the following, subject to the applicable cost principles:

- "Buying out" faculty time dedicated to teaching or administrative responsibilities,
- Support for administrative personnel dedicated to the proposed activity,
- Support for professional development, training, mentoring of students and junior researchers,
- Travel to meet with collaborators at other institutions and relevant DOE/NNSA national laboratories, including costs for internships at the national laboratories; or to attend one or more science team, user facility, scientific conference, workshop, or professional society meetings relevant to the proposed research; or for the conduct of off-site research,
- Fringe benefits, which must be paid in accordance with an institution's negotiated rates agreement, institutional policies, and the individual's appointment,
- Temporary dependent-care costs incurred during travel,
- Membership costs in relevant professional societies, including both scientific societies and those dedicated to research administration,
- Instrumentation required to conduct proposed research,
- Equipment (items with a useful life of more than 12 months and a per-item acquisition cost of more than $10,000) required to conduct proposed research,
- Purchase of equipment, modification of equipment, or provision of services necessary to enable work to be carried out by project personnel with a disability,
- Stipends and benefits for students and post-doctoral researchers, recognizing their dual nature as both trainees and employees,
- Participation in standards development relevant to the proposed research, including travel and membership costs,
- Salary support to cover time to participate in outreach for recruitment, internships, and training events, science team meetings, partnership development, or information gathering, and

- Other direct costs, e.g., materials and supplies such as office supplies, desktop or laptop computer, and/or software licenses that are directly necessary to enable the proposed activities.

14. How to Register in PAMS

After you submit your application through Grants.gov, the application will automatically transfer into the Portfolio Analysis and Management System (PAMS) for processing by the DOE SC. Many functions for grants and cooperative agreements can be done in PAMS, which is available at https://pamspublic.science.energy.gov.

You will want to "register to" your application: a process of linking yourself to the application after it has been submitted through Grants.gov and processed by DOE.

You must register in PAMS to submit a pre-application or a LOI.

Notifications sent from the PAMS system will come from the PAMS email address <PAMS.Autoreply@science.doe.gov>. Please make sure your email server/software allows delivery of emails from the PAMS email address to yours.

Registering to PAMS is a two-step process; once you create an individual account, you must associate yourself with ("register to") your institution. Detailed steps are listed below.

CREATE PAMS ACCOUNT:

To register, click the "Create New PAMS Account" link on the website https://pamspublic.science.energy.gov/.

- Click the "No, I have never had an account" link and then the "Create Account" button.
- You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
- On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
- Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.
- PAMS will take you to the "Having Trouble Logging In?" page. (If you have been an SC merit reviewer or if you have previously submitted an application, you may already be linked to an institution in PAMS. If this happens, you will be taken to the PAMS home page.)

REGISTER TO YOUR INSTITUTION:

- Click the link labeled "Option 2: I know my institution and I am here to register to the institution." (Note: If you previously created a PAMS account but did not register to an institution at that time, you must click the Institutions tab and click the "Register to Institution" link.)
- PAMS will take you to the "Register to Institution" page.
- Type a word or phrase from your institution name in the field labeled, "Institution Name like," choose the radio button next to the item that best describes your role in the system and click the "Search" button. A "like" search in PAMS returns results that contain the word or phrase you enter; you do not need to enter the exact name of the institution, but you should enter a word or phrase contained within the institution name. (If your institution has a frequently used acronym, such as ANL for Argonne National Laboratory or UCLA for the Regents of the University of California, Los Angeles, you may find it easiest to search for the acronym under "Institution Name like." Many institutions with acronyms are listed in PAMS with their acronyms in parentheses after their names.)
- Find your institution in the list that is returned by the search and click the "Actions" link in the Options column next to the institution name to obtain a dropdown list. Select "Add me to this institution" from the dropdown. PAMS will take you to the "Institutions – List" page.
- If you do not see your institution in the initial search results, you can search again by clicking the "Cancel" button, clicking the Option 2 link, and repeating the search.
- If, after searching, you think your institution is not currently in the database, click the "Cannot Find My Institution" button and enter the requested institution information into PAMS. Click the "Create Institution" button. PAMS will add the institution to the system, associate your profile with the new institution, and return you to the "Institutions – List" page when you are finished.

For help with PAMS, click the "PAMS Help" link on the PAMS website, https://pamspublic.science.energy.gov/. You may also contact the PAMS Help Desk, which can be reached Monday through Friday, 9AM – 5:30 PM Eastern Time. Telephone: (855) 818-1846 (toll free) or (301) 903-9610, email: sc.pams-helpdesk@science.doe.gov. All submission and inquiries about this NOFO should reference the NOFO number printed on the cover page.

15. How to View Applications in PAMS

Each Grants.gov application submitted to the DOE SC automatically transfers into PAMS and is subsequently assigned to a program manager. At the time of program manager assignment, the three people listed on the SF-424 (R&R) cover page will receive an email with the subject line, "Receipt of Proposal 0000xxxxxx by the DOE Office of Science." These three people are the PI (Block 14), Authorized Representative (Block 19), and Point of Contact (Block 5). In PAMS notation, applications are known as proposals, the PI is known as the PI, the Authorized Representative is known as the Sponsored Research Officer/Business Officer/Administrative Officer (SRO/BO/AO), and the Point of Contact is known as the POC.

There will be a period of time between the application's receipt at Grants.gov and its assignment

to a DOE SC program manager. Program managers are typically assigned two weeks after applications are due at Grants.gov: please refrain from attempting to view the proposal in PAMS until you receive an email providing the assignment of a program manager.

Once the email is sent, the PI, SRO/BO/PO, and POC will each be able to view the submitted proposal in PAMS. Viewing the proposal is optional.

Following are two sets of instructions for viewing the submitted proposal, one for individuals who already have PAMS accounts and one for those who do not.

If you already have a PAMS account, follow these instructions:

1. Log in to PAMS at https://pamspublic.science.energy.gov/.
2. Click the "Proposals" tab and click "Access Previously Submitted Grants.gov Proposal."
3. Enter the following information:
   - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, "Receipt of Proposal …".
   - Email (as entered in Grants.gov application): Enter your email address as it appears on the SF424(R&R) Cover Page.
   - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select "SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer)." If your name appears in block 14 of the SF424 R&R cover page as the PI, select "Principal Investigator (PI)." If your name appears in block 5 of the SF424 R&R as the point of contact, select "Other (POC)."
4. Click the "Save and Continue" button. You will be taken to your "My Proposals" page. The Grants.gov proposal will now appear in your list of proposals. Click the "Actions/Views" link in the options column next to this proposal to obtain a dropdown list. Select "Proposal" from the dropdown to see the proposal. Note that the steps above will work only for proposals submitted to the DOE SC since May 2012.

If you do not already have a PAMS account, follow these instructions:

1. To register, click the "Create New PAMS Account" link on the website https://pamspublic.science.energy.gov/.
2. Click the "No, I have never had an account" link and then the "Create Account" button.
3. You will be prompted to enter your name and email address, create a username and password, and select a security question and answer. Once you have done this, click the "Save and Continue" button.
4. On the next page, enter the required information (at least one phone number and your mailing address) and any optional information you wish to provide (e.g., FAX number, website, mailstop code, additional email addresses or phone numbers, Division/Department). Click the "Create Account" button.
5. Read the user agreement and click the "Accept" button to indicate that you understand your responsibilities and agree to comply with the rules of behavior for PAMS.

6. You will be taken to the Register to Institution page. Select the link labeled, "Option 1: My institution has submitted a proposal in Grants.gov. I am here to register as an SRO, PI, or POC (Sponsored Research Officer, Principal Investigator, or Point of Contact)."
7. Enter the following information:
   - Proposal ID: Enter the ten-digit PAMS proposal ID, including the leading zeros (e.g., 00002xxxxx). Do not use the Grants.gov proposal number. Use the PAMS number previously sent to you in the email with subject line, "Receipt of Proposal …".
   - Email (as entered in Grants.gov proposal): Enter your email address as it appears on the SF424(R&R) Cover Page.
   - Choose Role: Select the radio button in front of the role corresponding to the SF-424 (R&R) cover page. If your name appears in block 19 of the SF-424 (R&R) cover page as the authorizing representative, select "SRO/BO/AO (Sponsored Research Officer/Business Officer/Administrative Officer)." If your name appears in block 14 of the SF424 R&R cover page as the PI, select "Principal Investigator (PI)." If your name appears in block 5 of the SF424 R&R as the point of contact, select "Other (POC)."
8. Click the "Save and Continue" button. You will be taken to your "My Proposals" page. The Grants.gov proposal will now appear in your list of proposals. Click the "Actions/Views" link in the options column next to this proposal to obtain a dropdown list. Select "Proposal" from the dropdown to see the proposal.

If you were listed as the PI on a prior submission but you have not previously created an account, you may already be listed in PAMS. If this is the case, you will be taken to the PAMS home page after agreeing to the Rules of Behavior. If that happens, follow the instructions listed above under "If you already have a PAMS account…" to access your Grants.gov proposal.

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

SYSTEMS TO REGISTER IN

Applicants must register with FedConnect at www.FedConnect.net. The full, binding version of assistance agreements will be posted to FedConnect. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf

Recipients must register with the Federal Funding Accountability and Transparency Act Subaward Reporting System at https://www.fsrs.gov. This registration must be completed before an award may be made: you are advised to register while preparing your application.

REGISTERING IN GRANTS.GOV

Applicants must register with Grants.gov, following the instructions at https://www.Grants.gov/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.

C. Administrative and National Policy Requirements

1. Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulations).

2. Availability of Funds

Funds are not presently available for this award. The Government's obligation under this award is contingent upon the availability of appropriated funds from which payment for award purposes can be made. No legal liability on the part of the Government for any payment may arise until funds are made available to the DOE Contracting Officer for this award and until the recipient receives notice of such availability, to be confirmed in writing by the DOE Contracting Officer.

3. Buy America 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 -See 2 CFR 184.3 Definitions.

Construction Materials -See 2 CFR 184.3 Definitions.

Domestic Content Procurement Preference Requirement – means a requirement that no amount of funds 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 -See 2 CFR 184.4(c) and (d).

Infrastructure Project – See 2 CFR 184.3 Definitions.

Manufactured Products -See 2 CFR 184.3 Definitions

Predominantly of iron or steel or a combination of both -See 2 CFR 184.3 Definitions.

Produced in the United States -See 2 CFR 184.3 Definitions.

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 (private) infrastructure. For purposes of this guidance, infrastructure should be considered "public" if it is: (1) publicly owned (owned, operated, funded and managed, in whole or in part, by any unit or authority of a Federal, State, or Local government-including U.S. Territories and Indian Tribes); or (2) privately owned but utilized primarily for a public purpose. Infrastructure should be considered to be "utilized primarily for a public purpose", and therefore "public", if it is privately owned but operated on behalf of the public or is a place of public accommodation.

Section 70917(c) Materials – See 2 CFR 184.3 Definitions.

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 project for infrastructure 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. See 2 CFR 184.5 for determining the cost of components for manufactured products; and

(3) all construction materials[20] are manufactured in the United States—this means that all manufacturing processes for the construction material occurred in the United States. See 2 CFR 184.6 for construction material standards.

The Buy America Requirement only applies to those articles, materials, and supplies that are consumed in, incorporated into, or affixed to the infrastructure in the project. As such, it does not apply to tools, 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 only applies to an article, material, or supply classified into one of the following categories* based on its status at the time it is brought to the work site for incorporation into an infrastructure project:

(i) Iron or steel products;
(ii) Manufactured products; or
(iii) Construction materials;

The Buy America Requirement only applies to the iron or steel products, manufactured products, and construction materials used for the construction, alteration, maintenance, or repair of public infrastructure in the United States when those items are consumed in, incorporated into, or permanently affixed to the infrastructure. An article, material, or supply incorporated into an infrastructure project should not be considered to fall into multiple categories, but rather must meet the Buy America Preference Requirement for only the single category in which it is classified.

All iron and steel, manufactured products, and construction materials used in the infrastructure project must be produced in the United States.

* Section 70917(c) Materials are cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives as provided in section 70917(c) of BABA. Section 70917 (c) materials are excluded from Construction materials. Asphalt concrete pavement mixes are typically composed of asphalt cement (a binding agent) and aggregates such as stone, sand, and gravel. Accordingly, asphalt is also excluded from the definition of Construction materials.

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

Section 70917(c) materials, on their own, are not manufactured products. Further, Section 70917(c) materials should not be considered manufactured products when they are used at or combined proximate to the work site—such as is the case with wet concrete or hot mix asphalt brought to the work site for incorporation. However, certain Section 70917(c) materials (such as stone, sand, and gravel) may be used to produce a manufactured product, such as is precast concrete. Precast concrete is made of components, is processed into a specific shape or form, and is in such state when brought to the work site. Furthermore, wet concrete should not be considered a manufactured product if not dried or set prior to reaching the work site.

Further clarification is provided in 2 CFR 184 on the circumstances under which a determination is made that Section 70917(c) materials should be treated as components of a manufactured product. That determination is based on consideration of: (i) the revised definition of the "manufactured products" at 2 CFR 184.3; (ii) a new definition of "section 70917(c) materials" at 2 CFR 184.3; (iii) new instructions at 2 CFR 184.4(e) on how and when to categorize articles, materials, and supplies; and (iv) new instructions at 2 CFR 184.4(f) on how to apply the Buy America preference by category.

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 constructions 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 subawards, 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 subrecipient 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 an approved waiver or an exemption provided in 2 CFR 184.8, are produced in the United States. The certification or proof of compliance must be provided by the suppliers or manufacturers of the iron, steel, manufactured products and construction materials and flow up from all subawardees, contractors and vendors to the recipient. Recipients must keep these certifications with the award/project files and be able to produce them upon request from DOE, auditors or Office of Inspector General.

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 (OMB) Made in America Office and are subject to a public comment period of no less than 15 calendar days.

Waiver Requests may be submitted utilizing Optional Form 2211 (OF2211) or any other format to provide the required information below. DOE or OMB may request additional information for consideration of the wavier. DOE may reject or grant waivers in whole or in part depending on its review, analysis, and/or feedback from OMB or the public. DOEs final determination regarding approval or rejection of the waiver request may not be appealed by a Recipient. The waiver request review and public comment process required for a waiver determination can take up to 65 calendar days.

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 award- project objectives, location, and the specific infrastructure project involved;
- Total estimated Financial Assistance award value, inclusive of recipient cost share;
- Total estimated infrastructure costs (estimated costs of the Iron, Steel, Manufactured

Products and Construction Materials being purchased under the award and utilized in the infrastructure project);

- 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 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;
- A description of the market research conducted that includes who conducted the market research, when it was conducted, sources that were used, and the methods used to conduct the research; 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, or phased-out over 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.

4. Conference Spending (February 2015)

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States Government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the United States Government would otherwise exceed $20,000, thereby circumventing the required notification by the head of any such Executive Branch department, agency, board, commission, or office to the Inspector General (or senior ethics official for any entity without an Inspector General), of

the date, location, and number of employees attending such conference.

5. Commitment of Public Funds

(a) A DOE financial assistance award is valid only if it is in writing and is signed, either in writing or electronically, by a DOE Contracting Officer.

(b) Recipients are free to accept or reject the award. A request to draw down DOE funds constitutes the Recipient's acceptance of the terms and conditions of this Award.

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

In submitting an application in response to this NOFO the Applicant represents that:

- It is **not** a corporation that has been convicted of a felony criminal violation under any Federal law within the preceding 24 months,
- It is **not** a corporation that has any unpaid Federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

- A Corporation includes any entity that has filed articles of incorporation in any of the 50 states, the District of Columbia, or the various territories of the United States [but not foreign corporations]. It includes both for-profit and non-profit organizations.

7. Digital Persistent Identifier (PID)

Covered individuals[21] listed on applications must provide a digital persistent identifier (PID) in the common Biographical Sketch and Current and Pending (Other) Support forms as part of the application. Included PIDs must meet the common/core standards specified in the NSPM-33 Implementation Guidance or successor guidance (e.g., an ORCID iD). The inclusion of an individual's PID will be optional until May 1, 2025, and mandatory thereafter.

8. 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.

---

21 Covered Individual has the same meaning as in the Research Security Training Requirement provision.

The recipient shall apply this provision to all subrecipients at any tier.

9. 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.

10. 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.

11. Foreign Travel

If international travel is proposed for your project, please note that your organization must comply with the International Air Transportation Fair Competitive Practices Act of 1974 (49 U.S.C. § 40118), commonly referred to as the "Fly America Act," and implementing regulations at 41 CFR 301-10.131 through 301-10.143. The law and regulations require air transport of people or property to, from, between, or within a country other than the United States, the cost of which is supported under this award, to be performed by or under a cost-sharing arrangement with a United States flag carrier, if service is available.

12. Funding Restrictions

Funding for all awards and future budget periods are contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority.

Cost Principles: Costs must be allowable, allocable and reasonable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation).

Pre-award Costs: Recipients may charge to an award resulting from this NOFO pre-award costs that were incurred within the 90-day calendar period immediately preceding the effective date of the award, if the costs are allowable in accordance with the applicable Federal cost principles referenced in 2 CFR 200 as modified by 2 CFR 910 (DOE Financial Assistance Regulation). Recipients must obtain the prior approval of the DOE Contracting Officer for any pre-award costs that are for periods greater than this 90-day calendar period.

Pre-award costs are incurred at the applicant's risk. DOE is under no obligation to reimburse such costs if for any reason the applicant does not receive an award or if the award is made for a lesser amount than the applicant expected.

13. Government Right to Reject or Negotiate

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

14. Intergovernmental Review

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

15. 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.

16. 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.

17. Modifications

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

18. 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 compliance document such as a categorical exclusion (CX), environmental impact statement (EIS),) or an environmental assessment (EA) prepared after selection.

This CX, EIS, or EA process would need to be completed prior to the applicant taking any action on the proposed project that could have adverse environmental effects or that could limit the choice of reasonable alternatives. The three processes would each begin with a request from DOE for an environmental disclosure. If DOE is able to make a CX determination base on that disclosure, that would end the NEPA process.). If DOE determines that an EIS or EA is necessary, it would need to be funded by the applicant and at DOE's discretion also their participation. Note that in most cases, even when "Potential Impact to the Environment" is checked "Yes" on the other Project Information Form, preparation of EISs and EAs is rarely necessary, but DOE has the expectation that the recipient will disclose the potential, which would serve to initiate dialog with DOE as necessary. The inability to satisfy the NEPA requirements after an award would result in cancellation of the award.

19. Nondisclosure and Confidentiality Agreements Representations (June 2015)

By submitting an application in response to this NOFO, the Applicant represents that:

(1) It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contactors 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.

20. 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.

21. Portable Document Format (PDF) Generation

The Project Narrative in an application must be one single PDF file that contains the DOE Title Page, Project Narrative, all required appendices, and other attachments. This single PDF file may not be scanned from a printed document and must be attached in Field 8 on the Grants.gov form. This must be a plain PDF file consisting of text, numbers, and images. The Project Narrative will be read by SC staff using the full version of Adobe Acrobat: Please ensure that the narrative is readable in Acrobat.

Do not submit files with editable fields, password-protection, encryption, redactions, comments, or any other advanced features in some PDF-compatible software. If a file cannot be opened and searched, an application may be declined.

If combining multiple files into one Project Narrative, ensure that a PDF portfolio or binder is not created.

If creating PDF files using any software other than Adobe Acrobat, please use a "Print to PDF" or equivalent process to ensure that all content is visible in the Project Narrative.

Once a Project Narrative has been assembled, please submit the combined Project Narrative file through a "Print to PDF" or equivalent process to ensure that all content is visible in one PDF file that can be viewed in Adobe Acrobat.

Review your submission to ensure that blank pages are not present.

22. 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.

23. Prohibition on Discrimination and Harassment

All people conducting, supporting, or participating in scientific research under this award must be able to do so on the basis of their abilities and without any unnecessary barriers. Recipients of awards resulting from this NOFO are prohibited from engaging in discrimination on any basis prohibited by law, including harassment (sexual or non-sexual) as contained in 10 CFR 1040, 1041, and 1042.

Recipients may contact the DOE's Office of Civil Rights for technical assistance in meeting their institutional requirements under these regulations, including assistance in addressing complaints of discrimination or harassment. DOE is committed to meeting its obligations under Title IV of the Civil Rights Act. The United States Equal Employment Opportunity Commission also makes a number of resources available at https://www.eeoc.gov/eeoc/publications/index.cfm to ensure that employees may perform their work without hindrance. Graduate students and post-doctoral researchers are understood to have a dual role as both trainees and employees, in accordance with 2 CFR 200.400 (f).

24. Prohibition on Entities of Concern

DOE is prohibited by law from using funds made available by the Consolidated Appropriations Act, 2024 (Public Law 118-42) to award any grant, contract, cooperative agreement, or loan of $10 million or more in DOE funds to entities of concern, as defined in section 10114 of Public Law 117-167 (42 USC 18912), also known as the CHIPS and Science Act[22]. In addition, such

22 DOE activities authorized under Public Law 117-167 include Office of Science user facilities, basic energy sciences program, computational materials and chemical sciences centers, foundational nuclear science, carbon materials science initiative, carbon sequestration research and geologic computational science initiative, biological and environmental research, advanced scientific computing research program, quantum network infrastructure research and development and user expansion programs, fusion energy research, high energy physics program, nuclear physics program, accelerator research and development, isotope research and development, high intensity laser research, biological threat preparedness research initiative. See sections 10101-10113. Authorized DOE activities also include technology transfer and laboratory activities such as the Foundation for Energy Security and

entities (including an individual that owns or controls, is owned or controlled by, or is under common ownership or control with an entity of concern) are prohibited from receiving any funds or performing work under any award involving Department activities authorized under Division A or B of Public Law 117-167, subject to certain penalties. See section 10114 of Public Law 117-167 (42 USC 18912) and section 310 of Public Law 118-42 for additional information.

Congress has given DOE authority to require the submission of documentation necessary to implement the requirements of this term by an entity seeking or receiving this award. By submitting an application to this NOFO, the applicant is certifying that neither the applicant nor any of the project participants qualify as Entities of Concern.

Definitions
Entity of Concern is defined as in section 10114 of Public Law 117-167 (42 USC 18912), also known as the CHIPS and Science Act, as any entity, including a national, that is—

> (A) identified under section 1237(b) of the Strom Thurmond National Defense Authorization Act for Fiscal Year 1999 (50 U.S.C. 1701 note; Public Law 105–261);
>
> (B) identified under section 1260H of the William M. (Mac) Thornberry National Defense Authorization Act for Fiscal Year 2021 (10 U.S.C. 113 note; Public Law 116–283);
>
> (C) on the Entity List maintained by the Bureau of Industry and Security of the Department of Commerce and set forth in Supplement No. 4 to part 744 of title 15, Code of Federal Regulations;
>
> (D) included in the list required by section 9(b)(3) of the Uyghur Human Rights Policy Act of 2020 (Public Law 116–145; 134 Stat. 656); or
>
> (E) identified by the Secretary, in coordination with the Director of the Office of Intelligence and Counterintelligence and the applicable office that would provide, or is providing, covered support, as posing an unmanageable threat—
>
> > (i) to the national security of the United States; or
> >
> > (ii) of theft or loss of United States intellectual property.

25. Prohibition on Lobbying Activity

By accepting funds under this award, you agree that none of the funds obligated on the award

---

Innovation (section 10691), the national clean incubator program (section 10713), clean energy technology transfer (sections 10714-10715), Lab partnering service pilot program (section 10716), Lab-embedded entrepreneurship program (section 10717), small business voucher program (section 10718), entrepreneurial leave program (section 10719) , and non-federal employee outside employment authority (section 10720).

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.

26. Prohibition Related to Malign Foreign Talent Recruitment Programs

Prohibition
As required by law,[23] *Covered Individuals* participating in a *Malign Foreign Talent Recruitment Program* are prohibited from participating in projects selected for federal funding under this NOFO. Should an award result from this NOFO, the recipient must exercise ongoing due diligence to reasonably ensure that no such individuals participating on the DOE-funded project are participating in a *Malign Foreign Talent Recruitment Program*. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy.

Further, the recipient must notify DOE within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a malign foreign talent recruitment program. DOE may modify and add requirements related to this prohibition to the extent required by law.

Covered Individuals and the applicant must provide certifications regarding no participation in *Malign Foreign Talent Recruitment Programs* (see the Current and Pending Support section and Transparency of Foreign Connections section).

Non-Discrimination
DOE will ensure that the Malign Foreign Talent Recruitment Program Prohibition is carried out in a manner that does not target, stigmatize, or discriminate against individuals on the basis of race, ethnicity, or national origin, consistent with title VI of the Civil Rights Act of 1964 (42 U.S.C. 2000d et seq.).

Definitions

Malign Foreign Talent Recruitment Program. as defined in P.L. 117-167, Section 10638(4):
A) any program, position, or activity that includes compensation in the form of cash, in-kind compensation, including research funding, promised future compensation, complimentary foreign travel, things of non de minimis value, honorific titles, career advancement opportunities, or other types of remuneration or consideration directly provided by a foreign country at any level (national, provincial, or local) or their designee, or an entity based in, funded by, or affiliated with a foreign country, whether or not directly sponsored by the foreign country, to the targeted individual, whether directly or indirectly stated in the arrangement, contract, or other documentation at issue, in exchange for the individual—

23 See sections 10631-10632 of P.L. 117-167 (42 USC 19231-19232); OSTP-Foreign-Talent-Recruitment-Program-Guidelines.pdf (whitehouse.gov).

i. engaging in the unauthorized transfer of intellectual property, materials, data products, or other nonpublic information owned by a United States entity or developed with a federal research and development award to the government of a foreign country or an entity based in, funded by, or affiliated with a foreign country regardless of whether that government or entity provided support for the development of the intellectual property, materials, or data products;
ii. being required to recruit trainees or researchers to enroll in such program, position, or activity;
iii. establishing a laboratory or company, accepting a faculty position, or undertaking any other employment or appointment in a foreign country or with an entity based in, funded by, or affiliated with a foreign country if such activities are in violation of the standard terms and conditions of a federal research and development award;
iv. being unable to terminate the foreign talent recruitment program contract or agreement except in extraordinary circumstances;
v. through funding or effort related to the foreign talent recruitment program, being limited in the capacity to carry out a research and development award or required to engage in work that would result in substantial overlap or duplication with a federal research and development award;
vi. being required to apply for and successfully receive funding from the sponsoring foreign government's funding agencies with the sponsoring foreign organization as the recipient;
vii. being required to omit acknowledgment of the recipient institution with which the individual is affiliated, or the federal research agency sponsoring the research and development award, contrary to the institutional policies or standard terms and conditions of the federal research and development award;
viii. being required to not disclose to the federal research agency or employing institution the participation of such individual in such program, position, or activity; or
ix. having a conflict of interest or conflict of commitment contrary to the standard terms and conditions of the federal research and development award; and

B) a program that is sponsored by—
i. a foreign country of concern or an entity based in a foreign country of concern, whether or not directly sponsored by the foreign country of concern;
ii. an academic institution on the list developed under section 1286(c)(8) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note; [1] Public Law 115–232); or
iii. a foreign talent recruitment program on the list developed under section 1286(c)(9) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 2358 note; [1] Public Law 115–232).

Consistent with applicable law (42 U.S.C. 19232), this provision does not prohibit, unless such activities are funded, organized, or managed by an academic institution or a foreign talent recruitment program on the lists developed under paragraphs (8) and (9) of section 1286(c) of the John S. McCain National Defense Authorization Act for Fiscal Year 2019 (10 U.S.C. 4001 note; Public Law 115–232)—

A) making scholarly presentations and publishing written materials regarding scientific information not otherwise controlled under current law;

B) participation in international conferences or other international exchanges, research projects or programs that involve open and reciprocal exchange of scientific information, and which are aimed at advancing international scientific understanding and not otherwise controlled under current law;

C) advising a foreign student enrolled at an institution of higher education or writing a recommendation for such a student, at such student's request; and

D) other international activities determined appropriate by the federal research agency head or designee.

27. Proprietary Application Information

Department of Energy (DOE) takes very seriously the confidentiality of all applicants and will treat information submitted in applications, as well as the identity of applicants, as confidential to the fullest extent permissible under Federal law. In order for DOE to protect confidential information, the applicant must also treat the information as confidential and properly mark it as described below. DOE will not be able to protect information that the applicant has released publicly or is in the public domain. For additional information on DOE's Freedom of Information Act (FOIA) regulations, see 10 CFR 1004.

Applicants should not include business sensitive information (e.g., commercial or financial information that is privileged or confidential), trade secrets, proprietary, or otherwise confidential information in their application unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the NOFO. Applicants are advised to not include any critically sensitive proprietary detail.

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the FOIA. Without assuming any liability for inadvertent disclosure, DOE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

Applications and other submissions containing confidential, proprietary, or privileged information must be marked as described below. Failure to comply with these marking requirements may result in the disclosure of the unmarked information under the FOIA or otherwise. The U.S. Government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose.

The cover sheet of the Application and other submission must be marked as follows and identify the specific pages containing trade secrets, confidential, proprietary, or privileged information:

> **Notice of Restriction on Disclosure and Use of Data:**
> Pages [list applicable pages] of this document may contain trade secrets, confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for evaluation purposes or in accordance with a financial assistance or loan agreement between the submitter and the Government. The Government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. [End of Notice]

The header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Trade Secrets, Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure." In addition, each line or paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

IMPORTANT GUIDANCE FOR COMPANY SUBMITTERS:

As per DOE's FOIA regulations and Department of Justice FOIA guidance, if DOE receives a FOIA request the following general steps will be taken:

1. DOE will review the request to determine whether your company's information is subject to the request. Only federal records are subject to FOIA requests. Depending on the circumstances, information submitted by an outside entity may be considered "federal records" for purposes of FOIA.
2. If your company information is determined to be a federal record and responsive to a FOIA request, DOE will review what was submitted in order to determine if DOE can make a determination whether the information is legally exempt.
    a. If DOE determines your information is fully exempt under an exemption and that it will not be released, DOE may not contact you.
    b. If DOE is unable to determine whether the information is exempt under an exemption or is planning on releasing some or all of your information, DOE will first contact you in order for you to have an opportunity to respond and provide additional justification as to why it may be exempt. DOE will do all that it can to work with company submitters to be in compliance with the law and maintain positive relations with company submitters.
    c. It is critical if DOE or DOE's contractors who are processing your FOIA contact you that you respond in a timely manner. DOE is under strict deadlines when processing a FOIA request.

28. Publications

The recipient is expected to publish or otherwise make publicly available the results of the work conducted under any award resulting from this NOFO. Publications and other methods of public communication describing any work based on or developed under an award resulting from this NOFO must contain an acknowledgment of SC support. The format for such acknowledgments is provided at https://science.osti.gov/funding-opportunities/acknowledgements/. The author's copy of any peer-reviewed manuscript accepted for publication must be announced to DOE's Office of Scientific and Technical Information (OSTI) and made publicly available in accordance with the instructions contained in the Reporting Requirements Checklist incorporated in all Assistance Agreements. Awards made under this NOFO are subject to DOE's Public Access Plan. Full-text versions of scientific publications must be made publicly accessible at no charge to readers.

29. 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.

30. Research Misconduct

Scientific discoveries can only take place when scientific research is conducted in a fair, transparent, and honestly reported manner. Any form of dishonesty—whether plagiarism, falsifying results, or misrepresenting conditions—makes it impossible to advance our understanding of the physical universe.

Recipients are "responsible for maintaining the integrity of research of any kind under an award from DOE including the prevention, detection, and remediation of research misconduct, and the conduct of inquiries, investigations, and adjudication of allegations of research misconduct," and conducting appropriate administrative processes in response to allegations of research misconduct in accordance with 2 CFR 910.132. Allegations of any misconduct under an award resulting from this NOFO must be reported to the appropriate institutional officials in accordance with institutional policies against misconduct. Additional information on DOE research misconduct policies can be found at: https://science.osti.gov/grants/Policy-and-Guidance/Research-Misconduct.

31. Research Security Training Requirement

Covered individuals listed on the application are required to certify that they have taken research security trainings consistent with Section 10634 of the CHIPS and Science Act of 2022. In addition, Applicants must maintain sufficient records (records must be made available to DOE upon request) of their compliance with this requirement for covered individuals at the recipient organization and they must extend this requirement to any and all subrecipients. To fulfill this requirement, applicants may utilize the four training modules developed by the National Science Foundation at https://new.nsf.gov/research-security/training or develop and implement their own

research security training program aligned with the requirements in Section 10634(B) of the CHIPS and Science Act of 2022. The submission of an application to this NOFO constitutes the applicant's acceptance of this requirement.

Covered Individual means an individual who (a) contributes in a substantive, meaningful way to the development or execution of the scope of work of a project funded by DOE or proposed for funding by DOE, and (b) is designated as a covered individual by DOE.

DOE designates as covered individuals any principal investigator (PI); project director (PD); co-principal investigator (Co-PI); co-project director (Co-PD); project manager; and any individual regardless of title that is functionally performing as a PI, PD, Co-PI, Co-PD, or project manager. Status as a consultant, graduate (master's or PhD) student, or postdoctoral associate does not automatically disqualify a person from being designated as a "covered individual" if they meet the definition in (a) above.

The prime applicant is responsible for assessing the applicability of (a) against each person listed on the application. Further, the prime applicant is responsible for identifying any such individual to DOE for designation as a covered individual, if not already designated by DOE as described above.

Individuals committing no measurable effort or "as-needed" effort are not automatically exempt from being designated as a covered individual. The prime applicant's listing of an individual in the "Senior/Key Person" section of an SF-424(R&R) budget serves as an acknowledgement that DOE designates that person as a covered individual.

DOE may further designate covered individuals during award negotiations or the award period of performance.

32. 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.

33. Statement of Federal Stewardship

DOE will exercise normal federal stewardship in overseeing the project activities performed under DOE awards. Stewardship activities include but are not limited to conducting site visits; reviewing performance and financial reports; providing assistance and/or temporary intervention in unusual circumstances to correct deficiencies that develop during the project; assuring compliance with terms and conditions; and reviewing technical performance after project completion to ensure that the project objectives have been accomplished.

34. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR 170. (See: www.eCFR.gov). Prime recipients must register with the new Federal Funding and Transparency Act Subaward Reporting System (FSRS) at https://www.fsrs.gov and report the required data on their first tier subrecipients. Prime recipients may be required to report the total compensation for their five most highly compensated executives as part of their registration profile in SAM.gov and for first-tier subrecipients' five most highly compensated executives as in FSRS.gov.

35. Title to Subject Inventions

Ownership of subject inventions is governed pursuant to the authorities listed below:

- **Nonprofit organizations or small business firms**: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), nonprofit organizations or small business firms as defined by 35 U.S.C. 201 may elect to retain title to their subject inventions.
- **All other parties**: The federal Non-Nuclear Energy Act of 1974, 42. U.S.C. 5908, provides that the government obtains title to new inventions unless a waiver is granted (see below).
- **Patent Waiver**: DOE has issued Class Patent Waiver W(C) 2022-03 which allows domestic large businesses providing at least 20% cost share to elect to retain title to their subject inventions. Class Patent Waiver W(C) 2022-03 includes a U.S. Competitiveness provision requiring any products embodying or produced through the use of a subject invention first created or reduced to practice in the performance of work under this NOFO to be substantially manufactured in the United States. A domestic large business is any for-profit entity that does not qualify as a "small business" and is incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and is not owned, controlled, or influenced by a foreign government, agency, firm, corporation, or person. Applicants may request a waiver of all or any part of the rights of the United States in inventions conceived or first actually reduced to practice in performance of an agreement as a result of this NOFO, in advance of or within 30 days after the effective date of the award. Even if such advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver of the rights of the United States in identified inventions, i.e., individual inventions conceived or first actually reduced to practice in performance of the award. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784. For more information, see https://www.energy.gov/gc/office-assistant-general-counsel-technology-transfer-and-

intellectual-property Nonprofit organizations and small business firms do not need a patent waiver in order to retain title to their subject inventions (see above).

- **Determination of Exceptional Circumstances (DEC)**: On June 07, 2021, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES (DEC) UNDER THE BAYH-DOLE ACT TO FURTHER PROMOTE DOMESTIC MANUFACTURE OF DOE SCIENCE AND ENERGY TECHNOLOGIES. In accordance with this DEC, all awards, including sub-awards, under this NOFO shall include the U.S. Competitiveness Provision in accordance with Section IX of this NOFO. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs.
- Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.
- DOE may issue and publish on the website above further DECs prior to the issuance of awards under this NOFO. DOE may require additional submissions or requirements as authorized by any applicable DEC.
- **[IF APPLICABLE] DEC**: **QUANTUM INFORMATION SCIENCE TECHNOLOGIES DEC**: On August 28, 2020, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES UNDER THE BAYH-DOLE ACT FOR QUANTUM INFORMATION SCIENCE TECHNOLOGIES, pursuant to 37 CFR 401.3(a)(2), which applies to agreements issued under this NOFO requiring each applicant to agree to a U.S. Competitiveness Provision. DOE has determined that exceptional circumstances exist that warrant the modification of the standard patent rights clause for small businesses and non-profit recipients under the Bayh-Dole Act, 35 U.S.C. 200 et seq., to the extent necessary to ensure that DOE "obtains sufficient rights in the federally supported inventions to meet the needs of [DOE]" and "to promote the commercialization and public availability of inventions made in the United States by United States industry and labor" and/or further promote other purposes of the Bayh-Dole Act. 35 U.S.C. § 200. In accordance with this DEC, all awards, including sub-awards, under this NOFO shall include the U.S. Competitiveness Provision in accordance with Section IX of this NOFO. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs.

[IF APPLICABLE] Class Patent Waiver: DOE has issued Class Patent Waiver No. W(C) 2020-001 of Patent Rights Related to Quantum Information Science and its Technology Applications that applies to this NOFO for any domestic large business that is a recipient, or subrecipient at any tier to this NOFO and is providing at least 20% cost share. Under this Class Patent Waiver, domestic large businesses may elect title to their subject inventions similar to the right provided to the domestic small businesses, educational institutions, and nonprofits by law. In order to avail itself of the class patent waiver, a domestic large business must agree that any products embodying or produced using a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States. Entities not eligible under the Class Patent Waiver are still able to petition DOE for rights under an Advanced or Identified Patent Waiver as described above.

Nonprofit organizations and small business firms do not need a patent waiver in order to retain

title to their subject inventions (see above).

36. Trafficking in Persons

Awards resulting from this NOFO are subject to the requirements of 2 CFR 175 (https://www.ecfr.gov) which prohibit recipients, their employees, subrecipients, and their employees from severe forms of trafficking in persons; the procurement of a commercial sex act during the period of time that this award or any subaward is in effect; the use of forced labor in the performance of this award or any subaward; or acts that directly support or advance trafficking in persons.

37. U.S. Competitiveness

A primary objective of DOE's multi-billion-dollar research, development and demonstration investments is to cultivate new research and development ecosystems, manufacturing capabilities, and supply chains for and by U.S. industry and labor. Therefore, in exchange for receiving taxpayer dollars to support an applicant's project, the applicant must agree to a U.S. Competitiveness provision requiring to any products embodying any subject invention or produced using any subject invention will be manufactured substantially in the United States unless the Recipient can show to the satisfaction of DOE that it is not commercially feasible. Award terms, including the U.S. Competitiveness Provision, are available at https://www.energy.gov/gc/standard-intellectual-property-ip-provisions-financial-assistance-awards.

Please note that a subject invention is any invention conceived or first actually reduced in performance of work under an award. An invention is any invention or discovery which is or may be patentable. The recipient includes any awardee, recipient, sub-awardee, or sub-recipient.

As noted in the U.S. Competitiveness Provision, if an entity cannot meet the requirements of the U.S. Competitiveness Provision, the entity may request a modification or waiver of the U.S. Competitiveness Provision. For example, the entity may propose modifying the language of the U.S. Competitiveness Provision in order to change the scope of the requirements or to provide more specifics on the application of the requirements for a particular technology. As another example, the entity may request that the U.S. Competitiveness Provision be waived in lieu of a net benefits statement or U.S. manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the U.S. economy and competitiveness. Examples of such commitments could include manufacturing specific products in the U.S., making a specific investment in a new or existing U.S. manufacturing facility, keeping certain activities based in the U.S. or supporting a certain number of jobs in the U.S. related to the technology. DOE may, in its sole discretion, determine that the proposed modification or waiver promotes commercialization and provides sufficient U.S. economic benefits, and grant the request. If granted, DOE will modify the award terms and conditions for the requesting entity accordingly. More information and guidance on the waiver and modification request process can be found in the DOE Financial Assistance Letter on this topic, available here at https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-

doe-determination-exceptional-circumstances-under. Additional information on DOE's Commitment to Domestic Manufacturing for DOE-funded R&D is available at https://www.energy.gov/gc/us-manufacturing.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See Section IX.

38. 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. 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 NOFO may be reviewed by a Committee of Visitors.

D. Reference Material

Glossary of Useful Grants and Cooperative Agreement terms

Acquisition cost	*Acquisition cost* 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	*Administrative requirement*s 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	*Advance payment* 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	*Allocation* 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	*Allocability* 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	*Allowable cost* 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	*Application* 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	*Appropriation act* 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 *approved budget* 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	*Assurance* 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	*Authorized organizational representative* 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	*Award* 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	*Award documents* means the entirety of the documents describing the legal relationship between DOE and an awardee or recipient. The award documents include an Assistance Agreement and other documents which may be incorporated by reference or as attachments to the Assistance Agreement. The award documents are the official, legally binding document, signed (or the electronic equivalent of signature) by a Contracting Officer that: • notifies the recipient of the award of an award; • contains or references all the terms and conditions of the grant and Federal funding limits and obligations; and, • provides the documentary basis for recording the obligation of Federal funds in the DOE accounting system.
Bayh-Dole Act	*Bayh-Dole Act* 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	*Budget* 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	*Budget period* means the intervals of time (usually 12 months each) into which a project period is divided for budgetary and funding purposes.
Business officer	*Business officer* means the financial official of the recipient who has primary fiscal responsibility for the grant. Also known as authorized organizational representative.
Capital assets	*Capital assets* means tangible or intangible assets used in operations having a useful life of more than one year which are capitalized in accordance with GAAP. Capital assets include: (a) Land, buildings (facilities), equipment, and intellectual property (including software) whether acquired by purchase, construction, manufacture, lease-purchase, exchange, or through capital leases; and (b) Additions, improvements, modifications, replacements, rearrangements, reinstallations, renovations or alterations to capital assets that materially increase their value or useful life (not ordinary repairs and maintenance).
Carryover	*Carryover* 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	*Change in scope* 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	*Closeout* 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	*Competitive segment* means the initial project period recommended for support or each extension of a project period resulting from a renewal award.
Conference (domestic or international)	*Conference (domestic or international)* 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	*Consortium or sub-award agreement* 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	*Consultant* 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	*Continuation application/award* 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	*Contract* 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	*Contractor* means an entity that receives a contract as defined in 2 CFR 200.1 Contract.
Contracting (or Grants) Officer	*Contracting (or Grants) Officer* 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	*Contracting (or Grants Management) specialist* 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	*Cooperative agreement* 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	*Cost principles* 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	*Cost sharing or matching* 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	*Deadline* means the published date and/or time that a grant application is to be submitted to the funding agency.
Debarment and suspension	*Debarment and suspension* 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	*Direct costs* 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	*Disallowed costs* 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	*Domestic organization* 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	*Effort* 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	*Equipment* means tangible personal property (including information technology systems) having a useful life of more than one year and a per-unit acquisition cost which equals or exceeds the lesser of the capitalization level established by the non-Federal entity for financial statement purposes, or $10,000. See also 2 CFR 200.1 Capital assets, Computing devices, General purpose equipment, Information technology systems, Special purpose equipment, and Supplies.
Expanded authorities	*Expanded authorities* 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	*Expiration date* 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	*Facilities and administrative costs* 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	*Federal financial report* 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	*Financial assistance* 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	*Financial status report* means see Federal Financial Report.
Foreign travel	*Foreign travel* is meant to include travel outside of North America (Canada, Mexico, and the United States) and U.S. territories and possessions (Guam, American Samoa, Puerto Rico, the U.S. Virgin Islands. A trip is considered foreign travel for all legs of the itinerary if the traveler does not return to his or her post prior to departure for a foreign destination. Costs for foreign travel may be restricted by the language of a Funding Opportunity Announcement.
Grant agreement	*Grant agreement* 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: (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; (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. (c) Does not include an agreement that provides only: (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	*Grant-supported project or activity* 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	*Grants.gov* (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)	*Indirect (F&A) costs* 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	*Institutional base salary* 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	*Matching or cost sharing* 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	*Merit (or peer) review* 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	*Monitoring* 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	*NEPA* 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	*No-cost extension* 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	*Non-Federal share* means when cost sharing or matching is required as a condition of an award, the portion of allowable project/program costs not borne by the Federal government.
Notice of Funding Opportunity (NOFO)	*Notice of Funding Opportunity (NOFO)* means a publicly available document by which a Federal Agency makes known its intentions to award discretionary grants or cooperative agreements, usually as a result of competition for funds. NOFOs may be known as program announcements, requests for applications, notices of funding availability, solicitations, or other names depending on the Agency and type of program. NOFOs can be found at www.Grants.gov. A NOFO may also be known as a solicitation. NOFOs were previously known as Funding Opportunity Announcements (FOAs).
Obligations	*Obligations,* 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	*OMB circulars* are government-wide guidance issued to Heads of Federal agencies by the Director of the Office of Management and Budget.
Other significant contributors	*Other significant contributors* 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	*Program participants* 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	*Participant support costs* 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	*Person months* 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	*Pre-application or pre-proposal* means a brief outline or narrative of proposed work and sometimes budget, for informal review by a sponsor to determine

	whether an application should be submitted. Three predominant reasons for requiring submission of a preliminary pre-application are: • Reduce the applicant's unnecessary effort in proposal preparation when the chance of success is very small. This is particularly true of exploratory initiatives where the community senses that a major new direction is being identified, or competitions that will result in a small number of actual awards. • Increase the overall quality of the submission. • Distill the number of applications that will be submitted to the agency and the number of anticipated reviewers needed to review.
Pre-award costs	*Pre-award costs* 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	*Prior approval* means written approval from the designated Contracting Officer.
Program Director/ Principal Investigator	*Program Director/ Principal Investigator* 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	*Program income* 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 or 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	*Program Manager* 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	*Progress report* 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	*Project/ performance site* means location(s) of where the work described in the research plan will be conducted.
Project period	*Project period* 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	*Re-budgeting* means reallocation of funds available for spending between approved budget categories to allow best use of funds to accomplish the project goals.
Real Property	*Real property* means land, including land improvements, structures and appurtenances thereto, but excludes moveable machinery and equipment.
Recipient	*Recipient* 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	*Renewal application* 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	*Research* 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	*Research misconduct* 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	*SAM.gov* 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	*Scope of work* 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	*Senior/Key personnel* 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	*Significant re-budgeting* 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	*Small business concern* means a business that meets the regulatory and size requirements established by the SBA at 13 CFR 121.

Solicitation	See Funding Opportunity Announcement.
Subaward	*Subaward* 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	*Subrecipient* 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	*Supplement* 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	*Terms and conditions of award* 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	*UEI* is the Unique Entity Identifier, a twelve-digit alphanumerical sequence established and assigned by the System for Award Management at https://www.SAM.gov to uniquely identify an entity.
Unallowable costs	*Unallowable costs* 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	*Unliquidated obligations* 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	*Unobligated balance* 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, *validate* 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.