

Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

AMMTO-BTO and OE FY22 Multi-Topic FOA

Funding Opportunity Announcement (FOA) Number: DE-FOA-0002864

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FOA Issue Date:	01/04/2023
Submission Deadline for Concept Papers:	2/3/2023 5:00pm ET
Submission Deadline for Full Applications:	4/7/2023 5:00pm ET
Expected Submission Deadline for Replies to Reviewer Comments:	5/11/2023 5:00pm ET
Expected Date for EERE Selection Notifications:	8/7/2023
Expected Timeframe for Award Negotiations:	Aug-Sep 2023

- Applicants must submit a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.
- To apply to this FOA, applicants must register with and submit application materials through EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov>, EERE's online application portal.
- **Unique Entity Identifier (UEI) and System for Award Management (SAM)** - Each applicant (unless the applicant is excepted from those requirements under 2 CFR 25.110) is required to: (1) Be registered in the SAM at <https://www.sam.gov> before submitting its application; (2) provide a valid UEI number in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency. DOE may not make a federal award to an applicant until the applicant has complied with all applicable UEI and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, the DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

NOTE: Due to the high demand of UEI requests and SAM registrations, entity legal business name and address validations are taking longer than expected to process. Entities should start the UEI and SAM registration process as soon as

possible. 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. Additional entity validation resources can be found here: [GSAFSD Tier 0 Knowledge Base - Validating your Entity](#).

- Applicants must designate primary and backup points-of-contact in EERE eXCHANGE with whom EERE will communicate to conduct award negotiations. If an application is selected for award negotiations, it is not a commitment to issue an award. It is imperative that the applicant/selectee be responsive during award negotiations and meet negotiation deadlines. Failure to do so may result in cancelation of further award negotiations and rescission of the selection.

Modifications

All modifications to the FOA are HIGHLIGHTED in the body of the FOA.

Mod. No.	Date	Description of Modification
0001	1/30/2023	<ol style="list-style-type: none">1. Changes include updates to FOA subtopics 1.1 and 1.3 in Section I.B as highlighted below2. Updated maximum file size to 50MB in sections IV.B and IV.D.i3. Changes also include an update to Appendix C on foreign work as highlighted below
0002	3/8/2023	<ol style="list-style-type: none">1. Changes include revisions to the following sections:<ol style="list-style-type: none">a. IV.D.iii Resumesb. IV.D.xvi Current and Pending Supportc. IV.D.xvii Transparency of Foreign Connection
0003	3/16/2023	<ol style="list-style-type: none">1. Changes include corrections to the naming convention of the Community Benefits Plan submissions under Section IV.D.i. and elimination of a paragraph referencing a separate submittal of a Diversity, Equity, and Inclusion Plan in Section IV.D.xv.

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I. Funding Opportunity Description

A. Background and Context

i. Background and Purpose

This multitopic FOA is a joint effort between EERE's [Advanced Materials and Manufacturing Technologies Office \(AMMTO\)](#), the [Building Technologies Office \(BTO\)](#), and DOE's [Office of Electricity \(OE\)](#). The mission of **AMMTO** is to advance energy-related materials and manufacturing technologies to increase domestic competitiveness and build a clean, decarbonized economy. This is in alignment with AMMTO's vision for the future – a competitive U.S. manufacturing sector that accelerates the adoption of innovative material and manufacturing technologies in support of a clean, decarbonized economy. Until October 9, 2022, the relevant workshops and prior research highlighted in the various subtopic descriptions below were supported by EERE's Advanced Manufacturing Office (AMO). On October 9, AMO officially split into two offices within EERE: the [Industrial Efficiency and Decarbonization Office \(IEDO\)](#) and AMMTO.

BTO develops, demonstrates, and accelerates the adoption of cost-effective technologies, techniques, tools and services that enable high-performing, energy-efficient and demand-flexible residential and commercial buildings in both the new and existing buildings markets, in support of an equitable transition to a decarbonized energy system by 2050, starting with a decarbonized power sector by 2035.

OE provides national leadership to ensure that the Nation's energy delivery system is secure, resilient, and reliable. Through research and development, OE develops new technologies to improve the infrastructure that effectively and securely brings electricity into our homes, offices, and factories, and also oversees the Federal and state electricity policies and programs that shape electricity system planning and market operations.

Specifically, the goals of this multi-topic FOA are to:

- Validate and demonstrate next generation materials and manufacturing processes including domestic pilot demonstrations and related technologies to support the transition to U.S. manufacturing;
- Enable environmentally and socially responsible domestic manufacturing with diversified domestic supply of feedstocks including from recycled goods; and

- Mature nascent technologies, processes, and methods that improve the performance and market penetration of clean energy technologies and emerging building efficiency technologies.

These goals are aligned with AMO's Workshops on CABLE¹ and Harsh Environment Materials, as well as with DOE's Energy Storage Grand Challenge Roadmap.²

Building a clean and equitable energy economy and addressing the climate crisis is a top priority of the Biden Administration. This FOA will advance the Biden Administration's goals to achieve carbon pollution-free electricity by 2035 and to "deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050," to the benefit of all Americans.³ The Department of Energy is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of underserved communities.

The research, development, and deployment (RD&D) activities to be funded under this FOA will support the government-wide approach to the climate crisis by driving innovation that can lead to the deployment of clean energy technologies, which are critical for climate protection. Specifically, each subtopic in this FOA makes a unique contribution to decarbonization of the grid, industry, transportation and buildings. Generally, this multi-topic FOA supports next generation materials and technology innovation to enable the grid and energy technology infrastructure needed for carbon pollution-free electricity by 2035. It also supports secure and sustainable materials and decarbonization technologies needed to achieve net zero Greenhouse Gas (GHG) emissions by 2050.

This FOA will support activities to advance efficiency improvements and enhance manufacturing competitiveness through technological innovation by focusing on three main topic areas: (1) Next Generation Materials and Manufacturing Processes; (2) Secure and Sustainable Materials; and (3) Energy Technology Manufacturing. The multi-topic FOA integrates several identified research opportunities across AMMTO into a single funding opportunity that is intended to fund high-impact RD&D.

¹ See <https://cable-bigidea.anl.gov/workshop/2021-workshop/> and <https://cable-bigidea.anl.gov/workshop/2022-workshop/>.

² See <https://www.energy.gov/sites/default/files/2020/12/f81/Energy%20Storage%20Grand%20Challenge%20Roadmap.pdf>

³ Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021.

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The activities under this multi-topic FOA are authorized under § 911 of the Energy Policy Act of 2005, codified at 42 U.S.C. 16191, which authorizes energy efficiency programs with objectives to “increase energy efficiency of vehicles, buildings and industrial processes” as well as “reducing the cost of energy and making the economy more efficient and competitive.” In addition, the FOA relies on the authority of § 3201 of the Energy Act of 2020, codified at 42 U.S.C. 17232, which authorizes DOE to carry out programs to address energy storage technologies and applications, including vehicle-grid integration; energy storage systems, components, and materials; and R&D of advanced manufacturing technologies that can increase U.S. competitiveness in energy storage manufacturing.

ii. **Technology Space and Strategic Goals**

To achieve the goals outlined above, this FOA seeks to advance development of next-generation structural and functional materials and materials for energy technology, as well as field validation and pilot demonstration of technologies for materials and manufacturing processes. This FOA seeks to leverage the technology and capabilities developed by academia including minority serving institutions, entrepreneurs, and industry, including small businesses.

Manufacturing Landscape

The United States (U.S.) manufacturing sector uses 25% of the nation’s energy, has an annual energy bill generally exceeding \$125 billion, and accounts for the vast majority of the broader industrial sector's carbon emissions.⁴ Additionally, in 2019, the U.S. manufacturing sector accounted for 11% of gross domestic product (GDP),⁵ directly employed 12.8 million people,⁶ and sold products valued at \$5.7 trillion.⁷ In order to produce these goods, U.S. manufacturing firms used over 24.3 quads of total primary energy for all purposes in 2018 (where a “quad” denotes one quadrillion (10¹⁵) British thermal units (Btu)).⁸ In addition, because manufacturing is highly connected with other sectors of the

⁴ In Energy Information Administration statistics, the industrial sector includes manufacturing, agriculture and forestry, mining, and construction.

⁵ “Value Added by Industry as Percentage of Gross Domestic Product (2019).” U.S. Bureau of Economic Analysis. Last revised December 22, 2020. Available at:

<https://apps.bea.gov/iTable/iTable.cfm?reqid=150&step=2&isuri=1&categories=gdpind>.

⁶ “National Income and Product Accounts Tables – Section 6: Income and Employment History, Table 6.4D: Full-Time and Part-Time Employees by Industry (A).” U.S. Bureau of Economic Analysis. Last revised July 31, 2020. Available at: <https://apps.bea.gov/iTable/iTable.cfm?reqid=19&step=2>.

⁷ “Census Bureau Releases 2019 Annual Survey of Manufactures Data.” U.S. Census Bureau. Release Number CP21-TPS.18. Released February 18, 2021. Available at: <https://www.census.gov/newsroom/press-releases/2021/annual-survey-of-manufactures-data.html>

⁸ Estimated from the Energy Information Administration (EIA) 2018 MECS data and EIA Monthly Energy Review, February 2021. Available online at: <https://www.eia.gov/consumption/manufacturing/data/2018/> and <https://www.eia.gov/totalenergy/data/monthly/>.

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economy, manufacturing activities stimulate economic activity beyond the manufacturing sector itself. Reports have indicated that every \$1.00 spent in the U.S. manufacturing sector generates between \$1.33 and \$1.92 in other services and more production—a multiplier higher than that of any other sector.⁹ Manufacturing also has a positive effect on overall employment, with manufacturing-related employment ranging from mining to warehousing, as well as engineering, financial, and legal services. Advanced manufacturing technologies could have an even greater multiplier effect on employment than traditional manufacturing practices. As such, innovation in manufacturing also offers an opportunity to leverage economic growth across the U.S. economy.

Technology Offices Background and Objectives

The first subtopic on improved conductivity metals includes an area of interest—(1.1 b) Conductor/Cables Systems for Power Line Validation and Pilot Demonstration—in which AMMTO is partnering with DOE’s OE. While AMMTO’s interest in this topic is based in its previous work under its [Next Generation Materials and Processes](#) subprogram, OE’s interest is based on its [Advanced Grid Research and Development Division’s](#) technical objectives.

The second, third, fourth and fifth subtopics are being managed by AMMTO alone. The [AMMTO objectives](#) relevant to these topics/subtopics include:

- Improved Material Performance – (Topics 1 and 2)
- Innovative Manufacturing – (Topics 1, 2 and 3)
- Technology Transition --(Topics 1, 2 and 3)
- Robust Supply Chain – (Topic 2)

The sixth subtopic on dehumidification will be funded and managed by the Building Technologies Office (BTO) (<https://www.energy.gov/eere/buildings/building-technologies-office>). The BTO objectives relevant to this 3b subtopic include:

- Supporting the U.S. Economy
- Improving Energy Security
- Protecting the Environment

For all three offices, characteristics of past successful projects include collaborative efforts among manufacturers, other private sector organizations including small businesses, DOE labs, and academia.

⁹ Manufacturing’s Multiplier Effect is Stronger than Other Sectors” From the Manufacturing Institute, Updated April 2014. Available at: <https://sealectplastics.com/news/manufacturings-multiplier-effect-is-stronger-than-other-sectors/>

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iii. R&D Community Benefits Plan

DOE is committed to investing in research and development (R&D) innovations that deliver benefits to the American public and leads to commercialization of technologies and products that foster sustainable, resilient, and equitable access to clean energy. Further, DOE is committed to supporting the development of more diverse, equitable, inclusive, and accessible workplaces to help maintain the nation's leadership in science and technology.

To support the goal of building a clean and equitable energy economy, projects funded under this FOA are expected to (1) advance diversity, equity, inclusion and accessibility (DEIA); (2) contribute to energy equity; and (3) invest in America's workforce. To ensure these objectives are met, applications must include a Research and Development Community Benefits Plan (R&D Community Benefits Plan¹⁰) that addresses three objectives stated above. See Section IV.D.xv and Appendix H for the more information on the R&D Community Benefits Plan content requirements.

B. Topic Areas

AMMTO and its partner offices intend to fund high impact applied research and demonstration projects through this FOA. Proposed requested funding levels and project durations should be commensurate with the work scope necessary to advance the technology to the proposed technology readiness level (TRL). See Appendix E for EERE's definitions of TRLs. In general, efforts should include work scopes between TRL 3 and TRL 6, although accelerating from TRL 2 is also important for fast-moving innovation in advanced materials and manufacturing.

All applicants are expected to identify a baseline technology to compare their improvement against and justify why that technology is the appropriate baseline. In addition, the applicant shall provide at least three metrics for measuring their progress. The applicant also shall identify quantitative minimum and stretch goals that use these metrics. Examples of acceptable metrics and goals are provided for each subtopic. These are only examples, and applicants should use their own expertise and judgment to identify metrics and goals for their specific technology.

Topic Area 1: Next Generation Materials and Manufacturing Processes

¹⁰ Most DOE BIL FOAs focused on demonstration and deployment (D&D) also require a Community Benefits Plan; however, the plan content requirements for R&D-focused FOAs vary from the D&D Community Benefits Plan content requirements.

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This topic is focused on the development of novel materials with improved functional properties such as enhanced conductivity or high performance under extreme conditions as well as novel materials with improved properties such as high strength, light weight and ductility. The topic also focusses on cost-effective manufacturing processes for these materials.

Given the data-intensive nature of the Areas of Interest under Topic 1, awardees are expected to observe best practices for data stewardship. Throughout the project, applicants will be required to publish project datasets through a designated DOE-approved data repository using appropriate content models and/or data formats for the relevant field of study. Each applicant whose Full Application is selected for award negotiations will be required to submit an expanded Data Management Plan (DMP) during the award negotiations phase, in accordance with Section VI.B.xx.,

Subtopic 1.1: Increased Conductivity Metal-Based Material Systems

The objective of this sub-topic area is to increase the energy efficiency of electrification by increasing the conductivity of the best metal-based conductors and **advanced overhead conductor (AOHC)** systems through innovative compositions, conductor material fabrication (including the addition of non-metal materials) and conductor system manufacturing methods.

Subtopic 1.1 Background: Conductive metals such as copper and aluminum are required in electric applications. Decarbonizing the economy by 2050 will greatly increase electrification and hence demand for copper and aluminum. The maximum conductivity of copper (and aluminum), however, has increased only negligibly since 1913, when the International Annealed Copper Standard (IACS) was set (100% IACS = 58.1 mega Siemens per meter (MS/m)). Given recent scientific breakthroughs, however, developing conductivity-enhanced copper and aluminum may now be a viable approach to improve the energy efficiency of technologies that rely on these materials and enable the electrification needed to achieve net-zero carbon emissions.

In particular, the discovery of new nanocarbon allotropes, such as graphene and carbon nanotubes (CNTs), with their extraordinary electrical properties and reported

ability to raise the conductivity of metal electrical conductors,^{11,12,13} led DOE to create an initiative—entitled “Conductivity-enhanced materials for Affordable, Breakthrough, Leapfrog Electric and thermal applications (CABLE)”. A March 2022 report on advanced conductors from Grid Strategies, LLC articulates the enormous energy efficiency and carbon reduction potential of new advanced manufacturing techniques for powerline **AOHC** systems¹⁴.

This subtopic is intended to complement and build on activities sponsored by the CABLE Initiative through its [AMO-led Workshops](#), [SBIR/STTR awards](#), and CABLE Conductor Manufacturing [Prize](#), specifically for conductivity-enhanced metals. Beginning on October 9, 2022, when AMO split into two new offices, CABLE activities are run out of AMMTO.

Subtopic 1.1 Opportunity: Conductivity-enhanced metals and conductor systems are needed to enable and sustain electrification in applications including infrastructure, transportation, and industry. Electrolytic copper sales are estimated at \$150B and those for electrical aluminum at \$50B worldwide in 2022. Global copper demand is expected to triple over the coming decade due to projected increases in the demand for electric vehicles,¹⁵ stationary electrification technologies such as heat pumps, as well as undersea powerlines for offshore wind and marine power applications. Similarly, electric aluminum demand could double or triple over the same time period based on the projected tripling of transmission and overhead distribution lines needed to provide clean electricity to grids worldwide. Integration of conductivity-enhanced metals in transmission and distribution applications represents a key opportunity. Even the deployment of existing advanced, commercial aluminum conductors,

¹¹ Cao, M., D.-B. Xiong, L. Yang, S. Li, Y. Xie, Q. Guo, Z. Li, H. Adams, J. Gu, T. Fan, X. Zhang, and D. Zhang, 2019, “Ultrahigh Electrical Conductivity of Graphene Embedded in Metals,” *Advanced Functional Materials* 29(17):1806792, <https://doi.org/10.1002/adfm.201806792>.

¹² Pacific Northwest National Laboratory, 2020, “‘Better’ Copper Means Higher-Efficiency Electric Motors,” October 13, <https://www.pnnl.gov/news-media/better-copper-means-higher-efficiency-electric-motors>.

¹³ Subramanian, C., T. Yamada, K. Kobashi, A. Sekiguchi, D. Futaba, M. Yumura, and K. Hata, 2013, “One Hundred-Fold Increase in Current Carrying Capacity in a Carbon Nanotube–Copper Composite,” *Nature Communications* 4:2202, <https://www.nature.com/articles/ncomms3202>.

¹⁴ This report “Advanced Conductors on Existing Transmission Corridors to Accelerate Low Cost Decarbonization”, in March 2022 by Jay Caspary and Jesse Schneider of Grid Strategies LLC., , **and sponsored by a broad coalition of AOHC manufacturers, renewable energy, trade and environmental groups**, assumes that 200,000 miles of transmission will need to be replaced across the United States over the next decade. To calculate the benefit of using advanced conductor systems, the authors also assumed that 25% of these projects would be reconductored using advanced conductors, or 5,000miles of transmission annually, and that these projects would break down into 100 50-mile rebuild projects that are each capable of providing an additional 200 MW of capacity. Reconductoring 5,000 miles of transmission using advanced conductors would create 20 GW of transmission capacity each year, which can integrate up to 64 million MWh of renewable resource generation, equivalent to roughly 27 GWs of renewable capacity annually, and reduce power sector CO2 emissions by 44 million metric tons annually if the reconductoring were continued over the entire 10-year time period.

¹⁵ DOE Semiconductor Report February 24, 2022.

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moderately paced over 10 years, could save 3.5 billion MWh and save U.S. consumers more than \$140 billion⁵. Combined with enhanced conductivity materials, these **AOHCs** could also reduce the footprint of electrical systems, enabling more distributed application and fewer environmental justice issues around powerlines and stations. Replacing conventional conductors in vehicle motors is another application for such materials¹⁶. Electric energy costs make up about 96% of the total life cycle cost of a vehicle motor; thus, efficiency improvements will translate into significant savings. For example, a 10% increase in the conductivity of the conductor in an electric motor would result in a 30% electric vehicle efficiency improvement.

Subtopic 1.1 Technology Focus: This subtopic has two technology areas of interest: a) Materials Composition and Fabrication and b) Conductor/Cable Systems for Powerline Validation and Pilot Demonstration.

Topic 1, Subtopic 1.1, Area of Interest a) Materials Composition and Fabrication: The proposals sought by AMMTO under this Area of Interest (AOI), represent the continuation of applied R&D already sponsored by DOE as part of the CABLE initiative with a focus on metals and metal additives—but also including non-metal nanocarbon additives such as graphene or carbon nanotubes. This AOI is specifically focused on innovations in metal composition (including metals combined with small amounts of non-metal) and fabrication methods to manufacture conductivity-enhanced metals that could eventually become cost-competitive with copper or aluminum¹⁷. The way in which conductivity-enhanced material is processed is critical to achieving enhanced conductivity. The project team should use knowledge from theory, simulation, modelling (e.g., density functional theory (DFT) calculations, atomistic models) and/or characterization (Raman spectroscopy and X-ray diffraction) of their enhanced conductivity metals to inform the development of their metal composition and fabrication methods. For conductivity-enhanced metal material fabrication

¹⁶ Nationally, about 2,000 billion kWh are consumed annually by electric motors, 90% of which are alternating-current (AC) induction motors. If just 20% of the industrial AC motors had enhanced-conductivity copper wire, an annual energy savings of 36 billion kWh can be realized.

¹⁷ Conductivity-enhanced materials are defined as those at the micro scale—a size the same as or larger than that required for Stage 2 of the CABLE Conductor Manufacturing Prize. This stage presents participants with three contests, the first being Beat Copper: i.e., have electrical conductivity measured to be greater than 59.3 MS/m, or 102% International Annealed Copper Standard (IACS); and contain no bulk silver (Ag) and whose non-conductivity properties (e.g., strength, corrosivity) are equal to or better than those of electrolytic copper. The second contest is Beat Aluminum: i.e., have electrical conductivity measured to be greater than 37.7 MS/m or 65% IACS; have density measured at less than 2,710 kg/m³ and contain no bulk gold (Au) and whose non-conductivity properties (e.g., density, ductility, strength) are equal to or better than those of Al1350. The third contest is Beat a Conductor System: i.e., have electrical conductivity measured greater than the conductor system comprising a primary conductor in CABLE Prize Stage 2 Rules Appendix A with same or better than the primary conductor's nonconductivity system properties.

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innovations, proposers are encouraged to explore development and use of one or more of the following:

- Automated and high-throughput methods for reducing variability and reproducibility concerns in fabrication of enhanced conductivity materials;
- Annealing or other energetic processes for achieving desired microstructures;
- In situ and post-process surface finish techniques that improve properties;
- Precise, site-specific control of materials deposition (including compositional gradients) of materials and microstructures;
- Varied approaches to combine metal, and non-metal and potentially even different feedstock forms (e.g., wire and powder) within a single structure;
- Exploration of two or more consolidation methods (e.g., melting and sintering) and potential integration;
- Control of surface functionalities and structural properties through control of deposition rate, materials compositions, thermal input, and consolidation method;
- Incorporation of in-process diagnostic and control tools that provide the ability to monitor the process while applying heat into or withdrawing it from the platform.

Topic 1, Subtopic 1.1, Area of Interest b) Conductor/Cables Systems for Power line Validation and Pilot Demonstration: The proposals sought under the second area of interest by both AMMTO and the Office of Electricity (OE), would accelerate the deployment of conductivity-enhanced materials and higher ampacity conductor designs in AOHC systems for overhead powerlines. This AOI builds on the manufacturing technologies highlighted in the Grid Strategies, LLC report referenced above. This AOI supports validation and demonstrations showing how conductivity-enhanced materials can be used with AOHC system manufacturing methods. While AOHCs are relatively simple in concept, their implementation can introduce greater complexity due to new material properties and designs. These factors can affect O&M costs, require new tools and techniques for installation, and additional training, especially for splicing and connecting two spans. Under this AOI, proposals of interest include those that incorporate the following:

Table 1: Attributes of Proposals Sought under Topic 1, Subtopic 1.1, AOI (b)

<p>1. Conductors/cables with significant</p> <ul style="list-style-type: none"> • Increase in mechanical strength; • Reduction of thermal expansion; • Increase in the ampacity of similar conductor weight (lb/mile); • Sag reduction; • Line loss reduction; and • Life cycle cost-effectiveness and benefits vs initial cost.
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2. Manufacturing/assembly approaches to increase the amount of conductor (e.g., AL1350) in the conductor system for the same system volume (e.g., with trapezoidal rather than circular cross section);
3. Avoidance of need for low conductivity core material to provide strength, or incorporation of advanced lightweight core material with its own significant conductivity contribution;
4. Resistance to coastal weather including extreme events;
5. Manufacturing techniques to enable AOHC to be resilient to and maintain properties under various forms of mechanical and thermal stress;
6. Reduction in complexity of installation and maintenance;
7. Validation of long-term performance through accelerating aging;
8. Demonstration of performance in a real-life environment;
9. Embedded monitoring capabilities for cables/conductors;
10. Utility partnerships (including power marketing administrations); and
11. National labs partnerships.

Subtopic 1.1 Candidate Metrics & Targets: Applicants must identify and justify appropriate target metrics for their material process and/or pilot demonstration, and clearly indicate how the proposed innovation will satisfy the metrics, including a comparison of the current, commercially available state-of-the-art technology with the proposed advancement. As noted in the definition of “enhanced conductivity” the project team also is expected to show that the enhanced conductivity material in electrical applications (e.g., electric motors for vehicles or manufacturing) also has other key properties (e.g., current carrying capacity, linear coefficient of thermal expansion, yield strength and ultimate strength) the same as or better than that required for those applications. The proposal must include a thorough discussion of the proposed technical approach, including quantified energy metrics and life cycle cost. For Area of Interest b), proposals must include a comparison of the fraction of the total installed and operational cost (and services) of the power line system (including towers) of the advanced conductor.

Applicants should describe and provide supporting documentation for what they consider to be an acceptable maximum payback (in years, which can vary significantly depending on the end use). In all cases, applicants are expected to fully describe the “next best alternative” technology or practice (e.g., the baseline or state of the art) against which this solution’s performance, manufacturability and economic competitiveness is being compared, as well as any assumptions regarding economies of scale or learning curves that are determinative in the cost of their proposed solution such that their calculations can be properly validated by AMMTO. Metrics should be specific to the material or fabrication method and must define appropriate benchmarks or baselines, minimum targets, and stretch targets.

Example metrics include:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Better conductivity than electrolytic copper (w/o bulk Ag)	International Annealed Copper Standard (IACS)	108%	115%	100% IACS
Better conductivity than Al1350 (w/o bulk Au)	International Annealed Copper Standard (IACS)	65%	68%	65% IACS
Same or better yield strength and ultimate strength	% Above copper or Al (a) or ACSR (b)	0%	10%	Applicant Defined
Same or better current carrying capacity	% Above Al (a) or ACSR (b)			Applicant Defined
Same or better linear coefficient of thermal expansion,	% Above copper (a) or undersea standard (b)	0%	15%	Applicant Defined
Life cycle cost difference	% Above copper or Al (a) or ACSR (b)	5%	15%	Applicant Defined
Process Sensors and controls to enable automation and detect and correct failures before they happen	precise, site-specific control of materials deposition	Partial automation (e.g., heating only)	Full automation	Applicant Defined
Cost premium for conductor system assembly/manufacturing is 10% or less than for commercially available "advanced conductor" cables	b) only (see previous Table 1)	-10%	0%	Applicant Defined
Little or no loss in conductivity in strength in testing-equivalent to 30-year life in field	b) only (see previous Table 1)	-10%	0%	Applicant Defined

Subtopic 1.2: Harsh Environment Materials

Subtopic 1.2 Background: Harsh service environments (and the associated materials durability challenges) are common across multiple industrial applications and energy sectors. The objective of this sub-topic is foster RD&D to create new materials with improved properties in harsh operating environments. AMMTO considers harsh environments to include high temperature and/or high mechanical load, often in combination with aggressive chemical environments; also high pressure, high wear, undersea, hydrogen environments, and nuclear environments. AMMTO's drivers for research in such harsh environment materials include both its competitiveness mission and its mission to improve Americans' quality of life by reducing life cycle energy, resource use, and impacts. Harsh environment materials include those used

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in manufacturing and in other applications also of interest to AMMTO such as clean energy, heat recovery, and low-carbon process heating technologies. Such new materials also can include high temperature ceramic matrix materials for composite components (including silicon carbide) whose fabrication is enabled by polymer-based precursors for infiltration of SiC preforms. This sub-topic also seeks proposals demonstrating key applications of harsh environment materials such as integrated energy systems applied to decarbonized steel-making and refractory materials, including net zero or high-temperature hydrogen-based decarbonization.

Subtopic 1.2 Opportunity: Design engineers have long been limited in their ability to innovate by materials' physical limitations in challenging application environments. In order to meet rapidly growing climate and competitiveness challenges, new materials are urgently needed to meet new application demands.¹⁸ AMO supported workshops in 2015¹⁹ and 2020²⁰ addressing materials for thermal management and extreme temperatures, reduced wear, corrosion-resistance, and hydrogen embrittlement resistance, among other topics. Functionally graded materials and accelerated qualification of materials were also addressed.

Subtopic 1.2 Technology Focus: This subtopic builds on prior work and focuses on new materials and processing solutions to meet the demands of future manufacturing processes and key energy-related operating environments, including nuclear environments. These harsh environments include extreme temperatures, corrosive and oxidizing conditions, severe mechanical loading, and other performance-degrading factors such as nuclear radiation or hydrogen exposure. Materials that can withstand such environments for a longer time without degradation can lead to improved competitiveness (e.g., cost savings) and reductions in life cycle energy, carbon emissions, and other resource impacts. AMMTO also seeks new and improved manufacturing approaches for these materials, including incorporating state-of-the-art and emerging techniques for integrated computational materials engineering (ICME). New approaches are encouraged, such as artificial intelligence (AI) and machine learning (ML), that can leverage improved fundamental understanding of extreme and complex conditions to improve the design of materials and their manufacturing processes. Within this subtopic, AMMTO is seeking applicants who will advance materials for use in harsh environments. Representative opportunities of interest include:

- High temperature materials, especially those that

¹⁸ See the "Materials for Harsh Service Conditions" Technology Assessment, available at:

<https://www.energy.gov/sites/prod/files/2016/02/f29/QTR2015-6H-Materials-for-Harsh-Service-Conditions.pdf>

¹⁹ Workshop materials and presentations available at: <https://www.energy.gov/eere/amo/downloads/workshop-materials-harsh-service-conditions-november-19-20-2015>

²⁰ Lalena, J. Nick et al. "Material For Harsh Environments: 2020 Virtual Workshop Summary Report." Available at: https://inldigitallibrary.inl.gov/sites/sti/sti/Sort_35271.pdf.

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- Enable the use of low-carbon, alternative electric-based heating methods or production routes for thermal process loads in reduction, melting, and heating process applications;
- Enable significant energy efficiency improvement through the development and use of high temperature heat exchangers. (Waste heat to power and combined heat and power applications are excluded.);
- Enable use of hydrogen or low net carbon fuels in industrial thermal processes (i.e., are Hydrogen-friendly). Carbon capture is excluded. Turbine components not a priority in this FOA.
- Materials for high temperature, high-wear, and/or high-pressure conditions in energy intensive industries;
- Materials for nuclear environments (e.g., neutron radiation in fusion reactors)
- Field validations of aforementioned materials and materials manufacturing processes under real or simulated production conditions;
- New manufacturing processes for producing aforementioned materials at kilogram or larger scale;
- New approaches, such as artificial intelligence (AI) and machine learning (ML) that can leverage the improved fundamental understanding of harsh (especially extreme and complex) conditions to improve design of such materials and their manufacturing processes.

Subtopic 1.2 Candidate Metrics & Targets: Applicants must identify and justify appropriate target metrics for their technology, process and/or application, and clearly indicate how the proposed innovation will satisfy the metrics, including a comparison of the current, commercially available state-of-the-art technology with the proposed advancement. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Applications must clearly identify the starting and ending TRL for the project and justify the TRLs assigned. Successful applicants will be required to have a periodic evaluation of their metrics during the award to assess potential impacts. Examples of metrics include the following:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Reduce energy consumption (production or life cycle)	energy/unit (product mass or component basis)	15%	25%	<i>Applicant Defined</i>
Reduce carbon Intensity (production or life cycle)	% carbon intensity change as measured by ton CO ₂ e/kg product	20%	25%	<i>Applicant Defined</i>
Improve material performance (e.g.,	Performance property	20%	30%	<i>Applicant Defined</i>

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mechanical, physical, corrosion)				
Increase component lifetime	Time before replacement/failure	25%	40%	<i>Applicant Defined</i>
Reduce production cost	\$/product mass or component basis	10%	25%	<i>Applicant Defined</i>

Subtopic 1.3: AI/Machine Learning for Aerostructures

Subtopic 1.3 Background: Manufacturing of large scale aerostructures for aircraft applications is currently very costly and energy intensive. Machine learning (ML) utilizes computational tools to optimize processes, perform tasks, and make decisions/predictions. ML facilitates the analysis of large and complex data sets, such as those produced during the manufacturing of high reliability and/or high value components. The application of ML has the potential to significantly increase manufacturing speed, efficiency, and productivity in the United States (U.S.) aerospace industry.

Subtopic 1.3 Opportunity: The U.S. aerospace industry must continually increase efficiencies to meet production rate demands for aerostructures. Speeding production is particularly important for large, complex, and/or high-volume components. The application of ML to the production of these aerostructures represents an opportunity to increase manufacturing efficiency and quality in multiple ways, including reducing cycle times, increasing throughput, increasing process flexibility, reducing defects, and/or reducing required resources (e.g., energy, support activities/equipment, material).

Subtopic 1.3 Technology Focus: This subtopic focuses on developing methodologies and processes that use machine learning (ML) to increase efficiency of aerostructure component manufacturing. Specifically, the objective of this sub-topic is to use ML for efficiency increases in manufacturing large-scale aerostructures, such as airframe components and primary structure. The production of these components typically requires multiple manufacturing steps utilizing diverse processes with interdependent parameters. Currently, many of the manufacturing steps involve resource-intensive processes with empirically developed parameters. ML can be applied to any phase of the processing or multiple phases. The application of ML to the manufacturing of aerostructures has the potential to significantly increase processing efficiencies. Large-scale aerostructures produced at high rates represent a population of process-intensive components that would benefit from increased manufacturing efficiencies. Proposals must explicitly identify the aerospace component(s) and associated manufacturing process(es) being targeted for increased

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efficiency. The proposed approach should not require significant redesign of the finished product.

Proposals should indicate how the Office of Science’s (SC) high performance computing (HPC) assets—especially those managed by SC’s [Office of Advanced Computing and Scientific Research](#)—will be used in the proposed research. This can include proposals that reference work using SC HPC assets funded by (or proposed to be funded by) EERE’s [High Performance Computing for Innovation](#) program including AMO’s [High Performance Computing for Manufacturing Program \(HPC4Mfg\)](#).

Subtopic 1.3 Candidate Metrics and Targets: The reduction in resources through the use of ML in manufacturing extends beyond reduction in energy consumption, cost, and material usage. For example, the use of ML to optimize residual stress can be credited for all efficiencies derived from the resulting component stability, reduced scrap rate, improved fit-up, reduced inspections, reduced cycle time, and improved performance. Proposals must explicitly identify the aerospace component(s) and associated manufacturing process(es) being targeted for increased efficiency. Proposals must also identify and justify appropriate target metrics for their technology and application, as well as clearly indicate how the proposed utilization of ML will satisfy them. Metrics should be specific to the identified component(s) and process(es) and must define appropriate benchmarks or baselines, minimum targets, stretch targets, and the increase in efficiency when put into full rate production. Example metrics include:

Objective/Goal	Example Metric	Minimum	Stretch Target
Increased throughput	Component/hr.	15%	30%
Reduced number of defects	Defect/component	-15%	-35%
Reduced cost of production	\$/component	-10%	-25%
Improved material utilization	lb./component	-15%	-30%
Reduced life cycle cost due to longer component life	\$/component	-25%	-35%

Applications Not of Interest for Subtopic 1.3: Proposals specifically not of interest are those that address power and propulsion components, control surfaces, or launch and recover equipment.

Topic Area 2: Secure and Sustainable Materials

The Secure and Sustainable Materials topic is focused on materials RD&D supporting the establishment of a circular economy emphasizing material and product design, recycling technology development, and reverse supply chain logistics for a broad range of materials.

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Subtopic 2.1: Materials Circularity Regional Demonstrations

Subtopic 2.1 Background: The linear supply chain structure in which materials and products are subject to end-of-life disposed without being recycled or reused can be highly inefficient. Depending on the material class, materials circularity and efficiency can bring multiple benefits including reducing life cycle carbon emissions, diversifying supply for industry-relevant materials (such as metals, polymers, fibers and e-waste), and reducing end-of-life waste and environmental impact. As materials demand increases for products including clean energy technologies, there is value in transitioning towards a circular material economy, where these products are reused and recycled at end-of-life to maximize material efficiency, minimize life cycle energy requirements, and reduce waste overall. This also paves the way for focused regional development opportunities, increased clean energy jobs, and the establishment of a strong circular economy ecosystem.

Subtopic 2.1 Opportunity: The circular economy aims to keep resources in a closed cycle and to eliminate waste and pollution, thereby maximizing value over multiple life cycles of materials and products while minimizing material waste. The circular economy represents an opportunity to lower life cycle costs and energy requirements while increasing access to materials and resources, including critical materials. While there has been significant research investment in recycling technologies over the past two decades, implementation has been limited in scale. From an AMMTO perspective, pilot-scale regional efforts are still required to demonstrate technological efficacy as part of a circular economy. To maximize material efficiency and ease industry transition, a better understanding of current material recovery and processing technologies is needed.

Subtopic 2.1 Technology Focus: The objective of this sub-topic is to accelerate pilot scale demonstrations of a suite of circular economy technologies including innovative material recovery and end-of-life processing and recycling for key regional material supply chains. Circular economy technologies include innovative material recovery, end-of-life processing, reuse, remanufacturing, and recycling. This is intended to enable U.S. manufacturers to maximize product and material value. The team is expected to demonstrate value at a regional scale through recovery, recycling, and reuse of regional industry-relevant materials from material waste streams such as metals, polymers, fibers, and e-waste. Regional demonstration of net economic value while reducing embodied energy needs over the lifetime of products and materials should be a focus.

A successful proposal is expected to address barriers that influence the availability of and demand for secondary feedstocks with innovations across different material life cycle stages (such as design, manufacturing, remanufacturing, and recycling) and markets (primary and secondary feedstock and scrap) for a product or category of products. Proposals are expected to have strong cross-industry and regional municipality collaborations. For example, the team could be a network of companies and municipalities that recover wastes of different types from different sources and then use them in manufacturing, or a recycling company specifically working with materials recovery facilities to demonstrate technology solutions that can be integrated into the manufacturing or remanufacturing supply chain. The project teams can include industry, municipalities, academic institutions, or national laboratories as needed to ensure project success.

Subtopic 2.1 Candidate Metrics & Targets: A successful project should demonstrate pathways using early promising technology solutions to reduce waste, promote greater resource productivity, show cost competitiveness, advance resiliency to resource/scarcity issues in the future, and reduce environmental impacts of production and consumption while demonstrating regional economic development for the region. Applicants must identify and justify appropriate (e.g., material, energy, and emissions benefits of the regional demonstration) target metrics for their regional demonstration pathways, and clearly indicate how the proposed project will satisfy the metrics. Metrics should be specific to target material waste streams and must define appropriate baselines, minimum targets, and stretch targets. For example, proposals can specifically articulate the number of regional companies involved in recycling and/or use of secondary materials or product (size of market); or demonstrate the extension of product life through remanufacturing. Successful applicants will be required to have a periodic assessment of their metrics during the award to evaluate potential impacts. Examples of metrics include the following:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Reduce energy consumption (production or life cycle)	energy/unit (product mass or part basis)	10%	20%	<i>Applicant Defined</i>
Increased Secondary feedstock	Metric Tons	20%	30%	<i>Applicant Defined</i>
Reduce carbon Intensity	% Carbon intensity change as measured by ton CO ₂ e/kg product	20%	25%	<i>Applicant Defined</i>

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Improve material performance (e.g., mechanical, physical, corrosion)	Performance property	25%	40%	<i>Applicant Defined</i>
Increase process throughput	Time or rate	15%	30%	<i>Applicant Defined</i>
Reduce production cost	\$/component	10%	25%	<i>Applicant Defined</i>

Topic Area 3: Energy Technology Manufacturing

Under this topic, proposals of interest will focus on innovative manufacturing technologies that enable a clean energy economy, such as energy storage systems. Proposals should include manufacturing innovations to improve performance and address barriers to reducing manufacturing costs and accelerating market deployment.

Subtopic 3.1: Advanced Process Manufacturing of Electric Vehicle Cathode Active Materials at Volume

The objective of this sub-topic is to develop, scale-up, and pilot demonstrate chemistry-agnostic processing technologies to manufacture state-of-the-art cathode active materials (CAMs) that can be dropped into current domestic manufacturing lines.

Subtopic 3.1 Background: AMMTO seeks projects that focus on improving the manufacturability and processibility of cost-effective electric vehicle (EV) CAMs for lithium batteries at volume.

As highlighted by recent roadmap analyses and initiatives, accelerating domestic capabilities for battery manufacturing and supply chain security is critical for economy-wide decarbonization, as well as manufacturing competitiveness and resilience. For example, DOE's Energy Storage Grand Challenge (ESGC) addresses the importance of domestic manufacturing for energy storage technologies that can meet all U.S. market demands by 2030.²¹ The Federal Consortium for Advanced Batteries (FCAB), a federal interagency working group, released the National Blueprint for Lithium Batteries 2021–2030 to guide investments in the development of a domestic lithium-battery manufacturing value chain.²² Recent administration efforts, such as the American Battery Materials Initiative, have highlighted the

²¹ Department of Energy, [Energy Storage Grand Challenge](#)

²² Department of Energy, [National Blueprint for Lithium Batteries 2021-2030](#), June 2021

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urgent need for domestic battery manufacturing and processing of critical minerals.²³ Projects funded under this subtopic will directly support domestic manufacturing of CAMs, the goals of ESGC, and the Blueprint, specifically Goal 2: Support the growth of a U.S. materials processing base able to meet domestic battery manufacturing demand.

Producing battery-grade CAMs in US-based facilities is daunting because existing facilities are small, target cell compositions are still being developed, and there is virtually no domestic processing capacity in the U.S.²⁴ Nevertheless, recent U.S.-based advances and novel processing methodologies have shown the potential to leapfrog overseas competitors by mitigating degradation of active materials, enabling higher performance and production rates, and lowering the cost of materials manufacture.²⁵

This topic aims to accelerate the establishment of U.S. EV CAMs process manufacturing in the following ways:

- Produce enough high-quality CAMs to supply the roughly 400 GWh of battery capacity planned for the US market by 2030;²⁶ and
- Build out US battery processing/manufacturing capacity while also progressing on environmental equity and climate change mandates that have been adopted and are strongly championed by the US government.

Subtopic 3.1 Opportunity and Impact: Process innovations in CAMs offer a significant opportunity for reduction of cost and energy use in manufacturing, scaling of EV battery production processes, and/or enhancements in battery performance.²⁷ CAMs represent the most expensive portion (around 40%) of the cost of a lithium-ion battery cell. Of these costs, an estimated 30–40% is attributable to processing.²⁸ Additionally, the manufacture of active materials represents almost 50% of the energy use in battery manufacturing after raw material extraction and processing.²⁹

²³ [FACT SHEET: Biden-Harris Administration Driving U.S. Battery Manufacturing and Good-Paying Jobs - The White House](#)

²⁴ The White House, [Building Resilient Supply Chains, Revitalizing American Manufacturing, and Fostering Broad-based Growth, 100-Day Reviews under Executive Order 14017](#), June 2021

²⁵ J. Li *et al.*, From Materials to Cell: State-of-the-Art and Prospective Technologies for Lithium-Ion Battery Electrode Processing, *Chem. Rev.*, 2022, **122**, pp. 903-956

²⁶ Department of Energy, [National Blueprint for Lithium Batteries 2021-2030](#), June 2021

²⁷ S.G. Booth *et al.*, Perspectives for Next Generation Lithium-Ion Battery Cathode Materials, *APL Mater.*, 2021, **9**, pp. 109201-1-38

²⁸ M. Wenneker *et al.*, A Bottom-Up Approach to Lithium-Ion Battery Cost Modeling with a Focus on Cathode Active Materials, *Energies*, 2019, **12**, pp. 504-1-18

²⁹ J. Firth, Lithium-Ion Battery Manufacturing Emissions, BloombergNEF, June 27, 2019

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Forecasts project the demand for CAMs is expected to increase more than 4-fold to over 1.5 million tons by 2030.³⁰ Innovative processes for CAMs are required in order to position the U.S. domestic processing base as a global leader in EV battery manufacturing. Proving industrial viability and scaling up new CAM processing methods could disrupt the current CAM global manufacturing paradigm, thus leveling the EV-battery manufacturing playing field and transforming CAM production in a way that is conducive to US jobs, enables decarbonization of the transportation sector, and engages in environmentally conscious manufacturing. As EV battery technologies are still evolving, there is a particular opportunity to invest in platform manufacturing technologies that are adaptable to multiple chemistries or processing steps for EV battery manufacturing. Examples of platform manufacturing technologies for battery processing are coating/deposition methods such as sol-gel, aerosol, plasma spray, hydrothermal, chemical vapor deposition, roll-to-roll, atomic layer deposition, additive manufacturing, etc. This topic aims to capitalize on the opportunity by facilitating partnerships among industry, universities, and nonprofit organizations with expertise in EV manufacturing and regional innovation ecosystems.

Subtopic 3.1 Technology Focus: The objective of this subtopic to develop, scale-up, and demonstrate chemistry-agnostic³¹ processing technologies to manufacture state-of-the-art CAMs that can be dropped into current domestic manufacturing. For this subtopic, CAMs processing includes structural and morphological control (e.g., particle engineering, surface engineering) of the CAMs. It encompasses materials purification and refinement of precursor CAMs, as well as production of cathode materials and powders. Example technologies of interest include novel surface modification methods, improvements to CAMs calcination, preparation of CAMs using modern advances in green chemistry,³² and use of innovative reactors, among others. The material produced by the technology being developed must be in a form suitable for direct incorporation into conventional EV battery cathode manufacturing and into battery cells currently being produced. Manufacturing technologies that are adaptable to multiple chemistries or processing steps for EV battery manufacturing are strongly encouraged. These technologies can enable higher production rates for useable product while improving capability for scaling and industrial-scale implementation. This subtopic emphasizes processing technology rather than material; thus, project performance is measured via process improvement, optimization, or verification, with the goal of meeting or exceeding industry expectations.

³⁰ [AVICENNE ENERGY 2019, ADEME-Bpifrance](#), Battery Storage Meeting, Paris, France, May 28, 2019

³¹ Example chemistries may include lithium iron phosphate (LFP), nickel manganese cobalt oxides (NMC), etc.

³² For example, neoteric solvents such as supercritical fluids, ionic liquids, multiple-phase systems.

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Proposals must show and justify the ability to demonstrate the proposed technologies and processes at TRL/MRL 6 by the end of the project. The targeted technology should be able to show an improvement over existing technologies in one or more of the following manufacturing metrics: cost, product quality, throughput, energy efficiency, water use, greenhouse gas emissions, criteria air pollutant emissions, recyclability, and waste generation. The ultimate goal is for the CAM processing technology to be commercialized into the US supply chain. Project progress should be measurable in terms of multiple key process metrics such as production rate, scrap rate, energy use, water use, greenhouse gas and PM2.5 emissions, and projected cost³³. Project progress will also be measured against CAM performance targets, noted below.

Subtopic 3.1 Candidate Metrics & Targets: Applications must clearly identify the starting and ending TRL/MRL for the project and justify the TRLs/MRLs assigned. Proposed targets and measurement of progress toward meeting targets must be substantiated. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Proposals must specify the following required metrics:

Topic 3.1 Objective/Goal	Metric	Minimum	Stretch target	Baseline Performance/ Cost
Production Volume Rate ³⁴	GWh/year	1	30	N/A
Cost	\$/kg	15	10	N/A
Usable Specific Energy @ C/3 ³⁵	Wh/kg	500	1,000	N/A
Cycle Life (C/3 with deep discharge)	Cycles to <20% energy fade	1,000	3,000	N/A

Additionally, applicants are encouraged to consider the following metrics as examples to quantify further benefits of the proposed technology:

Topic 3.1 Objective/Goal	Metric	Minimum	Stretch target	Baseline Performance/Cost
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³³ PM2.5 refers to Particulate Matter that is 2.5 micrometer or less in diameter. These are very fine inhalable particles whose emissions are regulated by EPA's national air quality standards authorized by the Clean Air Act.

³⁴ Please specify in the metrics table the factory scale your application will target (e.g., "megafactories", "gigafactories", etc.). Proposals can also choose to specify production volume rate in kg/year.

³⁵ Please specify chemistry in metrics table (e.g., "500 Wh/kg for LFP-based chemistry", "600 Wh/kg for NMC-based chemistry", etc.).

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Reduce manufacturing energy consumption	Energy per kg produced	5%	40%	Applicant defined
Reduce greenhouse gas emissions	% reduction in CO ₂ (eq)	5%	30%	Applicant defined
Reduce water use				Applicant defined
Safety				Applicant defined

Applications Not of Interest for Subtopic 3.1: The following types of applications will be deemed nonresponsive and will not be reviewed or considered (see Section I.C of the FOA):

- Applications that are primarily focused on materials discovery.
- Applications for proposed technologies that target raw materials extraction, electrode R&D, and/or cell and pack fabrication.
- Applications that focus on optimizing conventional processes that do not propose a specific synthetic approach.

Projects are restricted to technologies and materials that can drop into conventional EV battery manufacturing in the near term.

AMMTO encourages applicants from the broader energy storage community to form cross-sector teams that span organizational boundaries to enable and accelerate the achievement of technological outcomes in process manufacturing of EV CAMs at volume. Of particular interest are partnerships and consortia that include private industry, universities with relevant manufacturing and workforce development expertise, and regional development organizations.

Subtopic 3.1 ONLY: In addition to the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under this topic:

1. Quarterly quantitative assessments of production volume and product qualification.
2. A technoeconomic cost model for production volumes consistent with US EV battery supply needs and which follows the best accepted practices of the chemical and materials engineering communities.³⁶
3. Two times during project duration, 1 kg CAM should be delivered to a to-be-designated DOE testing laboratory for performance testing. AMMTO will organize a meeting of all the performers, the test lab, and DOE to discuss

³⁶ An exemplar model is the BatPaC model. Available at: <https://www.anl.gov/partnerships/batpac-battery-manufacturing-cost-estimation>.

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testing and validation protocols. Subject to DOE discretion, applicants may elect to deliver fifteen (15) cells of a minimum capacity of 400 mAh.

- I. First delivery to be delivered between months 16-20 of program start.
 - II. Second delivery to be delivered before the end of the project period of performance.
4. One month (minimum) of testing data for all deliverable cells will be conducted by the Applicant following test protocols approved by the DOE. This data will be shared with DOE and the testing lab prior to deliverable shipment to the testing laboratory.³⁷

All cells and materials shall be provided to the DOE for validation testing at a to-be-designated DOE National Laboratory. Non-destructive performance validation testing will be conducted on the cells. This testing will be conducted outside the scope of the proposed project and should not be included in the total estimated project costs included with the application. Participation by a DOE National Laboratory in test planning and execution will be addressed by a non-disclosure agreement between the National Laboratory and the Applicant.

Test procedures will be finalized between the performers, the test lab, and DOE. However, initial plans for testing and test procedures must be addressed in the application. These initial plans shall incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, temperature recommendations, number of test sequences, and/or other relevant test conditions as appropriate. The results of the DOE national laboratory testing may be documented in a publicly releasable Summary Test Report (approved by both DOE and the Applicant prior to release) that validates performance of the deliverables relative to the performance targets, as well as the technology deployment impact relative to DOE strategic goals. AMMTO and the Applicant will approve the Summary Test Report. Test cells or special test equipment supplied by the manufacturer for the purposes of the test will be returned at the conclusion of testing at no cost to the project.

Subtopic 3.2: Building Dehumidification Scaleup

The objective of this sub-topic is to manufacture and pilot-demonstrate all-electric or low grade/waste sources-driven dehumidification systems (e.g., desiccants) that,

³⁷ All cell deliverables must be greater than 400 mAh; 1Ah or larger are preferred but not required. It is acceptable to deliver cells that do not meet performance targets, as long as the cell components (electrodes with similar active material content, porosity, thickness, loading, etc. and separator thickness) in the delivered cells, when scaled to automotive size (40Ah or greater) are capable of meeting the targets: i.e., an applicant will not be penalized for packaging inefficiencies of small cells, but needs to deliver cells with automotive relevant electrodes, separators, and electrolyte volume. If the deliverable cells do not meet performance targets, a model validating the proposed scaling factors will also be required for the interim and final cells.

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under extreme conditions (i.e., above 60% relative humidity), have high moisture removal efficiency (MRE), have reduced size and/or weight, are capable of flexible operation, and minimize water consumption.

Subtopic 3.2 Background: According to the IEA³⁸, air conditioning (AC) accounts for nearly 20% of the global electricity used in buildings around the world today, as well as increased emissions. Conventional air conditioners have limited dehumidifying control and potential. Dehumidification is a highly energy intensive process, especially in humid climates and for building typologies that require strict space humidity setpoints. According to a current publication by the National Renewable Energy Laboratory (NREL), energy-related greenhouse gas emissions for humidity loads equal 599 metric tons CO₂e, or 31% of the total air conditioning emissions and 53% of cooling energy emissions globally³⁹. A more energy efficient process of dehumidification could also limit the amount of refrigerant needed, thereby reducing refrigerant leakage and burden on energy systems during peak demand.

Subtopic 3.2 Opportunity: Desiccant-based dehumidifying systems have proven successful in handling latent loads in many specialized applications. However, for dehumidifying systems to be used on a broader basis for comfort conditioning, it must be demonstrated that they are also suitable to meet the needs of more conventional HVAC applications. Ongoing research and development works suggest that new materials and novel system configurations have significant potential for improving the performance and reliability (and reducing the cost and size) of dehumidification systems, thereby increasing their market competitiveness. These new Separate Sensible and Latent Cooling (SSLC) air conditioning (AC) systems, specifically technologies that have high performance under extreme conditions (i.e., above 60% relative humidity), have potential to save 30% of energy when compared with a conventional baseline system⁴⁰. These dehumidifying systems, which are more than just desiccant-based systems, also include membrane, electrostatic, and other non-vapor compression technologies⁴¹. Today's conventional AC systems provide reasonable humidity control (i.e., below 60% relative humidity (RH)) for summer conditions in warm-humid and mixed-humid climates but lack capabilities in more extreme conditions. High-performance SSLC can save energy by separating the total cooling load for a building. The reheat process in conventional systems is a major constraint on energy efficiency and limits the independent control of the

³⁸ IEA (2018), The Future of Cooling, IEA, Paris <https://www.iea.org/reports/the-future-of-cooling>

³⁹ Woods, Jason, Nelson James, Eric Kozubal, Eric Bonnema, Kristin Brief, Liz Voeller, and Jessy Revest. 2022. "Humidity's impact on greenhouse gas emissions from air conditioning." *Joule* 6(4): 726-741. doi.org/10.1016/j.joule.2022.02.013.

⁴⁰ Ling, Jiazhen; Hwang, Yunho; and Radermacher, Reinhard, "Theoretical Study on Separate Sensible and Latent Cooling Air Conditioning System" (2008). International Refrigeration and Air Conditioning Conference. Paper 902. <http://docs.lib.purdue.edu/iracc/902>

⁴¹ <https://www.energy.gov/eere/buildings/downloads/non-vapor-compression-hvac-technologies-report>

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sensible and latent cooling loads. In warm and humid climates, the AC not only reduces the air temperature, but further cooling is required to the dew point to dehumidify the air.

Subtopic 3.2 Technology Focus: The objective of this subtopic is to manufacture and demonstrate all-electric or low grade/waste sources-driven dehumidification systems. Example technologies of interest include but are not limited to novel desiccant material, membrane-based systems, other non-vapor compression dehumidification technologies, control strategies, and system configurations.

The project team is expected to perform field demonstrations at a minimum often building sites, each with a different design, approach, or control strategy to determine performance, energy savings, and cost effectiveness. The applicant will develop a best practices design guide using extensive real-time performance data and compare operational efficiencies across the different design approaches used in each of the demonstrations. This will help the design community select the configurations that are most suitable to their applications and ease some of the deployment, education, and market readiness barriers associated with the technology. The proposal should clearly detail a pathway for overcoming the identified technology and market deficiencies through their approach. This includes a thorough discussion of the proposed technical approach, including quantified energy metrics, cost characteristics, and impact on occupant comfort.

Applicants should describe and provide supporting documentation for what they consider to be an acceptable maximum payback (in years, which can vary significantly depending on the end use). In all cases, applicants are expected to fully describe the “next best alternative” technology or practice (e.g., the baseline or state of the art) against which this solution’s affordability is being compared, and any assumptions regarding economies of scale or learning curves that are determinative in the cost of their proposed solution such that their calculations can be properly validated by BTO. When considering affordability, applicants are encouraged to include costs that are related to the entire scope, i.e., “cradle-to-grave”, impacts of their approach.

Subtopic 3.2 Candidate Metrics & Targets: Applicants must identify and justify appropriate target metrics for their novel material and/or approach and clearly indicate how the proposed innovation will satisfy the metrics, including a comparison of the current, commercially available state-of-the-art technology with the proposed advancement. Metrics should be specific to the material and/or approach and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Example metrics include:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Dehumidification Moisture Removal Efficiency (MRE), measured at indoor air conditions of 75°F and 60% relative humidity	kg/kWh	>3.5 kg/kWh	5.25 kg/kWh	<i>Applicant Defined</i>
Integrated Seasonal Moisture Removal Efficiency (ISMRE), based on ASHRAE standard 90.1-2019 or ASHRAE standard 139, or ANSI/AHRI Standard 920	kg/kWh	>1.82 kg/kWh and water-cooled equipment 6 2.73 kg/kWh	2.75 kg/kWh	<i>Applicant Defined</i>
Reduced size and/or weight relative to today's current state of the art units. Volume important for system on the ground and weight critical for roof-based systems.	Volume (ft ³ , m ³) or Weight (lbs., kg)	0%, no increase in volume or weight	10%, decrease in volume and/or weight	<i>Applicant Defined</i>
Flexible operation capabilities to provide demand flexibility services ⁴² . System can cycle in response to external demand response signals. One flexibility is required, minimum.	Shed Load (Yes/No)	Reduces demand for a short time period during peak demand or emergency events.	Greater than one flexibility metric.	<i>Applicant Defined Applicant Defined</i>
	Shift Load, (Yes/No)	Changes the timing (and sometimes the amount) of energy use to minimize peak demand or to take advantage of renewable resources.		
	Modulate Load (Yes/No)	Automatically increases /decreases power demand or reactive power draw/supply in response to grid operator signals.		
Net zero water consumption	Yes/No	Yes		<i>Applicant Defined</i>

All work under EERE funding agreements must be performed in the U.S. See Section IV.J.iii. and Appendix C.

⁴² There are three basic flexibility modes and these are referred to in shorthand as shed, shift, and modulate: Shed: The ability to reduce electricity use during the generation balancing area's annual peak demand period(s) or during grid emergencies; Shift: The ability to change the timing of electricity use to minimize demand during peak events or to avoid renewable curtailment; Modulate: The ability to balance power demand or reactive power draw/supply automatically in response to a signal from the grid operator during the dispatch period.

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C. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D. of the FOA):

- Applications that fall outside the technical parameters specified in Section I.A. and I.B. of the FOA.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications for Subtopic 1.3 that are not of interest (i.e., those that address power and propulsion components, control surfaces, or launch and recover equipment.)
- Applications for Subtopic 3.1 that are not of interest (i.e., those that are primarily focused on materials discovery; that target raw materials extraction, electrode R&D, and/or cell and pack fabrication or that focus on optimizing conventional processes that do not propose a specific synthetic approach.)

D. Authorizing Statutes

The activities under this multi-topic FOA are authorized under § 911 of the Energy Policy Act of 2005, codified at 42 U.S.C. 16191, which authorizes energy efficiency programs with objectives to “increase energy efficiency of vehicles, buildings and industrial processes” as well as “reducing the cost of energy and making the economy more efficient and competitive.” In addition, the FOA relies on the authority of § 3201 of the Energy Act of 2020, codified at 42 U.S.C. 17232, which authorizes DOE to carry out programs to address energy storage technologies and applications, including vehicle-grid integration; energy storage systems, components, and materials; and R&D of advanced manufacturing technologies that can increase U.S. competitiveness in energy storage manufacturing.

Awards made under this announcement will fall under the purview of 2 Code of Federal Regulation (CFR) Part 200 as amended by 2 CFR Part 910.

II. Award Information

A. Award Overview

i. Estimated Funding

EERE expects to make a total of approximately \$52,000,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 18-36 awards under

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this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between \$200,000 and \$10 million. EERE may issue awards in one, multiple, or none of the following topic areas:

Topic Area Number	Topic Area Title	Anticipated Number of Awards	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Approximate Total Federal Funding Available for All Awards	Anticipated Period of Performance (months)
1.1a	Increased Conductivity Metal-Based Material Systems- Materials Composition and Fabrication	3-4	\$200,000	\$300,000	\$800,000	2-3 yrs
1.1b	Increased Conductivity Metal-Based Material Systems- Conductor/Cables Systems for Power line Validation and Pilot Demonstration	1-2	\$1,000,000	\$2,000,000	\$4,000,000	2-3 yrs
1.2	Harsh Environment Materials	6-10	\$1,000,000	\$2,000,000	\$9,700,000	2-3 yrs
1.3	AI/Machine Learning for Aerostructures	2-6	\$900,000	\$2,000,000	\$5,000,000	2-3 yrs
2.1	Materials Circularity Regional Pilot Demonstrations	1-5	\$2,000,000	\$10,000,000	\$10,000,000	2-3 yrs
3.1	Advanced Process Manufacturing of Electric Vehicle Cathode Active Materials at Volume	3-7	\$2,500,000	\$5,000,000	\$17,500,000	2-3 yrs
3.2	Building Dehumidification Scaleup	1-2	\$2,000,000	\$5,000,000	\$5,000,000	2-3 yrs
TOTAL		18-36			\$52,000,000	

EERE may establish more than one budget period for each award and fund only the initial budget period(s). Funding for all budget periods, including the initial budget period, is not guaranteed.

ii. Period of Performance

EERE anticipates making awards that will run from two years up to three years in length, comprising one or more budget periods. Project continuation will be contingent upon several elements, including satisfactory performance and Go/No-Go decision review. For a complete list, see Section VI.B.xiii. At the

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Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, the extent milestone objectives are met, compliance with reporting requirements, and overall contribution to the program goals and objectives. As a result of this evaluation, EERE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

iii. New Applications Only

EERE will accept only new applications under this FOA. EERE will not consider applications for renewals of existing EERE-funded awards through this FOA.

B. EERE Funding Agreements

Through cooperative agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the United States government.

i. Cooperative Agreements

EERE generally uses cooperative agreements to provide financial and other support to prime recipients.

Through cooperative agreements, EERE provides financial or other support to accomplish a public purpose of support or stimulation authorized by federal statute. Under cooperative agreements, the government and prime recipients share responsibility for the direction of projects.

EERE has substantial involvement in all projects funded via cooperative agreement. See Section VI.B.ix. of the FOA for more information on what substantial involvement may involve.

ii. Funding Agreements with Federally Funded Research and Development Center (FFRDCs)

In most cases, FFRDCs are funded independently of the remainder of the project team. The FFRDC then executes an agreement with any non-FFRDC project team members to arrange work structure, project execution, and any other matters. Regardless of these arrangements, the entity that applied as the prime recipient for the project will remain the prime recipient for the project.

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III. Eligibility Information

To be considered for substantive evaluation, an applicant's submission must meet the criteria set forth below. If the application does not meet these eligibility requirements, it will be considered ineligible and removed from further evaluation.

A. Eligible Applicants

i. Domestic Entities

The proposed prime recipient and subrecipient(s) must be domestic entities. The following types of domestic entities are eligible to participate as a prime recipient or subrecipient of this FOA:

1. Institutions of higher education;
2. For-profit entities;
3. Non-profit entities; and
4. State and local governmental entities, and tribal nations.

To qualify as a domestic entity, the entity must be organized, chartered or incorporated (or otherwise formed) under the laws of a particular state or territory of the United States; have majority domestic ownership and control; and have a physical place of business in the United States.

DOE/NNSA FFRDCs are eligible to apply for funding as a prime recipient or subrecipient.

Non-DOE/NNSA FFRDCs are eligible to participate as a subrecipient, but are not eligible to apply as a prime recipient.

Federal agencies and instrumentalities (other than DOE) are eligible to participate as a subrecipient, but are not eligible to apply as a prime recipient.

Entities banned from doing business with the United States government such as entities debarred, suspended, or otherwise excluded from or ineligible for participating in Federal programs are not eligible.

Nonprofit organizations described in Section 501(c)(4) of the Internal Revenue Code of 1986 that engaged in lobbying activities after December 31, 1995 are **not** eligible to apply for funding.

ii. Foreign Entities

In limited circumstances, DOE may approve a waiver to allow a foreign entity to participate as a prime recipient or subrecipient. A foreign entity may submit a Full Application to this FOA, but the Full Application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the Full Application for each proposed foreign subrecipient.

Appendix C lists the information that must be included in a foreign entity waiver request. The applicant does not have the right to appeal DOE's decision concerning a waiver request.

B. Cost Sharing

The cost share must be at least 20% of the total allowable costs for research and development projects (i.e., the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs equals the total allowable cost of the project) and must come from non-federal sources unless otherwise allowed by law. (See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.)

To assist applicants in calculating proper cost share amounts, EERE has included a cost share information sheet and sample cost share calculation as Appendices A and B to this FOA.

i. Legal Responsibility

Although the cost share requirement applies to the project as a whole, including work performed by members of the project team other than the prime recipient, the prime recipient is legally responsible for paying the entire cost share. If the funding agreement is terminated prior to the end of the project period, the prime recipient is required to contribute at least the cost share percentage of total expenditures incurred through the date of termination.

The prime recipient is solely responsible for managing cost share contributions by the project team and enforcing cost share obligation assumed by project team members in subawards or related agreements.

ii. Cost Share Allocation

Each project team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual

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project team members may vary, as long as the cost share requirement for the project as a whole is met.

iii. Cost Share Types and Allowability

Every cost share contribution must be allowable under the applicable federal cost principles, as described in Section IV.J.i. of the FOA. In addition, cost share must be verifiable upon submission of the Full Application.

Project teams may provide cost share in the form of cash or in-kind contributions. Cost share may be provided by the prime recipient, subrecipients, or third parties (entities that do not have a role in performing the scope of work). Vendors/contractors may not provide cost share. Any partial donation of goods or services is considered a discount and is not allowable.

Cash contributions include, but are not limited to: personnel costs, fringe costs, supply and equipment costs, indirect costs and other direct costs.

In-kind contributions are those where a value of the contribution can be readily determined, verified and justified but where no actual cash is transacted in securing the good or service comprising the contribution. Allowable in-kind contributions include, but are not limited to: the donation of volunteer time or the donation of space or use of equipment.

Project teams may use funding or property received from state or local governments to meet the cost share requirement, so long as the funding was not provided to the state or local government by the federal government.

The prime recipient may not use the following sources to meet its cost share obligations including, but not limited to:

- Revenues or royalties from the prospective operation of an activity beyond the project period;
- Proceeds from the prospective sale of an asset of an activity;
- Federal funding or property (e.g., federal grants, equipment owned by the federal government); or
- Expenditures that were reimbursed under a separate federal program.

Project teams may not use the same cash or in-kind contributions to meet cost share requirements for more than one project or program.

Cost share contributions must be specified in the project budget, verifiable from the prime recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are

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considered part of total project cost, the cost share dollars will be scrutinized under the same federal regulations as federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

Applicants are encouraged to refer to 2 CFR 200.306 as amended by 2 CFR 910.130 for additional cost sharing requirements.

iv. Cost Share Contributions by FFRDCs

Because FFRDCs are funded by the federal government, costs incurred by FFRDCs generally may not be used to meet the cost share requirement. FFRDCs may contribute cost share only if the contributions are paid directly from the contractor's Management Fee or another non-federal source.

v. Cost Share Verification

Applicants are required to provide written assurance of their proposed cost share contributions in their Full Applications.

Upon selection for award negotiations, applicants are required to provide additional information and documentation regarding their cost share contributions. Please refer to Appendix A of the FOA.

vi. Cost Share Payment

EERE requires prime recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the prime recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated). As FFRDC funding will be provided directly to the FFRDC(s) by DOE, prime recipients will be required to provide project cost share at a percentage commensurate with the FFRDC costs, on a budget period basis, resulting in a higher interim invoicing cost share ratio than the total award ratio.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may approve a request by the prime recipient to meet its cost share requirements on a less frequent basis, such as monthly or quarterly. Regardless of the interval requested, the prime recipient must be up-to-date on cost share at each interval. Such requests must be sent to the Contracting Officer during award negotiations and include the following information: (1) a detailed justification for the request; (2) a proposed schedule of payments, including

amounts and dates; (3) a written commitment to meet that schedule; and (4) such evidence as necessary to demonstrate that the prime recipient has complied with its cost share obligations to date. The Contracting Officer must approve all such requests before they go into effect.

C. Compliance Criteria

Concept Papers, Full Applications, and Replies to Reviewer Comments must meet all compliance criteria listed below or they will be considered noncompliant. EERE will not review or consider noncompliant submissions, including, Concept Papers, Full Applications, and Replies to Reviewer Comments that were: submitted through means other than EERE eXCHANGE; submitted after the applicable deadline; and/or submitted incomplete. EERE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

i. Compliance Criteria

All applicant submissions must:

- comply with the applicable content and form requirements listed in Section IV. of the FOA;
- include all required documents;
- be successfully uploaded in EERE Exchange <https://eere-Exchange.energy.gov>, including clicking the “Submit” button; and
- be submitted by the deadline stated in the FOA.

DOE will not review or consider submissions submitted through means other than EERE Exchange, submissions submitted after the applicable deadline, or incomplete submissions.

Applicants are strongly encouraged to submit their Concept Papers, Full Applications, and Replies to Reviewer Comments at least 48 hours in advance of the submission deadline. Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, Full Application, or Reply to Reviewer Comments is submitted in EERE Exchange, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline. DOE will not extend the submission deadline for applicants that fail to submit

required information by the applicable deadline due to server/connection congestion..

D. Responsiveness Criteria

All “Applications Specifically Not of Interest,” as described in Section I.C. of the FOA, are deemed nonresponsive and are not reviewed or considered.

E. Other Eligibility Requirements

i. Requirements for DOE/National Nuclear Security Agency (NNSA) Federally Funded Research and Development Centers (FFRDC) Listed as the applicant

A DOE/NNSA FFRDC is eligible to apply for funding under this FOA if its cognizant Contracting Officer provides written authorization and this authorization is submitted with the application.

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 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.

ii. Requirements for DOE/NNSA and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

DOE/NNSA and non-DOE/NNSA FFRDCs may be proposed as a subrecipient on another entity’s application subject to the following guidelines:

i. Authorization for non-DOE/NNSA FFRDCs

The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with its authority under its award.

ii. *Authorization for DOE/NNSA FFRDCs*

The cognizant Contracting Officer for the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The following wording is acceptable for this 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 assigned programs at the laboratory.

iii. *Funding, Cost Share and Subaward with FFRDCs*

The value of and funding for the FFRDC portion of the work will not normally be included in the award. DOE/NNSA FFRDCs participating as a subrecipient on a project will be funded directly through the DOE field work proposal (WP) process. Non-DOE/NNSA FFRDC participating as a subrecipient will be funded through an interagency agreement with the sponsoring agency.

Although the FFRDC portion of the work is excluded from the award, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's, the subrecipient's, and the FFRDC's portions of the project.

Unless instructed otherwise by the DOE CO for the DOE award, all FFRDCs are required to enter into a Cooperative Research and Development Agreement (CRADA) or, if the role of the DOE/NNSA FFRDC is limited to technical assistance and intellectual property is not anticipated to be generated from the DOE/NNSA FFRDC's work, a Technical Assistance Agreement (TAA), with at least the prime recipient before any project work begins. Any questions regarding the use of a CRADA or TAA should be directed to the cognizant DOE field intellectual property (IP) counsel.

The CRADA or TAA is used to ensure accountability for project work and provide the appropriate management of intellectual property (IP), e.g., data protection and background IP. The CRADA or TAA must be agreed upon by all parties and submitted to DOE or other sponsoring agency, when applicable, for approval, or submitted to DOE for notice under the Master Scope of Work process, when applicable, using any DOE or other sponsoring agency approved CRADA or TAA template without substantive changes by the time the award is made to the prime recipient.

iv. *Responsibility*

The prime recipient 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 prime recipient and the FFRDC contractor.

F. Limitation on Number of Concept Papers and Full Applications Eligible for Review

An entity may only submit one Concept Paper and one Full Application for each subtopic area of this FOA except where there are also areas of interest, in which case an entity may submit only one Concept Paper and one Full Application for each area of interest within a subtopic. If an entity submits more than one Concept Paper and one Full Application to the same subtopic area (or area of interest as applicable), EERE will request a determination from the applicant's authorizing representative as to which application should be reviewed. Any other submissions received listing the same entity as the applicant for the same subtopic area (or area of interest) will not be eligible for further consideration. This limitation does not prohibit an applicant from collaborating on other applications (e.g., as a potential subrecipient or partner) so long as the entity is only listed as the applicant on one Concept Paper and one Full Application for each subtopic (or area of interest) of this FOA.

G. Questions Regarding Eligibility

EERE will not make eligibility determinations for potential applicants prior to the date on which applications to this FOA must be submitted. The decision whether to submit an application in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

A. Application Process

The application process will include two phases: a Concept Paper phase, and a Full Application phase. **Only applicants who have submitted an eligible Concept Paper will be eligible to submit a Full Application.**

At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III. of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov>, unless

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specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than EERE eXCHANGE, submissions submitted after the applicable deadline, or incomplete submissions.** EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion.

A **Control Number** will be issued when an applicant begins the EERE eXCHANGE application process. This control number must be included with all application documents, as described below.

The Concept Paper, Full Application, and Reply to Reviewer Comments must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise;
- Each must be written in English;
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Calibri typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement;
- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page; and
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their, Concept Papers, Full Applications, and Replies to Reviewer Comments at least 48 hours in advance of the submission deadline.**

Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper, Full Application, or Reply to Reviewer Comments. Once the Concept Paper, Full Application, or Reply to Reviewer Comments is submitted in EERE eXCHANGE, applicants may revise or update that submission until the expiration of the applicable deadline. If changes are made to any of these documents, the applicant must resubmit the Concept Paper, Full Application, or Reply to Reviewer Comments before the applicable deadline.

EERE urges applicants to carefully review their Concept Papers, Full Applications, and Replies to Reviewer Comments to allow sufficient time for the submission of required information and documents. All Full Applications that pass the initial eligibility review will undergo comprehensive technical merit review according to the criteria identified in Section V.A.ii. of the FOA.

i. **Additional Information on EERE eXCHANGE**

EERE eXCHANGE is designed to enforce the deadlines specified in this FOA. The “Apply” and “Submit” buttons will automatically disable at the defined submission deadlines. Should applicants experience problems with EERE eXCHANGE, the following information may be helpful.

Applicants that experience issues with submission PRIOR to the FOA deadline: In the event that an applicant experiences technical difficulties with a submission, the applicant should contact the EERE eXCHANGE helpdesk for assistance (EERE-eXCHANGESupport@hq.doe.gov). The EERE eXCHANGE helpdesk and/or the EERE eXCHANGE system administrators will assist applicants in resolving issues.

B. Application Forms

The application forms and instructions are available on EERE eXCHANGE. To access these materials, go to <https://eere-eXCHANGE.energy.gov> and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the EERE eXCHANGE website is **50MB**. Files in excess of **50MB** cannot be uploaded, and hence cannot be submitted for review. If a file exceeds **50MB** but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1

TechnicalVolume_Part_2

C. Content and Form of the Concept Paper

Each Concept Paper must be limited to a single concept or technology. The Concept Paper must conform to the requirements listed below, including the stated page limits. To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time.

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Topic Area being addressed (if applicable), both the technical and business points of contact, names of

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		all team member organizations, and any statements regarding confidentiality.
Technology Description	4 pages maximum	Applicants are required to describe succinctly: <ul style="list-style-type: none">• The proposed technology, including its basic operating principles and how it is unique and innovative;• The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met);• The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges;• How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application;• The potential impact that the proposed project would have on the relevant field and application;• The key technical risks/issues associated with the proposed technology development plan; and• The impact that EERE funding would have on the proposed project.
Addendum	1 page maximum	Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed Project Team, including: <ul style="list-style-type: none">• Whether the Principal Investigator (PI) and Project Team have the skill and expertise needed to successfully execute the project plan;• Whether the applicant has prior experience which demonstrates an ability to perform tasks of similar risk and complexity;• Whether the applicant has worked together with its teaming partners on prior projects or programs; and• Whether the applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities.• Applicants may provide graphs, charts, or other data to supplement their Technology Description.

EERE makes an independent assessment of each Concept Paper based on the criteria in Section V.A.i. of the FOA. EERE will encourage a subset of applicants to submit Full Applications. Other applicants will be discouraged from submitting a Full Application. An applicant who receives a "discouraged" notification may still submit a Full Application. EERE will review all eligible Full Applications. However, by discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project in an effort to save the

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applicant the time and expense of preparing an application that is unlikely to be selected for award negotiations.

EERE may include general comments provided from reviewers on an applicant's Concept Paper in the encourage/discourage notification posted on EERE eXCHANGE at the close of that phase.

D. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the EERE eXCHANGE website at <https://eere-eXCHANGE.energy.gov/>, in accordance with the instructions.

Applicants will have approximately 30 days from receipt of the Concept Paper Encourage/Discourage notification on EERE eXCHANGE to prepare and submit a Full Application. Regardless of the date the applicant receives the Encourage/Discourage notification, the submission deadline for the Full Application remains the date and time stated on the FOA cover page.

All Full Application documents must be marked with the Control Number issued to the applicant. Applicants will receive a control number upon clicking the "Create Concept Paper" button in EERE eXCHANGE, and should include that control number in the file name of their Full Application submission (i.e., *Control number_Applicant Name_Full Application*).

i. Full Application Content Requirements

Each Full Application shall be limited to a single concept or technology. Unrelated concepts and technologies shall not be consolidated in a single Full Application. Full Applications must conform to the following requirements:

Component	File Format	Page Limit	File Name
Technical Volume	PDF	25	ControlNumber_LeadOrganization_Technical Volume
Resumes	PDF	3 pages each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	15	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	n/a	ControlNumber_LeadOrganization_App424
Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification

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Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS Powerpoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	MS Excel	n/a	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)	PDF	n/a	ControlNumber_LeadOrganization_WP
Authorization from cognizant Contracting Officer for FFRDC	PDF	n/a	ControlNumber_LeadOrganization_FFRDCAuth
SF-LLL Disclosure of Lobbying Activities	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Foreign Entity and Foreign Work Waivers	PDF	n/a	ControlNumber_LeadOrganization_Waiver
R&D Community Benefits Plan	PDF	5	ControlNumber_LeadOrganization_CBP
Current and Pending Support	PDF	n/a	ControlNumber_LeadOrganization_CPS
Transparency of Foreign Connection	PDF	n/a	ControlNumber_LeadOrganization_TFC
Potentially Duplicate Funding Notice	PDF	n/a	ControlNumber_LeadOrganization_PDFN

Note: The maximum file size that can be uploaded to the EERE eXCHANGE website is **50MB**. Files in excess of **50MB** cannot be uploaded, and hence cannot be submitted for review. If a file exceeds **50MB** but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1

TechnicalVolume_Part_2

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed **50MB.**

EERE provides detailed guidance on the content and form of each component below.

ii. Technical Volume

The Technical Volume must be submitted in PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.ii. of the FOA. Save the Technical Volume in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_TechnicalVolume”.

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Applicants must provide sufficient citations and references to the primary research literature to justify the claims and approaches made in the Technical Volume. However, EERE and reviewers are under no obligation to review cited sources.

The Technical Volume to the Full Application may not be more than 25 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.ii. of the FOA) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand upon information provided in the Concept Paper. The Technical Volume must conform to the following content requirements:

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, names of the senior/key personnel and their organizations, and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	The Project Overview should contain the following information: <ul style="list-style-type: none">• Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application.• Project Goal: The applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal.• DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.

<p>Technical Description, Innovation, and Impact (Approximately 30% of the Technical Volume)</p>	<p>The Technical Description should contain the following information:</p> <ul style="list-style-type: none"> • Relevance and Outcomes: The applicant should provide a detailed description of the technology, including the scientific and other principles and objectives that will be pursued during the project. This section should describe the relevance of the proposed project to the goals and objectives of the FOA, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Feasibility: The applicant should demonstrate the technical feasibility of the proposed technology and capability of achieving the anticipated performance targets, including a description of previous work done and prior results. • Innovation and Impacts: The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over current and emerging technologies, and the overall impact on advancing the state-of-the-art/technical baseline if the project is successful.
<p>Workplan and Market Transformation Plan (Approximately 40% of the Technical Volume)</p>	<p>The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go Decision Points, and Project Schedule. A detailed SOPO is separately requested. The Workplan should contain the following information:</p> <ul style="list-style-type: none"> • Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes. • Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on Go/No-Go decision points). The applicant should describe the specific expected end result of each performance period including milestones in the R&D Community Benefits Plan. • WBS and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as “we will then complete a proprietary process” is unacceptable). It is the applicant’s

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	<p>responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks.</p> <ul style="list-style-type: none"> • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO. During the award performance period, if appropriate for the subtopic/area of interest, carbon emissions, energy intensity, and cost should be validated via life cycle analysis (LCA) and technoeconomic analysis (TEA). • Go/No-Go Decision Points: The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. A Go/No-Go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. At a minimum, each project must have at least one project-wide Go/No-Go decision point for each budget period (12 to 18-month period) of the project. See Section VI.B.xiii. The applicant should also provide the specific technical and R&D Community Benefits Plan criteria to be used to evaluate the project at the Go/No-Go decision point. The summary provided should be consistent with the SOPO. Go/No-Go decision points are considered “SMART” and can fulfill the requirement for an annual SMART milestone. • End of Project Goal: The applicant should provide a summary of the end of project goal(s). At a minimum, each project must have one SMART end of project goal. The summary provided should be consistent with the SOPO. • Project Schedule (Gantt Chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and Go/No-Go decision points.
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	<ul style="list-style-type: none">• Buy America Requirements for Infrastructure Projects: Within the first 2 pages of the Workplan, include a short statement on whether the project will involve the construction, alteration, and/or repair of infrastructure in the United States. See Appendix D for applicable definitions and other information to inform this statement.• Project Management: The applicant should discuss the team's proposed management plan, including the following:<ul style="list-style-type: none">○ The overall approach to and organization for managing the work○ The roles of each project team member○ Any critical handoffs/interdependencies among project team members○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices○ The approach to project risk management○ A description of how project changes will be handled○ If applicable, the approach to Quality Assurance/Control○ How communications will be maintained among project team members• Market Transformation Plan: The applicant should provide a market transformation plan, including the following:<ul style="list-style-type: none">○ Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan○ Identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, and product distribution.
Technical Qualifications and Resources (Approximately 20% of the Technical Volume)	<p>The Technical Qualifications and Resources should contain the following information:</p> <ul style="list-style-type: none">• Describe the project team's unique qualifications and expertise, including those of key subrecipients.• Describe the project team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project.

	<ul style="list-style-type: none"> • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project. • Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable. • For multi-organizational or multi-investigator projects, describe succinctly: <ul style="list-style-type: none"> ○ The roles and the work to be performed by each PI and senior/key personnel; ○ Business agreements between the applicant and each PI and senior/key personnel; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on scientific/technical direction; ○ Publication arrangements; ○ Intellectual Property issues; and ○ Communication plans
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iii. Resumes

A resume provides information that can be used by reviewers to evaluate the individual's skills, experience, and potential for leadership within the scientific community. Applicants **must submit a resume (limited to three pages)** for each Principal Investigator and all Senior/Key Personnel that include the following:

1. Contact Information;
2. Education and training: Provide institution, major/area, degree, and year for undergraduate, graduate, and postdoctoral training;
3. 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 or not remuneration is received, and, whether full-time, part-time, or voluntary;
4. Awards and honors;
5. 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

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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;

6. Synergistic Activities: List up to five professional and scholarly activities related to the proposed effort; and
7. There should be no lapses in time over the past ten years or since age 18, which ever time period is shorter.

Save the resumes in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Resumes".

In future FOAs, EERE may require a biographical sketch for the PI and senior/key personnel. In the meantime, in lieu of a resume, it is acceptable to use the biographical sketch format approved by the National Science Foundation (NSF). The biographical sketch format may be generated by the Science Experts Network Curriculum Vita (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>, and is also available at <https://nsf.gov/bfa/dias/policy/nsfapprovedformats/biosketch.pdf>. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats.

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third-party cost share providers. If applicable, also include any letters of commitment from partners/end users (one-page maximum per letter). Save the letters of commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOCs".

v. Statement of Project Objectives (SOPO)

Applicants are required to complete a SOPO. A SOPO template is available on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov/>. The SOPO, including the Milestone Table, must not exceed 15 pages when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point (except in figures or tables, which may be 10 point font). Save the SOPO in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_SOPO".

vi. SF-424: Application for Federal Assistance

Applicants are required to complete the SF-424 Application for Federal Assistance. This form is available on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov/>. Complete all required fields in accordance with the

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instructions on the form. The list of certifications and assurances in Field 21 can be found at <http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms>, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period. Save the SF-424 in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_424".

vii. Budget Justification Workbook

Applicants are required to complete the Budget Justification Workbook. This form is available on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov/>. Prime recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the prime recipient and its subrecipients and contractors. Applicants should include costs associated with implementing the various requirements (e.g., R&D Community Benefits Plan, reporting, oversight) and with required annual audits and incurred cost proposals in their proposed budget documents. Such costs may be reimbursed as a direct or indirect cost. The "Instructions and Summary" included with the Budget Justification Workbook will auto-populate as the applicant enters information into the Workbook. Applicants must carefully read the "Instructions and Summary" tab provided within the Budget Justification Workbook. Save the Budget Justification Workbook in a single Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Budget_Justification".

viii. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes) and major participants (for collaborative projects) and the project's commitments and goals described in the R&D Community Benefits Plan. This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Summary".

ix. Summary Slide

Applicants are required to provide a single slide summarizing the proposed project. This slide is used during the evaluation process.

The Summary Slide template requires the following information:

- A technology summary;
- A description of the technology's impact;
- Proposed project goals;
- Any key graphics (illustrations, charts and/or tables);
- The project's key idea/takeaway;
- Project title, prime recipient, Principal Investigator, and senior/key personnel information; and
- Requested EERE funds and proposed applicant cost share.

Save the Summary Slide in a single Microsoft Powerpoint file using the following convention for the title "ControlNumber_LeadOrganization_Slide".

x. Subrecipient Budget Justification (if applicable)

Applicants must provide a separate budget justification for each subrecipient that is expected to perform work estimated to be more than \$250,000 or 25 percent of the total work effort (whichever is less). The budget justification must include the same justification information described in the "Budget Justification" section above. Save each subrecipient budget justification in a Microsoft Excel file using the following convention for the title "ControlNumber_LeadOrganization_Subrecipient_Budget_Justification".

xi. Budget for DOE/NNSA FFRDC (if applicable)

If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the applicant must provide a DOE WP in accordance with the requirements in DOE Order 412.1A, Work Authorization System, Attachment 3, available at: <https://www.directives.doe.gov/directives-documents/400-series/0412.1-BOrder-a-chg1-AdmChg> Save the WP in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_WP".

xii. Authorization for non-DOE/NNSA or DOE/NNSA FFRDCs (if applicable)

The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted with the application. The use of a FFRDC must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_FFRDCAuth".

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xiii. SF-LLL: Disclosure of Lobbying Activities (required)

Prime recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Prime recipients and subrecipients are required to complete and submit SF-LLL, “Disclosure of Lobbying Activities”

(<https://www.grants.gov/web/grants/forms/sf-424-individual-family.html>) to ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

- An officer or employee of any federal agency;
- A Member of Congress;
- An officer or employee of Congress; or
- An employee of a Member of Congress.

Save the SF-LLL in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_SF-LLL”.

xiv. Waiver Requests: Foreign Entity and Foreign Work (if applicable)**i. Foreign Entity Participation:**

As set forth in Section III.A.iii., all prime recipients and subrecipients must qualify as a domestic entity. See Section III. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix C lists the necessary information that must be included in a request to waive this requirement.

ii. Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section IV.J.iii., all work under EERE funding agreements must be performed in the United States. Appendix C lists the necessary information that must be included in a foreign work waiver request.

Save the Waivers in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_Waiver”..

xv. R&D Community Benefits Plan

The R&D Community Benefits Plan must set forth the applicant’s approach to ensuring the Federal investments advance the following three objectives: (1) advance diversity, equity, inclusion and accessibility (DEIA); (2) contribute to energy equity; and (3) invest in America’s workforce. The below sections set

forth the content requirements for the R&D Community Benefits Plan, which addresses each of the foregoing objectives. Applicants must address all three sections.

The applicant's R&D Community Benefits Plan must include at least one Specific, Measurable, Assignable, Relevant, and Timely (SMART) milestone per budget period to measure progress on the proposed actions. The R&D Community Benefits Plan will be evaluated as part of the technical review process. If EERE selects a project, EERE will incorporate the R&D Community Benefits Plan into the award and the recipient must implement its R&D Community Benefits Plan as part of carrying out its project. During the life of the EERE award, EERE will evaluate the recipient's progress, including as part of the Go/No-Go review process.

The plan should be specific to the proposed project and not a restatement of an organizational policies. Applicants should describe the future implications or a milestone-based plan for identifying future implications of their research on energy equity, including, but not limited to, benefits for the U.S. workforce. These impacts may be uncertain, occur over a long period of time, and/or have many factors within and outside the specific proposed research. Applicants are encouraged to describe the influencing factors and the most likely workforce and energy equity implications of the proposed research if the research is successful. While some guidance and example activities are provided in Appendix F, applicants are encouraged to leverage promising practices and develop a plan that is tailored for their project.

The R&D Community Benefits Plan must not exceed five (5) pages. It must be submitted in PDF format using the following convention name for the title: "Control Number_LeadOrganization_CBP." This Plan must address the technical review criterion titled, "R&D Community Benefits Plan." See Section V. of the FOA.

The applicant's R&D Community Benefits Plan must address the following three sections:

1) Diversity, Equity, Inclusion, and Accessibility:

To building a clean and equitable energy economy, it is important that there are opportunities for people of all racial, ethnic, socioeconomic and geographic backgrounds, sexual orientation, gender identity, persons with disabilities, and those re-entering the workforce from incarceration. This section of the plan must demonstrate how DEIA is incorporated in the technical project objectives. The plan must identify the specific action the applicant would undertake that integrated into the research goals and

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project teams. Submitting an institutional DEIA plan without specific integration into the project will be deemed insufficient.

2) Energy Equity:

This section must articulate the applicant's consideration of long-term equity implications of the research. It must identify how the specific project integrates equity considerations into the project design to support equitable outcomes should the innovation be successful. Like cost reductions and commercialization plans, the R&D Community Benefits Plan requires description of the equity implications of the innovation if successful.

3) Workforce Implications:

This section must articulate the applicant's consideration of long-term workforce impacts and opportunities of the research. It must identify how the project is designed and executed to include an understanding of the future workforce needs should the resulting innovation be successful.

~~The Diversity, Equity, and Inclusion Plan must not exceed 5 pages. Save the Diversity, Equity and Inclusion Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_DEIP".~~

xvi. Current and Pending Support

Current and pending support is intended to allow the identification of potential duplication, overcommitment, potential conflicts of interest or commitment, and all other sources of support. As part of the application, the principal investigator and senior/key personnel at the applicant and subrecipient level 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. All **connections with** foreign government-sponsored talent recruitment programs must be identified in 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

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- The total cost or value of the award or activity, including direct and indirect costs and cost share. 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

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

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. **Supporting documents of any identified source of support must be provided to DOE on request, including certified translations of any document.**

PIs and senior/key personnel must provide a separate disclosure statement listing the required information above regarding current and pending support. Each individual must sign and date their respective disclosure statement and include the following certification statement:

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.

The information may be provided in the format approved by the National Science Foundation (NSF), which may be generated by the Science Experts Network Curriculum Vita (SciENCv), a cooperative venture maintained at <https://www.ncbi.nlm.nih.gov/sciencv/>, and is also available at <https://www.nsf.gov/bfa/dias/policy/nsfapprovedformats/cps.pdf>. The use of a format required by another agency is intended to reduce the administrative burden to researchers by promoting the use of common formats. If the NSF

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format is used, the individual must still include a signature, date, and a certification statement using the language included in the paragraph above.

Save the Current and Pending Support in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_CPS".

Definitions:

Current and pending support – (a) All resources made available, or expected to be made available, to an individual in support of the individual's RD&D efforts, regardless of (i) whether the source is foreign or domestic; (ii) whether the resource is made available through the entity applying for an award or directly to the individual; or (iii) whether the resource has monetary value; and (b) includes in-kind contributions requiring a commitment of time and directly supporting the individual's RD&D efforts, such as the provision of office or laboratory space, equipment, supplies, employees, or students. This term has the same meaning as the term Other Support as applied to researchers in NSPM-33: For researchers, Other Support includes all resources made available to a researcher in support of and/or related to all of their professional RD&D efforts, including resources provided directly to the individual or through the organization, and regardless of whether or not they have monetary value (e.g., even if the support received is only in-kind, such as office/laboratory space, equipment, supplies, or employees). This includes resource and/or financial support from all foreign and domestic entities, including but not limited to, gifts provided with terms or conditions, financial support for laboratory personnel, and participation of student and visiting researchers supported by other sources of funding.

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

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complimentary foreign travel, honorific titles, career advancement opportunities, promised future compensation, or other types of remuneration or consideration, including in-kind compensation.

Senior/key personnel – an individual who contributes in a substantive, meaningful way to the scientific development or execution of a research, development and demonstration (RD&D) project proposed to be carried out with DOE award.⁴³

xvii. Transparency of Foreign Connection

Applicants must identify the following as they relate to the proposed recipient and subrecipients. U.S. National Laboratories, domestic government entities, and institutions of higher education are only required to respond to items 1, 2 and 9, and if applying as to serve as the prime recipient, must provide complete responses for project team members that are not U.S. National Laboratories, domestic government entities, or institutions of higher education.

1. Entity name, website address and mailing address;
2. The identity of all owners, principal investigators, project managers, and senior/key personnel who are a party to any *Foreign Government-Sponsored Talent Recruitment Program* of a foreign country of risk (i.e., China, Iran, North Korea, and Russia);
3. 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, including the People's Republic of China;
4. 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;
5. Percentage, if any, that the proposed recipient or subrecipient has foreign ownership or control;
6. Percentage, if any, that the proposed recipient or subrecipient is wholly or partially owned by an entity in a foreign country of risk;
7. The 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;

⁴³ 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, graduate students, and those with a postdoctoral role also may be considered senior/key personnel if they meet this definition.

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8. Any technology licensing or intellectual property sales to a foreign country of risk, during the 5-year period preceding submission of the proposal;
9. Any foreign business entity, offshore entity, or entity outside the United States related to the proposed recipient or subrecipient;
10. 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;
11. 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 five percent;
12. 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
13. 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.

Save the Transparency of Foreign Connection in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TFC".

xviii. Potentially Duplicate Funding Notice

If the applicant or project team member has other active awards of federal funds, the applicant must determine whether the activities of those awards potentially overlap with the activities set forth in its application to this FOA. If there is a potential overlap, the applicant must notify DOE in writing of the potential overlap and state how it will ensure any project funds (i.e., recipient cost share and federal funds) will not be used for identical cost items under multiple awards. Likewise, for projects that receive funding under this FOA, if a recipient or project team member receives any other award of federal funds for activities that potentially overlap with the activities funded under the DOE award, the recipient must promptly notify DOE in writing of the potential overlap and state whether project

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funds from any of those other federal awards have been, are being, or are to be used (in whole or in part) for one or more of the identical cost items under the DOE award. If there are identical cost items, the recipient must promptly notify the DOE Contracting Officer in writing of the potential duplication and eliminate any inappropriate duplication of funding.

Save the Potentially Duplicative Funding Notice in a single PDF file using the following convention for the title
“ControlNumber_LeadOrganization_PDFN.pdf.”.

E. Content and Form of Replies to Reviewer Comments

If replies to reviewer comments are applicable, EERE will provide applicants with reviewer comments following the evaluation of all eligible Full Applications. Applicants will have a brief opportunity to review the comments and to prepare a short Reply to Reviewer Comments responding to the comments however they desire or supplementing their Full Application. The Reply to Reviewer Comments is an optional submission; applicants are not required to submit a Reply to Reviewer Comments. EERE will post the Reviewer Comments in EERE eXCHANGE. The expected submission deadline is on the cover page of the FOA; however, it is the applicant’s responsibility to monitor EERE eXCHANGE in the event that the expected date changes. The deadline will not be extended for applicants who are unable to timely submit their reply due to failure to check EERE eXCHANGE or relying on the expected date alone. Applicants should anticipate having approximately three (3) business days to submit Replies to Reviewer Comments.

EERE will not review or consider ineligible Replies to Reviewer Comments (see Section III. of the FOA). EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

Replies to Reviewer Comments must conform to the following content and form requirements, including maximum page lengths, described below. If a Reply to Reviewer Comments is more than three (3) pages in length, EERE will review only the first three (3) pages and disregard any additional pages.

SECTION	PAGE LIMIT	DESCRIPTION
Text	2 pages max	Applicants may respond to one or more reviewer comments or supplement their Full Application.
Optional	1 page max	Applicants may use this page however they wish; text, graphs, charts, or other data to respond to reviewer comments or supplement their Full Application are acceptable.

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F. Post Selection Information Requests

If selected for award, EERE reserves the right to request additional or clarifying information regarding the following (non-exhaustive list):

- Personnel proposed to work on the project and collaborating organizations (See Section VI.B.xvii. Participants and Collaborating Organizations);
- Current and Pending Support (See Section VI.B.xviii. Current and Pending Support);
- An Intellectual Property Management Plan describing how the project team/consortia members will handle intellectual property rights and issues between themselves while ensuring compliance with federal intellectual property laws, regulations, and policies;
- A Data Management Plan describing how all research data displayed in publications resulting from the proposed work will be digitally accessible at the time of publications, in accordance with Section VI.B.xx.;
- Indirect cost information;
- Other budget information;
- Commitment Letters from Third Parties Contributing to Cost Share, if applicable;
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Information for the DOE Office of Civil Rights to process assurance reviews under 10 CFR 1040;
- Representation of Limited Rights Data and Restricted Software, if applicable; and
- Environmental Questionnaire.

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

Each applicant (unless the applicant is an individual or federal awarding agency that is excepted from those requirements under 2 CFR 25.110(b) or (c), or has an exception approved by the federal awarding agency under 2 CFR 25.110(d)) is required to: (1) Be registered in the SAM at <https://www.sam.gov> before submitting its application; (2) provide a valid UEI in its application; and (3) continue to maintain an active SAM registration with current information at all times during which it has an active federal award or an application or plan under consideration by a federal awarding agency. DOE may not make a federal award to an applicant until the applicant has complied with all applicable UEI and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, the DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

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NOTE: Due to the high demand of UEI requests and SAM registrations, entity legal business name and address validations are taking longer than expected to process. Entities should start the UEI and SAM registration process as soon as possible. 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. Additional entity validation resources can be found here: [GSAFSD Tier 0 Knowledge Base - Validating your Entity](#).

H. Submission Dates and Times

All required submissions must be submitted in EERE eXCHANGE no later than 5 p.m. Eastern Time on the dates provided on the cover page of this FOA.

I. Intergovernmental Review

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

J. Funding Restrictions

i. Allowable Costs

All expenditures must be allowable, allocable, and reasonable in accordance with the applicable federal cost principles.

Refer to the following applicable federal cost principles for more information:

- Federal Acquisition Regulation (FAR) Part 31 for For-Profit entities; and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

ii. Pre-Award Costs

Selectees must request prior written approval to charge pre-award costs. Pre-award costs are those incurred prior to the effective date of the federal award directly pursuant to the negotiation and in anticipation of the federal award where such costs are necessary for efficient and timely performance of the scope of work. Such costs are allowable only to the extent that they would have been allowable if incurred after the date of the federal award and **only** with the written approval of the federal awarding agency, through the Contracting Officer assigned to the award.

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Pre-award costs cannot be incurred prior to the Selection Official signing the Selection Statement and Analysis.

Pre-award expenditures are made at the selectee's risk. EERE is not obligated to reimburse costs: (1) in the absence of appropriations; (2) if an award is not made; or (3) if an award is made for a lesser amount than the selectee anticipated.

1. National Environmental Policy Act (NEPA) Requirements Related to Pre-Award Costs

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA. Applicants should carefully consider and should seek legal counsel or other expert advice before taking any action related to the proposed project that would have an adverse effect on the environment or limit the choice of reasonable alternatives prior to EERE completing the NEPA review process.

EERE does not guarantee or assume any obligation to reimburse pre-award costs incurred prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that DOE determines may have an adverse effect on the environment or limit the choice of reasonable alternatives prior to receiving such written authorization from the Contracting Officer, the applicant is doing so at risk of not receiving federal funding for their project and such costs may not be recognized as allowable cost share. Nothing contained in the pre-award cost reimbursement regulations or any pre-award costs approval letter from the Contracting Officer override these NEPA requirements to obtain the written authorization from the Contracting Officer prior to taking any action that may have an adverse effect on the environment or limit the choice of reasonable alternatives. Likewise, if an application is selected for negotiation of award, and the prime recipient elects to undertake activities that are not authorized for federal funding by the Contracting Officer in advance of EERE completing a NEPA review, the prime recipient is doing so at risk of not receiving federal funding and such costs may not be recognized as allowable cost share.

iii. Performance of Work in the United States (Foreign Work Waiver)

1. Requirement

All work performed under EERE awards must be performed in the United States. The prime recipient must flow down this requirement to its subrecipients.

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2. Failure to Comply

If the prime recipient fails to comply with the Performance of Work in the United States requirement, EERE may deny reimbursement for the work conducted outside the United States and such costs may not be recognized as allowable recipient cost share. The prime recipient is responsible should any work under this award be performed outside the United States, absent a waiver, regardless of whether the work is performed by the prime recipient, subrecipients, contractors or other project partners.

3. Waiver

To seek a foreign work waiver, the applicant must submit a written waiver request to EERE. Appendix C lists the necessary information that must be included in a request for a foreign work waiver.

Save the waiver request(s) in a single PDF file. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iv. Construction

Recipients are required to obtain written authorization from the Contracting Officer before incurring any major construction costs.

v. 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 USC 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 U.S. flag carrier, if service is available. Foreign travel costs are allowable only with the written prior approval of the Contracting Officer assigned to the award.

vi. Equipment and Supplies

Real property and equipment purchased with project funds (federal share and recipient cost share) under this Award are subject to the requirements at 2 CFR 200.311, 200.313, and 200.316 (non-Federal entities, except for-profit entities) and 2 CFR 910.360 (for-profit entities). The Recipient may continue to use the real property and equipment after the conclusion of the award period of performance so long as the Recipient: a. continues to use the property for the authorized project purposes; b. complies with the applicable reporting

requirements and regulatory property standards; c. as applicable to for-profit entities, UCC filing statements are maintained; and d. submits a written Request for Continued Use for DOE authorization, which is approved by the DOE Contracting Officer. The Recipient must request authorization from the Contracting Officer to continue to use the property for the authorized project purposes beyond the award period of performance (“Request for Continued Use”). The Recipient’s written Request for Continued Use must identify the property and include: a summary of how the property will be used (must align with the authorized project purposes); a proposed use period (e.g., perpetuity, until fully depreciated, or a calendar date where the Recipient expects to submit disposition instructions); acknowledgement that the recipient shall not sell or encumber the property or permit any encumbrance without prior written DOE approval; current fair market value of the property; and an Estimated Useful Life or depreciation schedule for equipment. When the property is no longer needed for authorized project purposes, the Recipient must request disposition instructions from DOE. For-profit entity disposition requirements are set forth at 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

vii. Buy America Requirements for Infrastructure Projects

Pursuant to the Build America Buy America Act, subtitle IX of BIL (Buy America, or “BABA”), federally assisted projects that involve infrastructure work, undertaken by applicable recipient types, require that:

All iron, steel, and manufactured products used in the infrastructure work are produced in the United States; and

All construction materials used in the infrastructure work are manufactured in the United States.

Whether a given project must apply this requirement is project-specific and dependent on several factors, such as the recipient’s entity type, whether the work involves “infrastructure,” as that term is defined in Section 70914 of the BIL, and whether the infrastructure in question is publicly owned or serves a public function.

Applicants are strongly encouraged to consult Appendix C of this FOA to determine whether their project may have to apply this requirement, both to make an early determination as to the need of a waiver, as well as to determine what impact, if any, this requirement may have on the proposed project’s budget.

Please note that, based on implementation guidance from the Office of Management and Budget (OMB) issued on April 18, 2022, the Buy America

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requirements of the BIL do not apply to DOE projects in which the prime recipient is a for-profit entity; the requirements only apply to projects whose prime recipient is a “non-Federal entity,” e.g., a State, local government, Indian tribe, Institution of Higher Education, or nonprofit organization. Subawards should conform to the terms of the prime award from which they flow; in other words, for-profit prime recipients are not required to flow down these Buy America requirements to subrecipients, even if those subrecipients are non-Federal entities as defined above. Conversely, prime recipients which are non-Federal entities must flow the Buy America requirements down to all subrecipients, even if those subrecipients are for-profit entities. Finally, for all applicants—both non-Federal entities and for-profit entities—DOE is including a Program Policy Factor that the Selection Official may consider in determining which Full Applications to select for award negotiations that considers whether the applicant has made a commitment to procure U.S. iron, steel, manufactured products, and construction materials in its project.

The DOE financial assistance agreement will require each recipient: (1) to fulfill the commitments made in its application regarding the procurement of U.S.-produced products and (2) to fulfill the commitments made in its application regarding the procurement of other key component metals and manufactured products domestically that are deemed available in sufficient and reasonably available quantities or of a satisfactory quality at the time of award negotiation. Applicants may seek waivers of these requirements in very limited circumstances and for good cause shown. Further details on requesting a waiver can be found in Appendix C and the terms and conditions of an award.

Applicants are strongly encouraged to consult Appendix D for more information.

viii. Lobbying

Recipients and subrecipients may not use any federal funds to influence or attempt to influence, directly or indirectly, congressional action on any legislative or appropriation matters.

Recipients and subrecipients are required to complete and submit SF-LLL, “Disclosure of Lobbying Activities” (<https://www.grants.gov/web/grants/forms/sf-424-individual-family.html>) to ensure that non-federal funds have not been paid and will not be paid to any person for influencing or attempting to influence any of the following in connection with the application:

- An officer or employee of any federal agency;
- A Member of Congress;

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-
- An officer or employee of Congress; or
 - An employee of a Member of Congress.

ix. Risk Assessment

Prior to making a federal award, the DOE is required by 31 U.S.C. 3321 and 41 U.S.C. 2313 to review information available through any Office of Management and Budget (OMB)-designated repositories of government-wide eligibility qualification or financial integrity information, such as SAM Exclusions and “Do Not Pay.”

In addition, DOE evaluates the risk(s) posed by applicants before they receive federal awards. This evaluation may consider: results of the evaluation of the applicant's eligibility; the quality of the application; financial stability; quality of management systems and ability to meet the management standards prescribed in this part; history of performance; reports and findings from audits; and the applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities.

In addition to this review, DOE must comply with the guidelines on government-wide suspension and debarment in 2 CFR 180 and must require non-federal entities to comply with these provisions. These provisions restrict federal awards, subawards and contracts with certain parties that are debarred, suspended or otherwise excluded from or ineligible for participation in federal programs or activities.

Further, as DOE invests in critical infrastructure and funds critical and emerging technology areas, DOE also considers possible vectors of undue foreign influence in evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

x. Invoice Review and Approval

DOE employs a risk-based approach to determine the level of supporting documentation required for approving invoice payments. Recipients may be required to provide some or all of the following items with their requests for reimbursement:

- Summary of costs by cost categories;
- Timesheets or personnel hours report;
- Invoices/receipts for all travel, equipment, supplies, contractual, and other costs;
- UCC filing proof for equipment acquired with project funds by for-profit recipients and subrecipients;
- Explanation of cost share for invoicing period;

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- Analogous information for some subrecipients; and
- Other items as required by DOE.

xi. Prohibition Related to Foreign Government-Sponsored Talent Recruitment Programs

a. Prohibition

Persons participating in a *Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk* are prohibited from participating in projects selected for federal funding under this FOA. Should an award result from this FOA, the recipient must exercise ongoing due diligence to reasonably ensure that no individuals participating on the DOE-funded project are participating in a *Foreign Government-Sponsored Talent Recruitment Program of a Foreign Country of Risk*. Consequences for violations of this prohibition will be determined according to applicable law, regulations, and policy. Further, the recipient must notify DOE within five (5) business days upon learning that an individual on the project team is or is believed to be participating in a foreign government talent recruitment program of a foreign country of risk. DOE may modify and add requirements related to this prohibition to the extent required by law.

b. Definitions

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

future compensation, or other types of remuneration or consideration, including in-kind compensation.

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

xii. Foreign Collaboration Considerations

- a. Consideration of new collaborations with foreign organizations and governments. The recipient will be required to provide DOE with advanced written notification of any potential collaboration with foreign organizations or governments in connection with its DOE-funded award scope. The recipient will then be required to await further guidance from DOE prior to contacting the proposed foreign organization or government regarding the potential collaboration or negotiating the terms of any potential agreement.
- b. Existing collaborations with foreign organizations and governments. The recipient will be required to provide DOE with a written list of all existing foreign collaborations in which has entered in connection with its DOE-funded award scope.
- c. Description of collaborations that should be reported: In general, a collaboration will involve some provision of a thing of value to, or from, the recipient. A thing of value includes but may not be limited to all resources made available to, or from, the recipient in support of and/or related to the DOE award, regardless of whether or not they have monetary value. Things of value also may include in-kind contributions (such as office/laboratory space, data, equipment, supplies, employees, students). In-kind contributions not intended for direct use on the DOE award but resulting in provision of a thing of value from or to the DOE award must also be reported. Collaborations do not include routine workshops, conferences, use of the recipient's services and facilities by foreign investigators resulting from its standard published process for evaluating requests for access, or the routine use of foreign facilities by awardee staff in accordance with the recipient's standard policies and procedures.

V. Application Review Information

A. Technical Review Criteria

i. Concept Papers

Concept Papers are evaluated based on consideration the following factors. All sub-criteria are of equal weight.

Concept Paper Criterion: Overall FOA Responsiveness and Viability of the Project (Weight: 100%)

This criterion involves consideration of the following factors:

- The applicant clearly describes the proposed technology, describes how the technology is unique and innovative, and how the technology will advance the current state-of-the-art;
- The applicant has identified risks and challenges, including possible mitigation strategies, and has shown the impact that EERE funding and the proposed project would have on the relevant field and application;
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project; and
- The proposed work, if successfully accomplished, would clearly meet the objectives as stated in the FOA.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (50%)

This criterion involves consideration of the following factors:

Technical Merit and Innovation

- Extent to which the proposed technology or process is innovative;
- Degree to which the current state of the technology and the proposed advancement are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will move the state-of-the-art to the proposed advancement; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and revolutionary, including relevant data, calculations and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Impact of Technology Advancement

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the state-of-the-art.

Criterion 2: Project Research and Market Transformation Plan (25%)

This criterion involves consideration of the following factors:

Research Approach, Workplan and SOPO

- Degree to which the approach and critical path have been clearly described and thoughtfully considered; and
- Degree to which the task descriptions are clear, detailed, timely, and reasonable, resulting in a high likelihood that the proposed Workplan and SOPO will succeed in meeting the project goals.

Identification of Technical Risks

- Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.

Baseline, Metrics, and Deliverables

- The level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and a mid-point deliverable defined in the application, such that meaningful interim progress will be made.

Market Transformation Plan

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including mitigation plan; and
- Comprehensiveness of market transformation plan including but not limited to product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, and product distribution.

Criterion 3: Team and Resources (15%)

This criterion involves consideration of the following factors:

- The capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success. The qualifications, relevant expertise, and time commitment of the individuals on the team;
- The sufficiency of the facilities to support the work;
- The degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further development and commercial deployment of the proposed technologies;

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- The level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- The reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: R&D Community Benefits Plan (10%)

This criterion involves consideration of the following factors:

Diversity, Equity, Inclusion and Accessibility (DEIA)

- Clear articulation of the project's goals related to diversity, equity, inclusion, and accessibility;
- Quality of the project's DEIA goals, as measured by the goals' depth, breadth, likelihood of success, inclusion of appropriate and relevant SMART milestones, and overall project integration;
- Degree of applicant's commitment and ability to track progress towards meeting each of the diversity, equity, inclusion, and accessibility goals; and
- Extent of engagement of organizations that represent underserved communities as a core element of their mission, including MSIs, Minority Business Entities, and non-profit or community-based organizations.

Energy Equity

- Clear workplan tasks, staffing, research, and timeline for engaging energy equity stakeholders and/or evaluating the possible near and long-term implications of the project for the benefit of the American public, including, but not limited to the public health and public prosperity benefits;
- Approach, methodology, and expertise articulated in the plan for addressing energy equity and justice issues associated with the technology innovation; and
- Likelihood that the plan will result in improved understanding of distributional public benefits and costs related to the innovation if successful.

Workforce Implications

- Clear and comprehensive workplan tasks, staffing, research, and timeline for engaging workforce stakeholders and/or evaluating the possible near and long-term implications of the project for the U.S. workforce;
- Approach to document the knowledge, skills, and abilities of the workforce required for successful commercial deployment of innovations resulting from this research; and
- Likelihood that the plan will result in improved understanding of the workforce implications related to the innovation if successful.

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iii. Criteria for Replies to Reviewer Comments

EERE has not established separate criteria to evaluate Replies to Reviewer Comments. Instead, Replies to Reviewer Comments are attached to the original applications and evaluated as an extension of the Full Application.

B. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this FOA, by the standards set forth in EERE's Notice of Objective Merit Review Procedure (76 Fed. Reg. 17846, March 31, 2011) and the guidance provided in the "DOE Merit Review Guide for Financial Assistance," effective September 2020, which is available at: <https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current>.

C. Other Selection Factors

i. Program Policy Factors

In addition to the above criteria, the Selection Official may consider the following program policy factors in determining which Full Applications to select for award negotiations:

- The degree to which the proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- The degree to which the proposed project, including proposed cost share, optimizes the use of available EERE funding to achieve programmatic objectives;
- The level of industry involvement and demonstrated ability to accelerate commercialization and overcome key market barriers;
- The degree to which the proposed project is likely to lead to increased high quality employment and manufacturing in the United States;
- The degree to which the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty; and
- The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
- The degree to which the proposed project incorporates diversity, equity, and inclusion elements, including but not limited to team members from Minority Serving Institutions (e.g., Historically Black Colleges and Universities

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(HBCUs)/Other Minority Institutions), Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or members within underserved communities.

- The degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials.

D. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors, in determining which applications to select.

ii. Recipient Integrity and Performance Matters

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 (currently FAPIIS) (see 41 U.S.C. 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.

iii. Selection

The Selection Official may consider the technical merit, the Federal Consensus Board's recommendations, program policy factors, and the amount of funds available in arriving at selections for this FOA.

E. Anticipated Notice of Selection and Award Negotiation Dates

EERE anticipates notifying applicants selected for negotiation of award and negotiating awards by the dates provided on the cover page of this FOA.

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE eXCHANGE. The notification letter will state the basis upon which the Concept Paper or the Full Application is ineligible and not considered for further review.

ii. Concept Paper Notifications

EERE will notify applicants of its determination to encourage or discourage the submission of a Full Application. EERE will post these notifications to EERE eXCHANGE.

Applicants may submit a Full Application even if they receive a notification discouraging them from doing so. By discouraging the submission of a Full Application, EERE intends to convey its lack of programmatic interest in the proposed project. Such assessments do not necessarily reflect judgments on the merits of the proposed project. The purpose of the Concept Paper phase is to save applicants the considerable time and expense of preparing a Full Application that is unlikely to be selected for award negotiations.

A notification encouraging the submission of a Full Application does not authorize the applicant to commence performance of the project. Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

iii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in EERE eXCHANGE. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations. Alternatively, EERE may notify one or more applicants that a final selection determination on

particular Full Applications will be made at a later date, subject to the availability of funds or other factors.

iv. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the prime recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in EERE eXCHANGE with whom EERE will communicate to conduct award negotiations. The applicant must be responsive during award negotiations (i.e., provide requested documentation) and meet the negotiation deadlines. If the applicant fails to do so or if award negotiations are otherwise unsuccessful, EERE will cancel the award negotiations and rescind the Selection. EERE reserves the right to terminate award negotiations at any time for any reason.

Please refer to Section IV.J.ii. of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

In some instances, an applicant may receive a notification that its application was not selected for award and EERE designated the application to be an alternate. As an alternate, EERE may consider the Full Application for federal funding in the future. A notification letter stating the Full Application is designated as an alternate does not authorize the applicant to commence performance of the project. EERE may ultimately determine to select or not select the Full Application for award negotiations.

vi. Unsuccessful Applicants

EERE shall promptly notify in writing each applicant whose application has not been selected for award or whose application cannot be funded because of the unavailability of appropriated funds.

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with

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an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. EERE Funding Opportunity Exchange (eXCHANGE)

Register and create an account on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov>. This account will allow the user to apply to any open EERE FOAs that are currently in EERE eXCHANGE.

Beginning on July 8, 2022*, eXCHANGE will be updated to integrate with [Login.gov](https://login.gov). As of August 5, 2022*, potential applicants will be required to have a Login.gov account to access [EERE eXCHANGE](https://eere-eXCHANGE.energy.gov). As part of the eXCHANGE registration process, new users will be directed to create an account in Login.gov. Please note that the email address associated with Login.gov must match the email address associated with the eXCHANGE account. For more information, refer to the Exchange Multi-Factor Authentication (MFA) Quick Guide in the [Manuals section](#) of eXCHANGE.

It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.** The eXCHANGE registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA.**

2. System for Award Management

Register with the SAM at <https://www.sam.gov>. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called a Marketing Partner ID Number (MPIN) are important steps in SAM registration. Please update your SAM registration annually.

3. FedConnect

Register in FedConnect at <https://www.fedconnect.net>. 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

* Please note that these dates are tentative and subject to change.

<https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnectReadySetGo.pdf>.

4. Grants.gov

Register in Grants.gov (<http://www.grants.gov>) to receive automatic updates when Amendments to this FOA are posted. However, please note that, Concept Papers, and Full Applications will not be accepted through Grants.gov.

5. Electronic Authorization of Applications and Award Documents

Submission of an application and supplemental information under this FOA through electronic systems used by the DOE, including EERE eXCHANGE and FedConnect.net, constitutes the authorized representative's approval and electronic signature.

ii. Award Administrative Requirements

The administrative requirements for DOE grants and cooperative agreements are contained in 2 CFR Part 200 as amended by 2 CFR Part 910.

iii. Foreign National Participation

All applicants selected for an award under this FOA and project participants (including subrecipients and contractors) who anticipate involving foreign nationals in the performance of an award, are required to provide DOE with specific information about each foreign national to satisfy requirements for foreign national participation. A "foreign national" is defined as any person who is not a United States citizen by birth or naturalization. The volume and type of information collected may depend on various factors associated with the award.

DOE may elect to deny foreign national's participation in the award. Likewise, DOE may elect to deny a foreign national's access to a DOE sites, information, technologies, equipment, programs or personnel.

iv. 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 Part 170. Prime recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier subrecipients. Prime recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

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v. National Policy Requirements

The National Policy Assurances that are incorporated as a term and condition of award are located at: <http://www.nsf.gov/awards/managing/rtc.jsp>.

vi. Environmental Review in Accordance with National Environmental Policy Act (NEPA)

EERE's decision whether and how to distribute federal funds under this FOA is subject to NEPA (42 U.S.C. 4321, *et seq.*). NEPA requires federal agencies to integrate environmental values into their decision-making processes by considering the potential environmental impacts of their proposed actions. For additional background on NEPA, please see DOE's NEPA website, at <https://www.energy.gov/nepa>.

While NEPA compliance is a federal agency responsibility and the ultimate decisions remain with the federal agency, all recipients selected for an award will be required to assist in the timely and effective completion of the NEPA process in the manner most pertinent to their proposed project. If DOE determines certain records must be prepared to complete the NEPA review process (e.g., biological evaluations or environmental assessments), the recipient may be required to prepare the records and the costs to prepare the necessary records may be included as part of the project costs.

vii. Applicant Representations and Certifications**1. Lobbying Restrictions**

By accepting funds under this award, the prime recipient agrees that none of the funds obligated on the award shall be expended, directly or indirectly, to influence Congressional action on any legislation or appropriation matters pending before Congress, other than to communicate to Members of Congress as described in 18 U.S.C. § 1913. This restriction is in addition to those prescribed elsewhere in statute and regulation.

2. Corporate Felony Conviction and Federal Tax Liability Representations

In submitting an application in response to this FOA, the applicant represents that:

- a. It is **not** a corporation that has been convicted of a felony criminal violation under any federal law within the preceding 24 months; and
- b. 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

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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.

3. Nondisclosure and Confidentiality Agreements Representations

In submitting an application in response to this FOA the applicant represents that:

a. It **does not and will not** require its employees or contractors to sign internal nondisclosure or confidentiality agreements or statements prohibiting or otherwise restricting its employees or contractors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a federal department or agency authorized to receive such information.

b. 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:

(1) *“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.”*

(2) The limitation above shall not contravene requirements applicable to Standard Form 312 Classified Information Nondisclosure Agreement (<https://fas.org/sgp/othergov/sf312.pdf>), Form 4414 Sensitive Compartmented Information Disclosure Agreement (<https://fas.org/sgp/othergov/intel/sf4414.pdf>),

or any other form issued by a federal department or agency governing the nondisclosure of classified information.

- (3) Notwithstanding the provision listed in paragraph (a), a nondisclosure or confidentiality policy form or agreement that is to be executed by a person connected with the conduct of an intelligence or intelligence-related activity, other than an employee or officer of the United States government, may contain provisions appropriate to the particular activity for which such document is to be used. Such form or agreement shall, at a minimum, require that the person will not disclose any classified information received in the course of such activity unless specifically authorized to do so by the United States government. Such nondisclosure or confidentiality forms shall also make it clear that they do not bar disclosures to Congress, or to an authorized official of an executive agency or the Department of Justice, that are essential to reporting a substantial violation of law.

viii. Statement of Federal Stewardship

EERE will exercise normal federal stewardship in overseeing the project activities performed under EERE 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.

ix. Statement of Substantial Involvement

EERE has substantial involvement in work performed under awards made as a result of this FOA. EERE does not limit its involvement to the administrative requirements of the award. Instead, EERE has substantial involvement in the direction and redirection of the technical aspects of the project as a whole. Substantial involvement includes, but is not limited to, the following:

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the project.
2. EERE may intervene in the conduct or performance of work under this award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.
3. EERE may redirect or discontinue funding the project based on the outcome of EERE's evaluation of the project at the Go/No-Go decision point(s).

4. EERE participates in major project decision-making processes.

x. Subject Invention Utilization Reporting

In order to ensure that prime recipients and subrecipients holding title to subject inventions are taking the appropriate steps to commercialize subject inventions, EERE may require that each prime recipient holding title to a subject invention submit annual reports for ten (10) years from the date the subject invention was disclosed to EERE on the utilization of the subject invention and efforts made by prime recipient or their licensees or assignees to stimulate such utilization. The reports must include information regarding the status of development, date of first commercial sale or use, gross royalties received by the prime recipient, and such other data and information as EERE may specify.

xi. Intellectual Property Provisions

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

xii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. In addition, only for Topic 1: Next Generation Materials and Manufacturing Processes, Subtopic 1.1: Increased Conductivity Materials, Subtopic 1.2 Harsh Environment Materials and for subtopic 1.2 AI/ML for Aerostructures) For this subset of topic areas (e.g. Topic Area 1) that include the use of data-intensive methods (e.g., high-throughput experimentation, machine learning, artificial intelligence), applicants will be required to publish project datasets through a designated DOE-approved data repository using appropriate content models and/or data formats for the relevant field of study. An additional report is required as a deliverable to show submission of the datasets to the repository.

xiii. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the EERE program goals and objectives. Federal funding beyond the Go/No-Go decision point (continuation funding) is contingent upon (1) availability of federal funds appropriated by Congress for the purpose of this program; (2) the availability of future-year budget authority; (3) recipient's technical progress compared to the Milestone Summary Table stated in Attachment 1 of the award; (4) recipient's submittal of required reports; (5)

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recipient's compliance with the terms and conditions of the award; (6) EERE's Go/No-Go decision; (7) the recipient's submission of a continuation application; and (8) written approval of the continuation application by the Contracting Officer.

As a result of the Go/No-Go Review, DOE may, at its discretion, authorize the following actions: (1) continue to fund the project, contingent upon the availability of funds appropriated by Congress for the purpose of this program and the availability of future-year budget authority; (2) recommend redirection of work under the project; (3) place a hold on federal funding for the project, pending further supporting data or funding; or (4) discontinue funding the project because of insufficient progress, change in strategic direction, or lack of funding.

The Go/No-Go decision is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xiv. Conference Spending

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.

xv. Uniform Commercial Code (UCC) Financing Statements

Per 2 CFR 910.360 (Real Property and Equipment) when a piece of equipment is purchased by a for-profit recipient or subrecipient with federal funds, and when the federal share of the financial assistance agreement is more than \$1,000,000, the recipient or subrecipient must:

Properly record, and consent to the Department's ability to properly record if the recipient fails to do so, UCC financing statement(s) for all equipment in excess of \$5,000 purchased with project funds. These financing statement(s) must be approved in writing by the Contracting Officer prior to the recording, and they shall provide notice that the recipient's title to all equipment (not real property) purchased with federal funds under the financial assistance agreement is

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conditional pursuant to the terms of this section, and that the government retains an undivided reversionary interest in the equipment. The UCC financing statement(s) must be filed before the Contracting Officer may reimburse the recipient for the federal share of the equipment unless otherwise provided for in the relevant financial assistance agreement. The recipient shall further make any amendments to the financing statements or additional recordings, including appropriate continuation statements, as necessary or as the Contracting Officer may direct.

xvi. Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty

States, local governments, or other public entities may not condition sub-awards in a manner that would discriminate, or disadvantage sub-recipients based on their religious character.

xvii. Participants and Collaborating Organizations

If selected for award negotiations, the selected applicant must submit a list of personnel who are proposed to work on the project, both at the recipient and subrecipient level and a list of collaborating organizations within 30 days after the applicant is notified of the selection. Recipients will have an ongoing responsibility to notify DOE of changes to the personnel and collaborating organizations, and submit updated information during the life of the award.

xviii. Current and Pending Support

If selected for award negotiations, within 30 days of the selection notice, the selectee must submit 1) current and pending support disclosures and resumes for any new PIs or senior/key personnel and 2) updated disclosures if there have been any changes to the current and pending support submitted with the application. Throughout the life of the award, the Recipient has an ongoing responsibility to submit 1) current and pending support disclosure statements and resumes for any new PI and senior/key personnel and 2) updated disclosures if there are changes to the current and pending support previously submitted to DOE. Also See Section IV.D.xvi.

xix. U.S. Manufacturing Commitments

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 United States 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 that any products embodying any subject invention or produced through the use of 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 specific U.S. Competitiveness Provision applicable to the various types of recipients and projects, 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 to practice 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 United States manufacturing plan. The statement or plan would contain specific and enforceable commitments that would be beneficial to the United States economy and competitiveness. Examples of such commitments could include manufacturing specific products in the United States, making a specific investment in a new or existing United States manufacturing facility, keeping certain activities based in the United States or supporting a certain number of jobs in the United States related to the technology. DOE may, in its sole discretion, determine that the proposed modification or waiver promotes commercialization and provides substantial United States 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 at <https://www.energy.gov/management/pf-2022-09-fal-2022-01-implementation-doe-determination-exceptional-circumstances-under>. Additional information on DOE's Commitment to Domestic Manufacturing for DOE-funded R&D is available at <https://www.energy.gov/gc/us-manufacturing>.

The U.S. Competitiveness Provision is implemented by DOE pursuant to a Determination of Exceptional Circumstances (DEC) under the Bayh-Dole Act and DOE Patent Waivers. See Section VIII.J. Title to Subject Inventions of this FOA for more information on the DEC and DOE Patent Waivers.

xx. Data Management Plan (DMP)

Each applicant whose Full Application is selected for award negotiations will be required to submit a DMP during the award negotiations phase. A DMP explains how, when appropriate, data generated in the course of the work performed under an EERE award will be shared and preserved in order to validate the results of the proposed work or how the results could be validated if the data is not shared or preserved. The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publications.

For Topic Area 1, Only each applicant whose Full Application is selected for award negotiations will be required to submit an expanded Data Management Plan (DMP) during the award negotiations phase. The expanded DMP will include:

- Explanation of how data generated in the course of the work performed under this award will be shared and preserved or, when justified, explaining why data sharing or preservation is not possible or scientifically appropriate.
- Outline of data to be collected, including the types of data to be collected and the timing of data collection throughout the project life cycle as well as selection of appropriate data standards, content models, and formats for the relevant field of study.
- Identification of one or more appropriate data repositories and/or registries on which project data will be stored and/or published. Appropriate data repositories may include those operated by National Labs, DOE, or the Federal Government (e.g., OpenEI, Energy Data Exchange) as well as those operated by the applicant or a third party. Regardless of the data repository chosen, links for all public datasets must be submitted for listing on OSTI.GOV.
- Identification of any anticipated sensitive or proprietary data that will be classified as protected data and will not be published in a public repository and explanation of how protected data will be shared with DOE during the protection period and made publicly available following the protection period.
- Workplan (including, e.g., tasks, timing, and costs) for data management, processing, and publication, including any work necessary to assemble the submission (e.g., conversion of raw data into more useable formats).
- Identification of any steps necessary to protect personal privacy, proprietary interests, or uphold the law.

In determining which data should be shared publicly, applicants must consider the data needed to validate published research findings and are encouraged to consider the potential benefits of their data to their own fields of research, fields other than their own, and society at large. #end of special provision for Topic 1 only.

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xxi. Interim Conflict of Interest Policy for Financial Assistance

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy)⁴⁴ 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. The term “Investigator” means the PI and any other person, regardless of title or position, who is responsible for the purpose, design, conduct, or reporting of a project funded by DOE or proposed for funding by DOE. Recipients must flow down the requirements of the interim COI Policy to any subrecipient non-federal entities. Further, for DOE funded projects, the recipient must include all financial conflicts of interest (FCOI) (i.e., managed and unmanaged/ unmanageable) in their initial and ongoing FCOI reports.

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

xxii. Human Subjects Research

Research involving human subjects, biospecimens, or identifiable private information conducted with DOE funding is subject to the requirements of DOE Order 443.1C, Protection of Human Research Subjects, 45 CFR Part 46, Protection of Human Subjects (subpart A which is referred to as the “Common Rule”), and 10 CFR Part 745, Protection of Human Subjects. Additional information on the DOE Human Subjects Research Program can be found at: [HUMAN SUBJECTS Human Subjects Pr... | U.S. DOE Office of Science \(SC\) \(osti.gov\)](#)

⁴⁴ DOE’s interim COI Policy can be found at [PF 2022-17 FAL 2022-02 Department of Energy Interim Conflict of Interest Policy Requirements for Financial Assistance](#).

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xxiii. Fraud Waste and Abuse

The mission of the DOE Office of Inspector General (OIG) is to strengthen the integrity, economy and efficiency of the Department's programs and operations including deterring and detecting fraud, waste, abuse and mismanagement. The OIG accomplishes this mission primarily through investigations, audits, and inspections of DOE activities to include grants, cooperative agreements, loans, and contracts.

The OIG maintains a Hotline for reporting allegations of fraud, waste, abuse, or mismanagement. To report such allegations, please visit <https://www.energy.gov/ig/ig-hotline>.

Additionally, recipients of DOE awards must be cognizant of the requirements of 2 CFR 200.113 Mandatory disclosures, which states:

The non-Federal entity or applicant for a Federal award must disclose, in a timely manner, in writing to the Federal awarding agency or pass-through entity all violations of Federal criminal law involving fraud, bribery, or gratuity violations potentially affecting the Federal award. Non-Federal entities that have received a Federal award including the term and condition outlined in appendix XII of 2 CFR Part 200 are required to report certain civil, criminal, or administrative proceedings to SAM (currently FAPIIS). Failure to make required disclosures can result in any of the remedies described in 2 CFR 200.339. (See also 2 CFR part 180, 31 U.S.C. § 3321, and 41 U.S.C. § 2313.) [85 FR 49539, Aug. 13, 2020]

Applicants and subrecipients (if applicable) are encouraged to allocate sufficient costs in the project budget to cover the costs associated for personnel and data infrastructure needs to support performance management and program evaluation needs including but not limited to independent program and project audits to mitigate risks for fraud, waste, and abuse.

VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted to:

AMMTO_MultitopicFOA@ee.doe.gov. Questions must be submitted not later than 3 business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

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Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.*

All questions and answers related to this FOA will be posted on EERE eXCHANGE at: <https://eere-exchange.energy.gov>. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA.** EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the EERE eXCHANGE website should be submitted to: EERE-eXCHANGESupport@hq.doe.gov.

VIII. Other Information

A. FOA Modifications

Amendments to this FOA will be posted on the EERE eXCHANGE website and the Grants.gov system. However, you will only receive an email when an amendment or a FOA is posted on these sites if you register for email notifications for this FOA in Grants.gov. EERE recommends that you register as soon after the release of the FOA as possible to ensure you receive timely notice of any amendments or other FOAs.

B. Government Right to Reject or Negotiate

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

C. Commitment of Public Funds

The Contracting Officer is the only individual who can make awards or commit the government to the expenditure of public funds. A commitment by anyone other than the Contracting Officer, either express or implied, is invalid.

D. Treatment of Application Information

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

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be

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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 Freedom of Information Act. Without assuming any liability for inadvertent disclosure, EERE 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.

Full 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 Freedom of Information Act 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 Full 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.

E. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Reviews and Peer Reviews, 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, including EERE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest (COI)

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and non-disclosure acknowledgements (NDA) prior to reviewing an application. Non-federal personnel conducting administrative activities must sign an NDA.

F. Notice Regarding Eligible/Ineligible Activities

Eligible activities under this FOA 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.

G. Notice of Right to Conduct a Review of Financial Capability

EERE reserves the right to conduct an independent third-party review of financial capability for applicants that are selected for negotiation of award (including personal credit information of principal(s) of a small business if there is insufficient information to determine financial capability of the organization).

H. Requirement for Full and Complete Disclosure

Applicants are required to make a full and complete disclosure of all information requested. Any failure to make a full and complete disclosure of the requested information may result in:

- The termination of award negotiations;
- The modification, suspension, and/or termination of a funding agreement;
- The initiation of debarment proceedings, debarment, and/or a declaration of ineligibility for receipt of federal contracts, subcontracts, and financial assistance and benefits; and
- Civil and/or criminal penalties.

I. Retention of Submissions

EERE expects to retain copies of all Full Applications and other submissions. No submissions will be returned. By applying to EERE for funding, applicants consent to EERE's retention of their submissions.

J. Title to Subject Inventions

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

- Domestic Small Businesses, Educational Institutions, and Nonprofits: Under the Bayh-Dole Act (35 U.S.C. § 200 et seq.), domestic small businesses, educational institutions, and nonprofits may elect to retain title to their subject inventions;

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- 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);
- Class Patent Waiver:
DOE has issued a class waiver that applies to this FOA. Under this class 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 waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States.
- Advance and Identified Waivers: For an applicant not covered by a Class Patent Waiver or the Bayh-Dole Act, the applicant may request a patent waiver that will cover subject inventions that may be invented under the award, in advance of or within 30 days after the effective date of the award. Even if an advance waiver is not requested or the request is denied, the recipient will have a continuing right under the award to request a waiver for identified inventions, i.e., individual subject inventions that are disclosed to EERE within the timeframes set forth in the award's intellectual property terms and conditions. Any patent waiver that may be granted is subject to certain terms and conditions in 10 CFR 784.
- DEC: On June 07, 2021, DOE approved a DETERMINATION OF EXCEPTIONAL CIRCUMSTANCES (DEC) UNDER THE BAYH-DOLE ACT TO FURTHER PROMOTE DOMESTIC MANUFACTURE OF DOE SCIENCE AND ENERGY TECHNOLOGIES. In accordance with this DEC, all awards, including sub-awards, under this FOA shall include the U.S. Competitiveness Provision in accordance with Section VI.B.xix. U.S. Manufacturing Commitments of this FOA. A copy of the DEC can be found at <https://www.energy.gov/gc/determination-exceptional-circumstances-decs>. Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.

K. Government Rights in Subject Inventions

Where prime recipients and subrecipients retain title to subject inventions, the U.S. government retains certain rights.

i. Government Use License

The U.S. government retains a nonexclusive, nontransferable, irrevocable, paid-up license to practice or have practiced for or on behalf of the United States any

subject invention throughout the world. This license extends to contractors doing work on behalf of the government.

ii. March-In Rights

The U.S. government retains march-in rights with respect to all subject inventions. Through “march-in rights,” the government may require a prime recipient or subrecipient who has elected to retain title to a subject invention (or their assignees or exclusive licensees), to grant a license for use of the invention to a third party. In addition, the government may grant licenses for use of the subject invention when a prime recipient, subrecipient, or their assignees and exclusive licensees refuse to do so.

DOE may exercise its march-in rights only if it determines that such action is necessary under any of the four following conditions:

- The owner or licensee has not taken or is not expected to take effective steps to achieve practical application of the invention within a reasonable time;
- The owner or licensee has not taken action to alleviate health or safety needs in a reasonably satisfied manner;
- The owner has not met public use requirements specified by federal statutes in a reasonably satisfied manner; or
- The U.S. manufacturing requirement has not been met.

Any determination that march-in rights are warranted must follow a fact-finding process in which the recipient has certain rights to present evidence and witnesses, confront witnesses and appear with counsel and appeal any adverse decision. To date, DOE has never exercised its march-in rights to any subject inventions.

L. Rights in Technical Data

Data rights differ based on whether data is first produced under an award or instead was developed at private expense outside the award.

“Limited Rights Data”: The U.S. government will not normally require delivery of confidential or trade secret-type technical data developed solely at private expense prior to issuance of an award, except as necessary to monitor technical progress and evaluate the potential of proposed technologies to reach specific technical and cost metrics.

Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under

EERE awards may be protected from public disclosure for up to five years after the data is generated (“Protected Data”). For awards permitting Protected Data, the protected data must be marked as set forth in the award’s intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

M. Copyright

The prime recipient and subrecipients may assert copyright in copyrightable works, such as software, first produced under the award without EERE approval. When copyright is asserted, the government retains a paid-up nonexclusive, irrevocable worldwide license to reproduce, prepare derivative works, distribute copies to the public, and to perform publicly and display publicly the copyrighted work. This license extends to contractors and others doing work on behalf of the government.

N. Export Control

The United States government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the United States to protect national security, foreign policy, and economic interests without imposing undue regulatory burdens on legitimate international trade. There is a network of federal agencies and regulations that govern exports that are collectively referred to as “Export Controls”. All recipients and subrecipients are responsible for ensuring compliance with all applicable United States Export Control laws and regulations relating to any work performed under a resulting award.

The recipient must immediately report to DOE any export control violations related to the project funded under the DOE award, at the recipient or subrecipient level, and provide the corrective action(s) to prevent future violations.

O. 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 uses *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,

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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.

P. Personally Identifiable Information (PII)

All information provided by the applicant must to the greatest extent possible exclude PII. The term “PII” refers to information which can be used to distinguish or trace an individual's identity, such as their name, social security number, biometric records, alone, or when combined with other personal or identifying information which is linked or linkable to a specific individual, such as date and place of birth, mother's maiden name. (See OMB Memorandum M-17-12 dated January 3, 2017)

By way of example, applicants must screen resumes to ensure that they do not contain PII such as personal addresses, personal landline/cell phone numbers, and personal emails. **Under no circumstances should Social Security Numbers (SSNs) be included in the application.** Federal agencies are prohibited from the collecting, using, and displaying unnecessary SSNs. (See, the Federal Information Security Modernization Act of 2014 (Pub. L. No. 113-283, Dec 18, 2014; 44 U.S.C. § 3551).

Q. Annual Independent Audits

If a for-profit entity is a prime recipient and has expended \$750,000 or more of DOE awards during the entity's fiscal year, an annual compliance audit performed by an independent auditor is required. For additional information, please refer to 2 CFR 910.501 and Subpart F.

If an educational institution, non-profit organization, or state/local government is a prime recipient or subrecipient and has expended \$750,000 or more of federal awards during the non-federal entity's fiscal year, then a Single or Program-Specific Audit is required. For additional information, please refer to 2 CFR 200.501 and Subpart F.

Applicants and subrecipients (if applicable) should propose sufficient costs in the project budget to cover the costs associated with the audit. EERE will share in the cost of the audit at its applicable cost share ratio.

APPENDIX A – COST SHARE INFORMATION

Cost Sharing or Cost Matching

The terms “cost sharing” and “cost matching” are often used synonymously. Even the DOE Financial Assistance Regulations, 2 CFR 200.306, use both of the terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses the term “cost sharing,” as it conveys the concept that non-federal share is calculated as a percentage of the Total Project Cost. An exception is the State Energy Program Regulation, 10 CFR 420.12, State Matching Contribution. Here “cost matching” for the non-federal share is calculated as a percentage of the federal funds only, rather than the Total Project Cost.

How Cost Sharing Is Calculated

As stated above, cost sharing is calculated as a percentage of the Total Project Cost. FFRDC costs must be included in Total Project Costs. The following is an example of how to calculate cost sharing amounts for a project with \$1,000,000 in federal funds with a minimum 20% non-federal cost sharing requirement:

- Formula: Federal share (\$) divided by federal share (%) = Total Project Cost
Example: \$1,000,000 divided by 80% = \$1,250,000
- Formula: Total Project Cost (\$) minus federal share (\$) = Non-federal share (\$)
Example: \$1,250,000 minus \$1,000,000 = \$250,000
- Formula: Non-federal share (\$) divided by Total Project Cost (\$) = Non-federal share (%)
Example: \$250,000 divided by \$1,250,000 = 20%

What Qualifies For Cost Sharing

While it is not possible to explain what specifically qualifies for cost sharing in one or even a couple of sentences, in general, if a cost is allowable under the cost principles applicable to the organization incurring the cost and is eligible for reimbursement under an EERE grant or cooperative agreement, then it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, then it is not allowable as cost share. In addition, costs may not be counted as cost share if they are paid by the federal government under another award unless authorized by federal statute to be used for cost sharing.

The rules associated with what is allowable as cost share are specific to the type of organization that is receiving funds under the grant or cooperative agreement, though are generally the same for all types of entities. The specific rules applicable to:

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- FAR Part 31 for For-Profit entities, (48 CFR Part 31); and
- 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

In addition to the regulations referenced above, other factors may also come into play such as timing of donations and length of the project period. For example, the value of ten years of donated maintenance on a project that has a project period of five years would not be fully allowable as cost share. Only the value for the five years of donated maintenance that corresponds to the project period is allowable and may be counted as cost share.

Additionally, EERE generally does not allow pre-award costs for either cost share or reimbursement when these costs precede the signing of the appropriation bill that funds the award. In the case of a competitive award, EERE generally does not allow pre-award costs prior to the signing of the Selection Statement by the EERE Selection Official.

General Cost Sharing Rules on a DOE Award

1. **Cash Cost Share** – encompasses all contributions to the project made by the recipient or subrecipient(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.
2. **In-Kind Cost Share** – encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In-Kind cost share items include volunteer personnel hours, donated existing equipment, donated existing supplies. The cash value and calculations thereof for all In-Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In-Kind cost share section of the Budget Justification.
3. **Funds from other federal sources MAY NOT be counted as cost share.** This prohibition includes FFRDC subrecipients. Non-federal sources include any source not originally derived from federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.
4. **Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award.** The project may only incur those costs that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

DOE Financial Assistance Rules 2 CFR Part 200 as amended by 2 CFR Part 910

As stated above, the rules associated with what is allowable cost share are generally the same for all types of organizations. Following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

(A) Acceptable contributions. All contributions, including cash contributions and third-party in-kind contributions, must be accepted as part of the prime recipient's cost sharing if such contributions meet all of the following criteria:

- (1)** They are verifiable from the recipient's records.
- (2)** They are not included as contributions for any other federally-assisted project or program.
- (3)** They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.
- (4)** They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:
 - a.** For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A-122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the FAR, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations; and
 - b.** Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.
- (5)** They are not paid by the federal government under another award unless authorized by federal statute to be used for cost sharing or matching.
- (6)** They are provided for in the approved budget.

(B) Valuing and documenting contributions

- (1)** Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item

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will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

- a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
 - b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.
- (2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.
- (3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.
- (4) Valuing property donated by third parties.
 - a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.
 - b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

-
- i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.
 - ii. The value of loaned equipment must not exceed its fair rental value.
 - (5) Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:
 - a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.
 - b. The basis for determining the valuation for personal services and property must be documented.

APPENDIX B – SAMPLE COST SHARE CALCULATION FOR BLENDED COST SHARE PERCENTAGE

The following example shows the math for calculating required cost share for a project with \$2,000,000 in federal funds with four tasks requiring different non-federal cost share percentages:

Task	Proposed Federal Share	Federal Share %	Recipient Share %
Task 1 (R&D)	\$1,000,000	80%	20%
Task 2 (R&D)	\$500,000	80%	20%
Task 3 (Demonstration)	\$400,000	50%	50%
Task 4 (Outreach)	\$100,000	100%	0%

Federal share (\$) divided by federal share (%) = Task Cost

Each task must be calculated individually as follows:

Task 1

\$1,000,000 divided by 80% = \$1,250,000 (Task 1 Cost)

Task 1 Cost minus federal share = non-federal share

\$1,250,000 - \$1,000,000 = \$250,000 (non-federal share)

Task 2

\$500,000 divided 80% = \$625,000 (Task 2 Cost)

Task 2 Cost minus federal share = non-federal share

\$625,000 - \$500,000 = \$125,000 (non-federal share)

Task 3

\$400,000 / 50% = \$800,000 (Task 3 Cost)

Task 3 Cost minus federal share = non-federal share

\$800,000 - \$400,000 = \$400,000 (non-federal share)

Task 4

Federal share = \$100,000

Non-federal cost share is not mandated for outreach = \$0 (non-federal share)

The calculation may then be completed as follows:

Tasks	\$ Federal Share	% Federal Share	\$ Non-Federal Share	% Non-Federal Share	Total Project Cost
Task 1	\$1,000,000	80%	\$250,000	20%	\$1,250,000
Task 2	\$500,000	80%	\$125,000	20%	\$625,000
Task 3	\$400,000	50%	\$400,000	50%	\$800,000
Task 4	\$100,000	100%	\$0	0%	\$100,000
Totals	\$2,000,000		\$775,000		\$2,775,000

Blended Cost Share %

Non-federal share (\$775,000) divided by Total Project Cost (\$2,775,000) = 27.9% (non-federal)

Federal share (\$2,000,000) divided by Total Project Cost (\$2,775,000) = 72.1% (federal)

APPENDIX C – WAIVER REQUESTS FOR: 1. FOREIGN ENTITY PARTICIPATION; AND 2. FOREIGN WORK

1. Waiver for Foreign Entity Participation

Many of the technology areas DOE funds fall in the category of critical and emerging technologies (CETs). CETs are a subset of advanced technologies that are potentially significant to United States national and economy security.⁴⁵ For projects selected under this FOA, all recipients and subrecipients must be organized, chartered or incorporated (or otherwise formed) under the laws of a state or territory of the United States; have majority domestic ownership and control; and have a physical location for business operations in the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Waiver Criteria

Foreign entities seeking to participate in a project funded under this FOA must demonstrate to the satisfaction of DOE that:

- a. Its participation is in the best interest of the United States industry and United States economic development;
- b. The project team has appropriate measures in place to control sensitive information and protect against unauthorized transfer of scientific and technical information;
- c. Adequate protocols exist between the United States subsidiary and its foreign parent organization to comply with export control laws and any obligations to protect proprietary information from the foreign parent organization;
- d. The work is conducted within the United States and the entity acknowledges and demonstrates that it has the intent and ability to comply with the U.S. Competitiveness Provision (see Section VI.B.xix.); and
- e. The foreign entity will satisfy other conditions that may be deemed necessary by DOE to protect United States government interests.

Content for Waiver Request

A Foreign Entity waiver request must include the following:

- a. Information about the entity: name, point of contact, and proposed type of involvement in the project;
- b. Country of incorporation, the extent of the ownership/level control by foreign entities, whether the entity is state owned or controlled, a summary of the ownership breakdown of the foreign entity and the percentage of

⁴⁵ See [Critical and Emerging Technologies List Update \(whitehouse.gov\)](https://www.whitehouse.gov/critical-emerging-technologies/).

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- ownership/control by foreign entities, foreign shareholders, foreign state or foreign individuals;
- c. The rationale for proposing a foreign entity participate (must address criteria above);
 - d. A description of the project's anticipated contributions to the United States economy;
 - How the project will benefit the United States, including manufacturing, contributions to employment in the United States and growth in new markets and jobs in the United States;
 - How the project will promote manufacturing of products and/or services in the United States;
 - e. A description of how the foreign entity's participation is essential to the project;
 - f. A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP; and
 - g. Countries where the work will be performed (Note: if any work is proposed to be conducted outside the United States, the applicant must also complete a separate request foreign work waiver).

DOE may also require:

- A risk assessment with respect to IP and data protection protocols that includes the export control risk based on the data protection protocols, the technology being developed and the foreign entity and country. These submissions could be prepared by the project lead (if not the prime recipient), but the prime recipient must make a representation to DOE as to whether it believes the data protection protocols are adequate and make a representation of the risk assessment – high, medium or low risk of data leakage to a foreign entity.
- Additional language be added to any agreement or subagreement to protect IP, mitigate risk or other related purposes.

DOE may require additional information before considering the waiver request.

DOE's decision concerning a waiver request is not appealable.

2. Waiver for Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section IV.J.iii., all work under funding under this FOA must be performed in the United States. To seek a waiver of the Performance of Work in the United States requirement, the applicant must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of DOE that it would further the purposes of this FOA and is otherwise in the economic interests of the United States to perform work outside of the United States. A request for a foreign work waiver must include the following:

1. The rationale for performing the work outside the United States (“foreign work”);
2. A description of the work proposed to be performed outside the United States;
3. An explanation as to how the foreign work is essential to the project;
4. A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the United States economy;
5. The associated benefits to be realized and the contribution to the project from the foreign work;
6. How the foreign work will benefit the United States, including manufacturing, contributions to employment in the United States and growth in new markets and jobs in the United States;
7. How the foreign work will promote domestic American manufacturing of products and/or services;
8. A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
9. The total estimated cost (DOE and recipient cost share) of the proposed foreign work;
10. The countries in which the foreign work is proposed to be performed; and
The name of the entity that would perform the foreign work

DOE may require additional information before considering the waiver request.

DOE’s decision concerning a waiver request is not appealable.

APPENDIX D -- REQUIRED USE OF AMERICAN IRON, STEEL, MANUFACTURED PRODUCTS, AND CONSTRUCTION MATERIALS BUY AMERICA REQUIREMENTS FOR INFRASTRUCTURE PROJECTS

A. Definitions

For purposes of the Buy America requirements, based both on the statute and OMB Guidance Document dated April 18, 2022, the following definitions apply:

Construction materials includes an article, material, or supply—other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives—that is or consists primarily of:

- non-ferrous metals;
- plastic and polymer-based products (including polyvinylchloride, composite building materials, and polymers used in fiber optic cables);
- glass (including optic glass);
- lumber; or
- drywall.

Infrastructure includes, at a minimum, the structures, facilities, and equipment for, in the United States, roads, highways, and bridges; public transportation; dams, ports, harbors, and other maritime facilities; intercity passenger and freight railroads; freight and intermodal facilities; airports; water systems, including drinking water and wastewater systems; electrical transmission facilities and systems; utilities; broadband infrastructure; and buildings and real property. Infrastructure includes facilities that generate, transport, and distribute energy.

Moreover, according to the OMB guidance document:

When determining if a program has infrastructure expenditures, Federal agencies should interpret the term “infrastructure” broadly and consider the definition provided above as illustrative and not exhaustive. When determining if a particular construction project of a type not listed in the definition above constitutes “infrastructure,” agencies should consider whether the project will serve a public function, including whether the project is publicly owned and operated, privately operated on behalf of the public, or is a place of public accommodation, as opposed to a project that is privately owned and not open to the public. Projects with the former qualities have greater indicia of infrastructure, while projects with the latter quality have fewer. Projects consisting solely of the purchase, construction, or improvement of a private home for personal use, for example, would not constitute an infrastructure project.

The Agency, not the applicant, will have the final say as to whether a given project includes infrastructure, as defined herein. Accordingly, in cases where the “public” nature of the infrastructure is unclear, but the other relevant criteria are met DOE strongly recommends that applicants complete their full application with the assumption that Buy America requirements will apply to the proposed project.

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

B. Buy America Requirements for Infrastructure Projects (“Buy America” requirements)

In accordance with Section 70914 of the BIL, none of the project 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 are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;
- (2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and
- (3) all construction materials are produced in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

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

These requirements must flow down to all sub-awards, all contracts, subcontracts, and purchase orders for work performed under the proposed project, except where the prime recipient is a for-profit entity. Based on guidance from the Office of Management and Budget (OMB), the Buy America requirements of the BIL do not apply to DOE projects in which the prime recipient is a for-profit entity; the requirements only apply to projects whose prime recipient is a State, local government, Indian tribe, Institution of Higher Education, or nonprofit organization.

For additional information related to the application and implementation of these Buy America requirements, please see OMB Memorandum M-22-11, issued April 18, 2022:

<https://www.whitehouse.gov/wp-content/uploads/2022/04/M-22-11.pdf>

Note that for all applicants—both non-Federal entities and for-profit entities—DOE is including a Program Policy Factor that the Selection Official may consider in determining which Full Applications to select for award negotiations that considers whether the applicant has made a commitment to procure U.S. iron, steel, manufactured products, and construction materials in its project.

C. Waivers

The DOE financial assistance agreement will require each recipient: (1) to fulfill the commitments made in its application regarding the procurement of U.S.-produced products and (2) to fulfill the commitments made in its application regarding the procurement of other key component metals and manufactured products domestically that are deemed available in sufficient and reasonably available quantities or of a satisfactory quality at the time of award negotiation.

In limited circumstances, DOE may waive the application of the Buy America requirements where DOE determines that:

- (1) applying the Buy America requirements would be inconsistent with the 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; 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.

If an applicant or recipient is seeking a waiver of the Buy America requirements, it may submit a waiver request after it has been notified of its selection for award negotiations. A waiver request must include:

- A detailed justification for the use of “non-domestic” iron, steel, manufactured products, or construction materials to include an explanation as to how the non-domestic item(s) is essential to the project
- A certification that the applicant or recipient made a good faith effort to solicit bids for domestic products supported by terms included in requests for proposals, contracts, and nonproprietary communications with potential suppliers

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-
- Applicant/Recipient name and Unique Entity Identifier (UEI)
 - Total estimated project cost, DOE and cost-share amounts
 - Project description and location (to the extent known)
 - List and description of iron or steel item(s), manufactured goods, and construction material(s) the applicant or recipient seeks to waive from Domestic Content Procurement Preference requirement, including name, cost, country(ies) of origin (if known), and relevant PSC and NAICS code for each
 - Waiver justification including due diligence performed (e.g., market research, industry outreach) by the applicant or recipient
 - Anticipated impact if no waiver is issued

DOE may require additional information before considering the waiver request.

Waiver requests are subject to public comment periods of no less than 15 days and must be reviewed by the Made in America Office.

DOE's decision concerning a waiver request is not appealable.

APPENDIX E – GLOSSARY

Applicant – The lead organization submitting an application under the FOA.

Continuation application – A non-competitive application for an additional budget period within a previously approved project period. At least ninety (90) days before the end of each budget period, the Recipient must submit to EERE its continuation application, which includes the following information:

- i. A report on the Recipient’s progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If the remaining unobligated balance is estimated to exceed 20 percent of the funds available for the budget period, explain why the excess funds have not been obligated and how they will be used in the next budget period.
- ii. A detailed budget and supporting justification if there are changes to the negotiated budget, or a budget for the upcoming budget period was not approved at the time of award.
- iii. A description of any planned changes from the negotiated Statement of Project Objectives and/or Milestone Summary Table.

Cooperative Research and Development Agreement (CRADA) – a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see <https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements>

Federally Funded Research and Development Centers (FFRDC) - FFRDCs are public-private partnerships which conduct research for the United States government. A listing of FFRDCs can be found at <http://www.nsf.gov/statistics/ffrdclist/>.

Go/No-Go Decision Points: – A decision point at the end of a budget period that defines the overall objectives, milestones and deliverables to be achieved by the recipient in that budget period. As of a result of EERE’s review, EERE may take one of the following actions: 1) authorize federal funding for the next budget period; 2) recommend redirection of work; 3) discontinue providing federal funding beyond the current budget period; or 4) place a hold on federal funding pending further supporting data.

Project – The entire scope of the cooperative agreement which is contained in the recipient’s Statement of Project Objectives.

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Recipient or “Prime Recipient” – A non-federal entity that receives a federal award directly from a federal awarding agency to carry out an activity under a federal program. The term recipient does not include subrecipients.

Subrecipient – 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 subrecipient may also be a recipient of other federal awards directly from a federal awarding agency. Also, a DOE/NNSA and non-DOE/NNSA FFRDC may be proposed as a subrecipient on another entity’s application. See Section III.E.ii.

APPENDIX F – DEFINITION OF TECHNOLOGY READINESS LEVELS

TRL 1:	Basic principles observed and reported
TRL 2:	Technology concept and/or application formulated
TRL 3:	Analytical and experimental critical function and/or characteristic proof of concept
TRL 4:	Component and/or breadboard validation in a laboratory environment
TRL 5:	Component and/or breadboard validation in a relevant environment
TRL 6:	System/subsystem model or prototype demonstration in a relevant environment
TRL 7:	System prototype demonstration in an operational environment
TRL 8:	Actual system completed and qualified through test and demonstrated
TRL 9:	Actual system proven through successful mission operations

APPENDIX G – LIST OF ACRONYMS

AC	Alternating current
AC	Air conditioning
ACSR	Aluminum-conductor steel-reinforced cable
AI	Artificial intelligence
AMMTO	Advanced Materials and Manufacturing Technologies Office
ANSI/AHRI	American National Standards Institute/Air-Conditioning, Heating, and Refrigeration Institute
AOI	Area of interest
ASHRAE	The American Society of Heating, Refrigeration and Air-Conditioning Engineers
BTO	Building Technologies Office
BTU	British Thermal Unit
CABLE	Conductivity-enhanced materials for affordable, breakthrough leapfrog electric and thermal applications
CAMS	Cathode active materials
CFR	Code of Federal Regulation
COI	Conflict of interest
CRADA	Cooperative Research and Development Agreement
DEC	Determination of Exceptional Circumstances
DEI	Diversity, equity, and inclusion
DFT	Density functional theory
DMP	Data Management Plan
DOI	Digital object identifier
EERE	Energy Efficiency and Renewable Energy
EIA	Energy Information Administration
ESGC	Energy Storage Grand Challenge
EV	Electric vehicles
FAR	Federal Acquisition Regulation
FCAB	Federal Consortium for Advanced Batteries
FFATA	Federal Funding and Transparency Act of 2006
FFRDF	Federally Funded Research and Development Centers
FOA	Funding Opportunity Announcement
GDP	Gross domestic product
GHG	Greenhouse gas
HBCU	Historically Black Colleges and Universities
HPC	High performance computing
HVAC	Heating, ventilation, and air conditioning
IACS	International Annealed Copper Standard
ICME	Integrated Computational Materials Engineering
IEA	International Energy Agency
IEDO	Industrial Efficiency and Decarbonization Office

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IP	Intellectual property
M&O	Management and operating
MECS	Manufacturing Energy Consumption Survey
ML	Machine learning
MPIN	Marketing Partner ID Number
MRE	Moisture removal efficiency
MRL	Manufacturing Readiness Level
MS	Megasiemens
MSI	Minority-Serving Institution
NDA	Non-disclosure agreement
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Agency
NSF	National Science Foundation
OE	Office of Electricity
OMB	Office of Management and Budget
OSTI	Office of Science and Technical Information
PI	Principal investigator
PII	Personally identifiable Information
PRL	Physical review letters
RD&D	Research, development, and demonstration
RDD&D	Research, development, demonstration, and deployment
RH	Relative humidity
SAM	System for Award Management
SBIR/STTR	Small Business Innovation Research/Small Business Technology Transfer
SC	DOE Office of Science
SMART	Specific, Measurable, Assignable, Realistic, and Time-Related
SOPO	Statement of project objectives
SSLC	Separate sensible and latent cooling
STEM	Science, technology, engineering, and math
TAA	Technical Assistance Agreement
TRL	Technology Readiness Level
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
WBS	Work breakdown structure
WP	Work proposal

APPENDIX H – R&D COMMUNITY BENEFITS PLAN GUIDANCE

The DOE is committed to pushing the frontiers of science and engineering; catalyzing high-quality domestic clean energy jobs through research, development, demonstration, and deployment; and ensuring energy equity and energy justice⁴⁶ for disadvantaged communities. Therefore, and in accordance with the Administration’s priority to empower workers and harness opportunities to create good union jobs as stated in EO 14008 (Executive Order on Tackling the Climate Crisis at Home and Abroad),⁴⁷ it is important to consider the impacts of the successful commercial deployment of any innovations resulting from this FOA on current and future workforce.

The goal of the three-section R&D Community Benefits Plan is to allow the application to illustrate engagement in critical thought about implications of how the proposed work will benefit the broadest swaths of American people and lead to broadly shared prosperity, including for workers and disadvantaged communities⁴⁸. The sections of the R&D Community Benefits Plans are considered together because there may be significant overlap between audiences considered in workforce and disadvantaged communities.

Example DEIA, Energy Equity, and Workforce Plan Elements

Outlined below are examples of activities that applicants might consider when developing their R&D Community Benefits Plan. Applicants are not required to implement any of these specific examples and should propose the Plan that best fits

⁴⁶ At DOE, we define energy justice as “the goal of achieving equity in both the social and economic participation in the energy system, while also remediating social, economic, and health burdens on those disproportionately harmed by the energy system” (Initiative for Energy Justice, 2019). Aligned with that document, the remainder of this document refers to this as, ‘energy equity,’ and is meant to encompass energy justice as well as DOE’s efforts related to Justice40. <https://www.energy.gov/diversity/articles/how-energy-justice-presidential-initiatives-and-executive-orders-shape-equity>

⁴⁷ <https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad>

⁴⁸ See footnote 2 for guidance on the definition and tools to locate and identify disadvantaged communities.

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their research goals, institutional environment, team composition, and other factors. Creativity is encouraged.

DEIA

DOE strongly encourages applicants to involve individuals and entities from disadvantaged communities. ~~that are~~ Tapping all of the available talent requires intentional approaches and yields broad benefits.

Equity extends beyond diversity to equitable treatment. Equitable access to opportunity for members of the project team is paramount. This includes ensuring that all members of the team, including students, are paid a living wage, provided appropriate working conditions, and provided appropriate benefits. In the execution of their project plan, applicants are asked to describe efforts in diversity, equity, inclusion, and accessibility. In this context, efforts toward DEIA are defined as:⁴⁹

- 1) the practice of including the many communities, identities, races, ethnicities, backgrounds, abilities, cultures, and beliefs of the American people,
- 2) the consistent and systematic fair, just, and impartial treatment of all individuals, including protecting workers rights and adhering to Equal Employment Opportunity laws,
- 3) the recognition, appreciation, and use of the talents and skills of employees of all backgrounds, and
- 4) the provision of accommodations so that all people, including people with disabilities, can fully and independently access facilities, information and communication technology, programs, and services.

Successful plans will not only describe how the project team seeks to increase DEIA, but will describe the overall approaches to retention, engagement, professional development, and career advancement. Specifically, they will demonstrate clear approaches to ensure all team members' strengths are meaningfully leveraged and all members are provided opportunities and paths for career development, especially including paths for interns and trainees to secure permanent positions. Diversity should be considered at all levels of the project team, not just leveraging early career individuals to meet diversity goals.

DOE strongly encourages applicants to consider partnerships as a means of promoting diversity, equity, inclusion, accessibility, justice, and workforce participation. Minority Serving Institutions, Minority Business Enterprises, Minority Owned Businesses,

⁴⁹ <https://www.whitehouse.gov/wp-content/uploads/2021/11/Strategic-Plan-to-Advance-Diversity-Equity-Inclusion-and-Accessibility-in-the-Federal-Workforce-11.23.21.pdf>

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Disability Owned Business, Women Owned Businesses, Native American-owned Businesses, Veteran Owned Businesses, or entities located in an underserved community that meet the eligibility requirements are encouraged to lead these partnerships as the prime applicant or participate on an application as a proposed partner to the prime applicant.

When crafting the DEIA section of the Plan, applicants should describe the ways in which they will act to promote each of the four DEIA efforts above into their investigation. It is important to note that diversity, equity, inclusion, and accessibility are four different, but related, concepts that should not be conflated. That is, you can achieve diversity without equity; all four must be addressed. Applicants could discuss how the proposed investigation could contribute to training and developing a diverse scientific workforce. Applicants could describe the efforts they plan to take, or will continue to take, to create an inclusive workplace, free from retaliation, harassment, and discrimination. Applicants could outline any barriers to creating an equitable and inclusive workplace and address the ways in which the team will work to overcome these barriers within the bounds of the specific research project. The plan could detail specific efforts to inform project team members in any capacity of their labor rights and rights under Equal Employment Opportunity laws, and their free and fair chance to join a union. Note that this inclusion of informing project team members is also incorporated into awards through the National Policy Assurances.

Equal treatment of workers, including students, is necessary but overcoming institutional bias requires intentionally reducing sometimes hidden barriers to equal opportunity. Applicants could consider measures like childcare, flexible schedules, paid parental leave, pay transparency, and other supports to ensure that societal barriers are not hindering realization of DEIA intentions. Some of these considerations may result in common approaches in different sections of the plan, and that is acceptable, as long as the submission is not a singular approach to all sections.

EERE especially encourages applicants to form partnerships with diverse and often underrepresented institutions, such as Minority Serving Institutions, labor unions, and community colleges that otherwise meet the eligibility requirements. Underrepresented institutions that meet the eligibility requirements are encouraged to lead these partnerships as the prime applicant. The DEIA section of the Plan could include engagement with underrepresented institutions to broaden the participation of disadvantaged communities and/or with local stakeholders, such as residents and businesses, entities that carry out workforce development programs, labor unions, local government, and community-based organizations that represent, support, or work with disadvantaged communities. Applicants should ensure there is transparency,

accountability, and follow-through when engaging with community members and stakeholders.

Specific examples include:

- Building collaborations and partnerships with researchers and staff at Minority Serving Institutions
- Addressing barriers identified in climate surveys to remove inequities
- Providing anti-bias training and education in the project design and implementation teams
- Offering training, mentorship, education, and other support to students and early/mid-career professionals from disadvantaged communities
- Providing efforts toward improving a workplace culture of inclusion
- Developing technology and technology integration innovations to meet the needs of disadvantaged communities
- Creating partnerships with local communities, especially under-resourced and disadvantaged communities
- Voluntary recognition of a union and informing employees of their rights, regardless of their classification
- Making research products and engagement materials accessible in a greater variety of formats to increase accessibility of research outputs
- Implementing training or distributing materials to reduce stigma towards individuals with disabilities
- Designing technologies that strategically fit within the existing workforce for installation and maintenance of the potential innovation

Energy Equity

The Energy Equity section should articulate how project proposals will drive equitable access to, participation in, and distribution of the benefits produced from successful technology innovations to disadvantaged communities and groups. Intentional inclusion of energy equity requires evaluating the anticipated long-term costs and benefits that will accrue to disadvantaged groups as a result of the project, and how research questions and project plans are designed for and support historically disadvantaged communities' engagement in clean energy decisions. Similar to potential cost reductions or groundbreaking research findings resulting from the research, energy equity and justice benefits may be uncertain, occur over a long period of time, and have many factors within and outside the specific proposed research influencing them.

Applicants should describe the influencing factors, and the most likely energy equity implications of the proposed research. Applicants should describe any

long-term constraints the proposed technology may pose to communities' access to natural resources and Tribal Cultural resources. There may be existing equity research available to use and citation in this description or the applicant could describe milestone-based efforts toward developing that understanding through this innovation. These near and long term outcomes may include, but are not limited to: a decrease in the percent of income a household spends on energy costs (energy burden⁵⁰); an increase in access to low-cost capital; a decrease in environmental exposure and burdens; increases in clean energy enterprise creation and contracting (e.g., women or minority-owned business enterprises); increased parity in clean energy technology access and adoption; increases in energy democracy, including community ownership; and an increase in energy resilience.

Specific examples include:

- Describing how a successful innovation will support economic development in diverse geographic or demographic communities
- Creating a plan to engage equity and justice stakeholders in evaluating the broader impacts of the innovation or in the development of the research methodology
- Describe how the proposed research strategy and methodology was informed by input from a wide variety of stakeholders
- A literature review of the equity and justice implications of the outcomes of the specific research if the innovation is successful or a plan with dedicated budget and expertise (staffing or subawardee) to evaluate the potential equity implications of successful innovation outcomes.

Workforce

The Workforce section of the R&D Community Benefits Plan should articulate the future workforce implications of the innovation or a milestone-driven plan for understanding those implications. This includes documenting the skills, knowledge, and abilities that would be required of workers installing, maintaining, and operating the technology that may be derivative of the applicant's research, as well as the training pathways and their accessibility for workers to acquire the necessary skills. There may be field-specific or relevant existing research that could be cited in this section. In addition, applicants could detail the process they will use to evaluate long-term impacts on jobs, including job growth or job loss, a change in job quality, disruptions to existing industry

⁵⁰ Energy burden is defined as the percentage of gross household income spent on energy costs:

<https://www.energy.gov/eere/slsc/low-income-community-energy-solutions>

Questions about this FOA? Email AMMTO_MultitopicFOA@ee.doe.gov.

Problems with EERE Exchange? Email EERE-ExchangeSupport@hq.doe.gov Include FOA name and number in subject line.

and resulting changes to relationships between employers and employees and improvements or reductions in the ability of workers to organize for collective representation, and anything else that could result in changes to regional or national labor markets.

For additional support with developing the Workforce section of a R&D Community Benefits Plan, please refer to the DOE's Community Benefits Plan Frequently Asked Questions (FAQs) webpage (<https://www.energy.gov/bil/community-benefits-plan-frequently-asked-questions-faqs>). This new resource, though created primarily for demonstration and deployment projects funded by the Bipartisan Infrastructure Law (BIL), may be useful for R&D projects which is the main subject of this FOA template. Applicants will find section 2 of the FAQ ("Investing in America's Workforce") particularly helpful for understanding key federal policies, terms and concepts, as well as workforce development strategies relevant to examination of the workforce implications of applicants' proposed research.

Specific examples include:

- Outlining the challenges and opportunities for commercializing the technology in the US
- Creating a literature review of the workforce implications of the outcomes of the specific research if the innovation is successful or a plan with dedicated budget and expertise (staffing or subawardee) to evaluate the potential equity implications of successful innovation outcomes
- Creating a plan and milestones for assessing how a successful innovation will have implications for job savings or loss, either at the macroeconomic level or within specific industries
- Describing how the project will support training of workforce to address needs of successful innovation
- Voluntary recognition of a union and informing employees of their rights, regardless of their classification
- Creating a plan to evaluate how a successful innovation, will result in potential workforce shifts between industries or geographies.

Inclusion of SMART milestones

EERE requires that the applicant's R&D Community Benefits Plan include one Specific, Measurable, Achievable, Relevant and Timely (SMART) milestone for

each budget period. An exemplar SMART milestone clearly answers the following questions:

- What needs to be accomplished?
- What measures and deliverables will be used to track progress toward accomplishment?
- What evidence suggests that the accomplishment is achievable?
- Why choose this milestone?
- When will the milestone be reached?