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Office of Energy Efficiency and Renewable Energy (EERE)
Industrial Efficiency and Decarbonization Office (IEDO) Fiscal
Year 2024 Cross-Sector Technologies FOA

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FOA Issue Date:	11/17/2023
Submission Deadline for Concept Papers:	12/18/2023 5:00 p.m. ET
Submission Deadline for Full Applications:	3/20/2024 5:00 p.m. ET
Expected Submission Deadline for Replies to Reviewer Comments:	4/26/2024 5:00 p.m. ET
Expected Date for EERE Selection Notifications:	7/23/2024
Expected Timeframe for Award Negotiations:	Fall - Winter 2024

- Applicants must submit a Concept Paper by 5:00 p.m. 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.
- 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.
- **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) register in the SAM at <https://www.sam.gov> before submitting an application; (2) provide a valid UEI number in the application; and (3) maintain an active SAM registration with current information when the applicant 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, 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 number 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 use the [HELP](#) feature on [SAM.gov](#). SAM.gov will address 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](#).

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I. Funding Opportunity Description

A. Background and Context

i. Background and Purpose

This Funding Opportunity Announcement (FOA) is issued by the Industrial Efficiency and Decarbonization Office (IEDO). IEDO provides funding, management, and the strategic direction necessary for a balanced national program of research, development, and demonstration (RD&D), as well as technical assistance and workforce development, to drive improvements in energy, materials, and production efficiency and to accelerate decarbonization across the industrial sector. IEDO and its programs are critical to putting the nation on a pathway to achieve net-zero carbon emissions by 2050.¹

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 "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"² to the benefit of all Americans. 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.

Decarbonizing the industrial sector is critical to achieving net-zero emissions, economy-wide, by no later than 2050, as well as to advancing energy and environmental justice. In 2020, industry accounted for 33% of the nation's primary energy use and 30% of energy-related carbon dioxide (CO₂) emissions.³ In addition, industrial facilities produce air pollutants—primarily through the combustion of fossil fuels—with harmful impacts on respiratory and cardiovascular health, including nitrogen oxides (NO_x), carbon monoxide (CO), and particulate matter (PM). In the United States, disadvantaged communities are disproportionately exposed to these pollutants, resulting in social, economic, and health burdens beyond those of the general population. Addressing pollution from industrial energy use to remediate these burdens is an integral step toward achieving environmental justice.⁴

¹ Section 6003 of the Energy Act of 2020, as codified at 42 U.S.C. § 17113 et seq.

² Executive Order 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021.

³ U.S. Energy Information Administration, Annual Energy Outlook 2021 with Projections to 2050, 2021.

⁴ DOE Office of Economic Impact and Diversity. "How Energy Justice, Presidential Initiatives, and Executive Orders Shape Equity at DOE." January 3, 2022. <https://www.energy.gov/diversity/articles/how-energy-justice-presidential-initiatives-and-executive-orders-shape-equity>.

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The industrial sector is considered one of the most difficult to decarbonize due to the diversity and complexity of energy inputs, processes, and operations.⁵ Achieving net-zero emissions across the U.S. economy by 2050 will require an aggressive, multidimensional approach to eliminating industrial emissions. While some technologies are ready to deploy today, it's estimated that addressing over 60% of emissions reductions needed in heavy industry currently costs more than \$50 per metric ton CO₂, making those solutions unlikely to be deployed on an economic basis.⁶ Additional RD&D is essential to reduce these costs and to unlock new pathways to reduce emissions.

To accelerate the development of these emerging industrial decarbonization technologies, DOE created the Technologies for Industrial Emissions Reduction Development (TIEReD) Program. This program leverages resources across DOE's applied research offices to invest in fundamental science, research, development, initial pilot-scale demonstrations projects, and technical assistance and workforce development. Rooted in the principles identified in the 2022 Industrial Decarbonization Roadmap, DOE is building an innovation pipeline to accelerate the development and adoption of industrial decarbonization technologies.⁷ The TIEReD Program leverages resources, expertise, and investments from the Offices of Energy Efficiency and Renewable Energy (EERE), Fossil Energy and Carbon Management (FECM), Nuclear Energy (NE), ARPA-E, and Science (SC) to achieve deep decarbonization across the U.S. industrial sector. The program complements the demonstration and large-scale deployment efforts led by DOE's Offices of Clean Energy Demonstrations (OCED) and Manufacturing and Energy Supply Chains (MESC) and the Loan Programs Office (LPO).

IEDO's RD&D strategy focuses on two complementary approaches: tackling subsector-specific decarbonization challenges in energy- and emissions-intensive industries and pursuing cross-sector challenges that are common across many industries. In this FOA, IEDO seeks to advance transformational cross-sector technologies and innovations needed to reduce industrial energy use and greenhouse gas (GHG) emissions through high-impact applied research, development, and pilot-scale technology validation and demonstration projects.

⁵ National Academies of Sciences, Engineering, and Medicine, Accelerating Decarbonization in the United States Energy Sector, February 2021. Available at: <https://www.nap.edu/catalog/25932/accelerating-decarbonization-of-the-us-energy-system>.

⁶ DOE. Pathway to Commercial Liftoff: Industrial Decarbonization, 2023, https://liftoff.energy.gov/wp-content/uploads/2023/10/LIFTOFF_DOE_Industrial-Decarbonization_v8.pdf.

⁷ DOE, Industrial Decarbonization Roadmap, 2022, <https://www.energy.gov/eere/doe-industrial-decarbonization-roadmap>.

The RD&D activities to be funded under this FOA will contribute to a clean and equitable energy economy, bolster the technological and economic competitiveness of domestic manufacturing, and boost the viability and competitiveness of U.S. industrial technology exports. IEDO expects additional funding opportunities to focus on transformational technologies to address subsector-specific challenges in energy- and emissions-intensive industries.

ii. Technology Space and Strategic Goals

DOE's Industrial Decarbonization Roadmap identifies four cross-cutting pillars of decarbonization as a framework to reduce emissions in the industrial sector: energy efficiency; industrial electrification; low-carbon fuels, feedstocks, and energy sources (LCFFES); and carbon capture, utilization, and storage (CCUS). For each pillar, the Roadmap identified the primary barriers and opportunities, as well as key RD&D needs. Key recommendations of the Roadmap include: advance early-stage RD&D and scale through demonstration; invest in multiple concurrent process strategies; address process and supply chain integration challenges for new technologies; conduct modeling and system analysis to ensure positive impact and commercial viability; decarbonize electricity sources to enable electrification pathways; and engage communities and develop a thriving workforce.

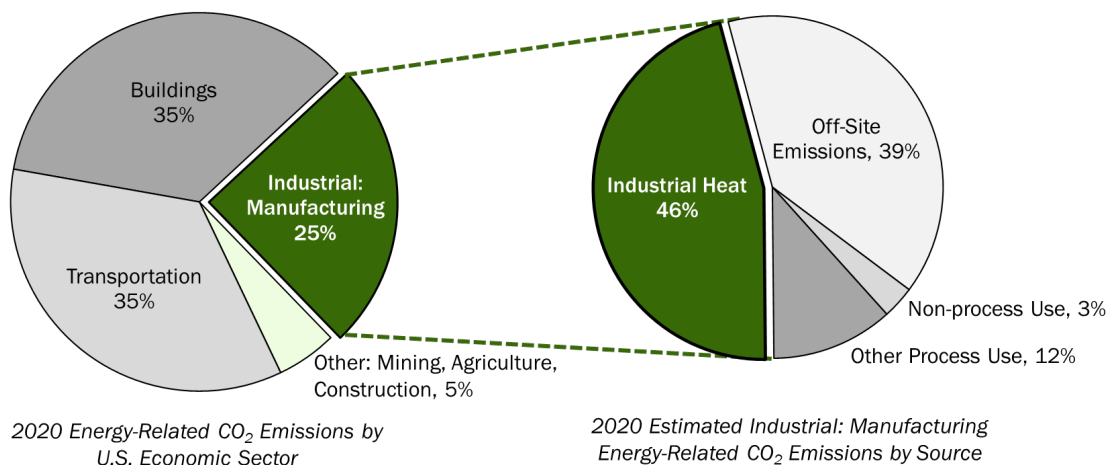


Figure 1. Estimated breakdown of U.S. energy-related emissions by sector and source, 2020.^{8,9}

⁸ EIA, Annual Energy Outlook 2021, 2022, https://www.eia.gov/outlooks/aeo/tables_side.php

⁹ DOE, Manufacturing Energy and Carbon Footprints, 2021, <https://www.energy.gov/eere/iedo/manufacturing-energy-and-carbon-footprints-2018-mecs>.

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The Industrial Decarbonization Roadmap also emphasizes the importance of addressing process heating efficiency and emissions across all sub-sectors. Industrial heat is responsible for 46% of all energy-related emissions in the manufacturing sector and is the largest single source of emissions. To address emissions from industrial heat, DOE launched the Industrial Heat Shot™, an Energy Earthshot™ aimed at dramatically reducing the cost, energy use, and carbon emissions associated with industrial heat demand.¹⁰ The Industrial Heat Shot™ seeks to develop cost-competitive solutions for industrial heat with at least 85% lower GHG emissions by 2035. If this target is achieved, the U.S. industrial sector will be on course to reduce its carbon equivalent emissions by 575 million metric tons by 2050, roughly equal to the annual emissions generated by all passenger cars currently on the road.

This FOA will aim to advance the strategies identified in the Industrial Decarbonization Roadmap and support the goals of the Industrial Heat Shot™ through a focus on cross-sector approaches for industrial decarbonization. Cross-sector technologies are decarbonization-enabling components, equipment, and systems that underpin processes and products across the industrial sector. Key themes of IEDO's strategy for cross-sector technologies include:

- Transforming electricity into useful industrial heat cost competitively and without putting undue stress on the grid;
- Developing combustion systems that enable fuel switching to hydrogen and other low-carbon fuels;
- Developing systems for the onsite production, storage, delivery, and recovery of energy;
- Reducing barriers to the integration of low-carbon electricity with industrial loads;
- Improving the energy efficiency of industrial processes; and
- Reducing the GHG emissions from industrial water and wastewater treatment.

This FOA will focus on a subset of these goals, as described in the specific Topic Areas in the sections that follow. This investment will drive U.S. leadership in industrial decarbonization and energy efficiency, will benefit American industrial communities and workers, and will support the Biden Administration's decarbonization goals of a 50-52% reduction in GHG emissions from 2005 levels by 2030 and a net-zero GHG emissions economy by 2050.

¹⁰ DOE, Energy Earthshots – Industrial Heat Shot Fact Sheet, <https://www.energy.gov/sites/default/files/2022-09/earth-shot-industrial-heat-fact-sheet.pdf>.

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B. Topic Areas

The topics in this FOA align with DOE's shared strategic framework for development of industrial decarbonization technologies. 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 primarily include work scopes between TRL 3 and TRL 7 to develop and validate technology advancements to facilitate industrial decarbonization.

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

Tiers: Awards will be made at one of two funding levels, with maximum award amount by tier and topic indicated in the table below:

Topic Area	Tier 1 Maximum Funding Level	Tier 2 Maximum Funding Level
1. Electrification of Industrial Heat	\$3 million	\$5 million
2. Efficient Energy Use in Industrial Systems	\$3 million	\$5 million
3. Decarbonizing Organic Wastewater and Wet Waste Treatment	\$2.5 million	\$2.5 million

Tier 1 projects are primarily focused on TRL 3 to TRL 5 R&D activities to validate technology components in a laboratory or relevant environment. The cost share for Tier 1 projects must be at least 20% of the total allowable costs.

Tier 2 projects can include activities in TRL 4 and 5 but must include activities at TRL 6 and/or TRL 7. Tier 2 projects must conduct system/subsystem prototype or pilot-scale technology validation in a relevant or operational environment. Tier 2 projects can include distinct phases below:

- R&D Phase (optional):** Research and development, where *research* is defined as a systematic study directed toward fuller scientific knowledge or understanding of the subject studied and *development* is defined as the systematic use of knowledge and understanding gained from research directed toward the production of useful materials, devices, systems, or methods, including design and development of prototypes and processes.
- Demo Phase:** Installation and demonstration, where *demonstration* means a project designed to determine the technical feasibility and economic potential of a technology on either a pilot or prototype scale.

The cost share for the R&D Phase must be at least 20% of the total allowable costs. For the Demo Phase, the cost share must be at least 50% of total allowable costs. Phases cannot be blended within a budget period. Applicants should indicate the funding structure they are applying for (i.e., Tier 1 or Tier 2) on the cover page of the Concept Paper and the Full Application.

Total allowable costs represent the sum of the government share, including FFRDC costs if applicable, and the recipient share of allowable costs for the project. See Appendices A and B for further discussion regarding cost-share.

Partner Organizations: Applications in Topic Areas 1 and 2 are strongly encouraged to include an industry partner on the project team. The term “Industry Partner” includes non-profit and for-profit entities engaged in production, processing, or equipment manufacturing in an industry relevant to the topic area.

For all Topic Areas, letters of commitment from partner organizations—particularly in the case of existing collaborations and partners contributing cost share—are highly encouraged.

Proposed Work: Applicants must explain their RD&D approach in detail, including the improvements required for their systems to move to the next step in commercialization. The role of modeling and simulations, experimentation, lab, bench, and pilot-scale testing should be explained. Anticipated technical barriers should be described, along with a planned approach to overcome them. Applicants should explain the underlying research to date, including any literature review or experimental data to support the proposed approach and to justify the RD&D needs.

Metrics and Benchmarks: Applications must clearly identify the starting and ending TRL for the project and justify the TRLs assigned. Applications should include energy and GHG intensity analyses, including a comparison of the current, commercially available state-of-the-art technology with the proposed advancement for both a unit level and national level if broadly implemented. These analyses should be expanded and validated as part of the proposed work via technoeconomic analysis (TEA) and lifecycle assessment (LCA). IEDO has developed resources to support assessment of the potential cost and environmental impacts of emerging technologies.¹¹ Applicants are not required to use these resources; however, these trainings, tools, and examples can help users understand impact drivers and quantify the impact potential of their technologies.

¹¹ IEDO, Life Cycle Assessment and Techno-Economic Analysis Training, <https://www.energy.gov/eere/iedo/life-cycle-assessment-and-techno-economic-analysis-training>.

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For all topics, the applicant must identify key technical and market barriers to successful achievement of topic area goals, describe how the project will overcome those barriers, and propose key metrics and targets to assess the success of the project. The barriers, metrics, and targets should be consistent with technical and market analysis of the application space, and the applicant should clearly indicate how the proposed innovations will satisfy those metrics.

Applicants are expected to explicitly compare their proposed technology advancement to an existing state-of-the-art baseline, in terms of both cost and performance, with justification as to why that technology is the appropriate baseline. Applications must define credible and measurable baselines for metrics, supported by prior data from literature and/or experimentation, preferably both. The quality and scientific depth of these proposed baselines and metrics will be an important element of the technical evaluation of applications.

Successful applicants will be required to have periodic assessments of their metrics during the award to evaluate potential impacts, and applications should include project-specific experimental metrics that can be evaluated at interim and end-of-project milestones. Examples of potential metrics are provided in each topic description.

Note on IEDO FY23 Multi-Topic FOA: Some of the topics and areas of interest anticipated to be covered in this FOA are similar in scope to those included in DE-FOA-0002997 (Industrial Efficiency and Decarbonization Office (IEDO) FY23 Multi-Topic FOA, henceforth “FY23 MT FOA”). Full applications submitted to the FY23 MT FOA are currently under review. For the topic areas within this FOA with substantially similar areas of interest as the FY23 MT FOA, applicants who responded to the FY23 MT FOA are strongly discouraged from resubmitting similar applications to those currently under review.

Topic Area 1: Electrification of Industrial Heat

Background and Opportunity: Process heating, or thermal processing, is essential to manufacture a wide variety of industrial and consumer products, including those made from metal, plastic, rubber, carbon fiber, concrete, glass, ceramics, and biomass. Thermal energy is needed to transform materials through processes such as drying, curing, melting, forming, sintering, calcining, and smelting.¹²

Process heating represents the largest energy use and the largest source of GHG emissions in the manufacturing sector. In 2018, process heating accounted for 31%

¹² DOE, Quadrennial Technology Review 2015, Technology Assessment 6I: Process Heating Systems, <https://www.energy.gov/sites/prod/files/2016/06/f32/QTR2015-6I-Process-Heating.pdf>.

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of sectoral energy use (7.5% of economy-wide energy use) and 51% of sectoral energy-related GHG emissions (10% of economy-wide energy-related GHG emissions).¹³ Direct energy use for process heating in the manufacturing sector includes fuel combustion (66%), steam (30%), and electricity (4%). When the fuel used to generate steam and electricity is considered, at least 95% of energy used for process heat is derived from combustion, including both fossil fuels and waste/byproduct fuels. Furthermore, about one-third of energy consumed in providing process heat is ultimately lost as waste heat.

The DOE Industrial Decarbonization Roadmap highlights the significant opportunity for cross-sector impact in developing technologies to reduce the emissions impact of thermal processing.¹⁴ Addressing the heterogeneous array of processes and industries with varied process heating requirements will require a competitive portfolio of low- and zero-carbon solutions, including clean sources of thermal energy, transformative low-thermal-budget technologies, waste heat management technologies, and other supplemental technologies.¹⁵ This portfolio approach will enable individual plants to determine the options best suited to their needs, weighing application, economics, geography, and other factors. Within this portfolio of industrial heating technologies, electrification will be an essential strategy for decarbonization as the carbon intensity of the electric grid decreases.

Technology Focus: This topic will accelerate high-impact technology innovations for equipment and components to decarbonize thermal processes across the industrial sector, contributing toward the goal of DOE's Industrial Heat Shot: to develop a cost-competitive portfolio of industrial heat decarbonization technologies with at least 85% lower GHG emissions by 2035.¹⁶

Because existing thermal processes are often relatively inefficient—for example, fossil-fuel-based thermal dehydration processes often operate with thermal efficiencies in the range of 20% to 60%—many electrified heating technologies, alternative low-thermal budget processes, and other low-carbon technologies have the potential to improve efficiency and reduce energy use.¹⁷ Electromagnetic heating technologies, for example, can reduce thermal losses by precisely delivering energy directly into materials. Industrial heat decarbonization technologies can also

¹³ DOE AMO, Manufacturing Energy and Carbon Footprints (2018 MECS), 2021,

<https://www.energy.gov/eere/amo/manufacturing-energy-and-carbon-footprints-2018-mecs>.

¹⁴ DOE, Industrial Decarbonization Roadmap, 2022, <https://www.energy.gov/eere/doe-industrial-decarbonization-roadmap>.

¹⁵ DOE AMO, Thermal Process Intensification: Transforming the Way Industry Uses Thermal Process Energy, 2022, <https://doi.org/10.2172/1871912>.

¹⁶ Industrial Heat Shot | Department of Energy. <https://www.energy.gov/eere/industrial-heat-shot>.

¹⁷ A.S. Mujumdar and Z.H. Wu, "Thermal Drying Technologies New Developments and Future R&D Potential; HEFAT2007 5th International Conference on Heat Transfer, Fluid Mechanics and Thermodynamics".

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offer non-energy and non-emissions co-benefits, which may include improved product quality, increased productivity, lower water consumption, and improved air quality. Many of these co-benefits are not considered as part of industrial plants' investment decision-making processes, partly because they have not been clearly quantified and monetized.¹⁸ Identification and quantification of co-benefits as part of the RD&D process can accelerate commercialization and adoption of these technologies. Applications are encouraged to include elements addressing the identification and quantification of non-energy and non-emissions co-benefits.

Topic 1 is focused on cross-sectoral impact and seeks applications pursuing advancements that will contribute to decarbonization of thermal processes across multiple industries. Thus, applications and concept papers must discuss the potential for cross-sectoral impact to justify the cross-sector nature of the proposed technology. Applicants are encouraged to assemble project teams that include advisers from multiple relevant industries. To the extent relevant, applicants are strongly encouraged to quantify technoeconomic and commercialization metrics to demonstrate their cross-sectoral relevance, including analysis of Total Addressable Market (TAM) and projected Compound Annual Growth Rates (CAGR). Applications focused on technologies or processes relevant to only a single subsector are not of interest for Topic 1.

In many cases, deploying innovative process heating technologies may require industrial plants to modify interconnected thermal transport systems, including heat exchangers, heat transfer media, and other components. For all AOIs in Topic 1, applicants are encouraged to consider what process integration challenges may arise when their technologies are deployed and how these challenges might be addressed or eliminated. In assessing commercialization potential, applicants should fully account for system-wide costs and benefits to potential users deploying the technology.

Topic 1 seeks both Tier 1 and Tier 2 applications. During the award performance period, an assessment of carbon emissions, energy intensity, and cost must be validated via LCA and TEA. Applications submitted under this topic must address at least one of the Areas of Interest (AOIs) below.

Not of Interest: For Topic 1 the following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D):

- Technologies or processes relevant to only a single subsector; and
- CCUS, onsite electricity generation, or the production of fuels/chemicals from byproducts or wastes.

¹⁸ Laaguidi, et al., The Non-Energy Benefits for Industrial Electric Technologies, ACEEE Summer Study on Energy Efficiency in Industry 2021, <https://www.aceee.org/sites/default/files/pdfs/ssi21/panel-2/Laaguidi.pdf>.

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Area of Interest 1: Electrotechnologies

This AOI seeks applications for the development, optimization, and/or integration of electrified thermal processing equipment that can utilize clean electricity to reduce the emissions intensity of existing processes. With these technologies, fundamental process steps and parameters may remain the same, but the method of supplying heat may change significantly. In addition to energy and emissions reductions, application of electrified heating technologies may offer reduced heating time, improved temperature uniformity, reduced manufacturing cost, improved product quality, higher product yield, reduced waste byproducts, and other co-benefits.

Technologies of interest include, but are not limited to, furnaces, boilers, ovens, heaters, and other thermal processing equipment powered by electric resistance, induction, electric arc/plasma, and electric infrared heating. Technologies of interest also include hybrid systems that utilize a combination of process heating technologies based on different heating principles and/or energy sources (at least one of which is electricity), including systems powered by multiple electrotechnologies and systems powered by a combination of electricity and combustion. This Topic is also interested in electrotechnologies that can effectively couple with intermittent or ramping power sources to increase flexibility and enable greater penetration of renewable electricity sources; however, these technologies will need to overcome integration and systems-level challenges associated with the resulting variation in process conditions and production rates. Innovative electrified process heating technologies beyond the specific examples listed here are also encouraged. This AOI highly encourages applications focused on addressing equipment development needs at commercially relevant scales.

Candidate Metrics and Targets: Proposals should justify that their technology will have a significant impact on reducing fossil fuel consumption and/or CO₂ emissions. Applications will be evaluated based on the potential to reduce carbon emissions annually within the industrial sector at the national level if broadly implemented. Applicants must clearly explain how the proposed technology will meet the following metric:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Reduce carbon intensity of thermal processes	% carbon intensity change as measured	85%	>90%	<i>Applicant defined</i>

	by ton CO ₂ equivalent (CO ₂ e)/kg product			
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Additional metrics and critical criteria that will lead to successfully meeting the goal above should also be identified, including non-energy/non-emissions co-benefits. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Examples of applicant-identified metrics include energy intensity of the heating operation, throughput, operating cost, and co-pollutant emissions (e.g., criteria air pollutants).

Area of Interest 2: Industrial Heat Pumps

This Area of Interest seeks applications on innovations in the design and integration of industrial heat pumps (IHPs). Compared to other electrified heating technologies that can approach 100% efficiency, heat pumping technologies can often significantly exceed this metric by moving heat, bypassing the limitations of energy conversions. Using electrical energy to move thermal energy also enables and leverages the availability of onsite or locally sourced low-grade heat (low-temperature heat source) that is wasted or goes unused, increasing its conversion into higher-quality heat (high-temperature heat sink) and making IHPs more cost-effective and higher-performing. Despite the energy and emissions advantages of IHPs, adoption by U.S. industry lags behind other nations, and additional RD&D is needed to lower costs, simplify integration, reduce direct GHG emissions, and expand the application space for IHPs.¹⁹

For this AOI, innovative solutions to simplify system design and integration are of high interest. Such technologies can drive adoption by lowering costs and technical hurdles. Integration of IHPs in existing industrial processes will require a systems approach because waste heat is not constant during operation and application. Technologies of interest include, but are not limited to, standardized or modular designs for common applications, standardized components, and approaches for system design and optimization (e.g., advancement of pinch analysis methods; novel machine learning/artificial intelligence-based methods for system design, heat integration, and/or operational strategies). Innovative approaches for system design and integration beyond the specific examples listed here are also encouraged.

¹⁹ American Council for an Energy-Efficient Economy, Industrial Heat Pumps: Electrifying Industry's Process Heat Supply, 2022, <https://www.aceee.org/research-report/ie2201>.

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Additionally, this AOI seeks research advances for all IHP components, including, but not limited to: next-generation low-global warming potential (GWP < 10) refrigerants with high critical temperatures and low critical pressures; new construction materials that can reduce capital costs; temperature-resistant components; heat exchanger materials and design; and compressors. Highly innovative technologies such as non-refrigerant-based solutions (e.g., non-vapor compression solutions, functional materials), heat-activated heat pumps, and steam-generating heat pumps are also encouraged. Applications targeting sink temperatures up to 200°C are encouraged.

Candidate Metrics and Targets: Proposals should justify that their technology will have a significant impact on reducing fossil fuel consumption and/or CO₂ emissions. Applications will be evaluated based on potential to reduce carbon emissions annually within the industrial sector at the national level if broadly implemented. Applicants must identify and justify appropriate metrics for their technologies and clearly indicate how the proposed innovations will satisfy those metrics. Given the wide range of technology suitable for this AOI, targets for specific use applications are not defined but innovations must exceed the state-of-the-art performance significantly. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets.

Applicants are encouraged to consider the following metrics as examples:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Improve payback period, cost- effectiveness	Years	$\leq 3 \text{ years}$	$\leq 2 \text{ years}$	<i>Applicant Defined</i>
Coefficient of performance (COP) @ highest supply temperature	Percent of Carnot COP	$\geq 45\%$ <i>Carnot COP</i>	$\geq 55\%$ <i>Carnot COP</i>	<i>Applicant Defined</i>
Reduce energy intensity of thermal process	Percent reduction in energy consumed per unit product	$\geq 40\%$	$\geq 70\%$	<i>Applicant Defined</i>
Lifetime	Years	$\geq 12 \text{ years}$	$\geq 20 \text{ years}$	<i>Applicant Defined</i>

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Reduce direct GHG emissions (refrigerants)	GWP value	≤ 10	≤ 3	<i>Applicant Defined</i>
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Topic Area 2: Efficient Energy Use in Industrial Systems

Innovations in industrial energy systems are needed at multiple levels to reduce the energy and emissions intensity of industrial operations. These innovations include both improvements to established, foundational technologies as well as development of new approaches to production. At the process level, new alternative process technologies are needed to reduce thermal demand and resulting emissions; plant-level energy use can be optimized through efficient management of materials and energy using integrated systems of advanced sensors, controls, data platforms, and efficient process equipment; and industrial facilities can contribute to energy systems outside the plant while simultaneously improving their own resiliency, emissions intensity, and operating economics by adopting technologies to enable more flexible operations. From this range of priorities, this topic focuses on equipment for low thermal budget separations (Area of Interest 1: Industrial Membranes) and for thermal management (Area of Interest 2: Industrial Heat Exchangers).

Topic 2 is focused on cross-sectoral impact and seeks applications pursuing advancements that will have impact across multiple industries; applications focused on technologies or processes relevant to only a single subsector are not of interest for Topic 2. Thus, applications and concept papers must discuss the potential for cross-sectoral impact to justify the cross-sector nature of the proposed technology. Applicants are encouraged to assemble project teams that include advisers from multiple relevant industries.

This topic seeks both Tier 1 and Tier 2 applications. Applications must establish the potential to be cost-competitive with commercially available state-of-the-art technology. During the award performance period, carbon emissions, energy intensity, and cost must be validated via LCA and TEA. Applications submitted under this topic must address at least one of the Areas of Interest below.

Area of Interest 1: Advanced Membrane Separations

Background and Opportunity: Separation technologies crosscut all manufacturing industries and have been estimated to account for about 22% of all in-plant energy

use in the United States.²⁰ The vast majority of this energy goes towards thermally intensive separations processes such as distillation, evaporation, and drying, which typically achieve the required temperatures via combustion of fossil fuels. Development and scale-up of low-carbon separations processes will be essential to decarbonization of the industrial sector.²¹

One strategy for the decarbonization of thermal processes is the adoption of *low thermal budget* alternatives, which are transformative changes from current production methods that achieve similar end products while using significantly less thermal energy.²² This strategy is a key aspect of DOE's Industrial Heat Shot, which targets innovative low- or no-heat processes as a pathway to develop cost competitive industrial heat decarbonization technologies with at least 85% lower greenhouse gas emissions.²³

Membrane- and molecular sieve-based separations represent a low thermal budget alternative to conventional thermal separations. These advanced separations technologies can be hybridized with or can fully replace thermal separation equipment, significantly improving energy efficiency and reducing GHG emissions. Membrane and molecular sieve separations are relevant to many industries, including chemicals, refining, pulp and paper, and food products. While these technologies have been commercialized in certain applications (e.g., enzyme concentration, hydrogen recovery, nitrogen production, juice clarification, cheese and dairy processing), many application areas remain underdeveloped due to challenges related to membrane material durability, fouling, module design, and process engineering and integration.²⁴ As one example, adoption of membrane separations involving organic solvents have faced hurdles related to membrane chemical and thermal stability, selectivity of similarly-sized solvents, and limited existing literature on innovative process configurations (e.g., membrane cascades, hybrid processes).²⁵ Furthermore, while a large emphasis has historically been placed on pressure and partial pressure driven membrane separation processes, separations focused on alternative driving forces (e.g., temperature, concentration gradient, electric potential) and novel process configurations may help membrane

²⁰ DOE Industrial Technologies Program. Materials for Separation Technologies. Energy and Emission Reduction Opportunities. <https://doi.org/10.2172/1218755>

²¹ DOE, Industrial Decarbonization Roadmap, 2022, <https://www.energy.gov/eere/doe-industrial-decarbonization-roadmap>.

²² DOE Advanced Manufacturing Office. Thermal Process Intensification: Transforming the Way Industry Uses Thermal Process Energy. <https://doi.org/10.2172/1867992>

²³ DOE, Industrial Heat Shot, <https://www.energy.gov/eere/industrial-heat-shot>

²⁴ Beuscher, U., Kappert, E.J., Wijmans, J.G. (2022). Membrane research beyond materials science. *Journal of Membrane Science*, 643, 1, 119902. <https://doi.org/10.1016/j.memsci.2021.119902>

²⁵ Hu, Y. (2023). Grand challenge in membrane applications: Liquid. *Frontiers in Membrane Science and Technology*. 2, 1177588. <https://doi.org/10.3389/frmst.2023.1177528>.

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processes become a more competitive option for process intensification across sectors.²⁶

Technology Focus: This area of interest will focus on the development and scale up of industrially relevant membranes for advanced separations, including organic membranes, inorganic membranes, mixed-matrix membranes, and molecular sieves. It seeks innovative technologies that have not been commercially proven, that can be applied across multiple processes or industries, and that have a path to commercially relevant scales. Applications include but are not limited to: replacement of incumbent distillation, fractionation, drying, and concentration technologies; adoption of hybrid approaches, such as those that combine membranes and thermal separations to reduce overall thermal demand; and other use cases that significantly reduce energy use and GHG emissions per unit product.

This area of interest seeks applications addressing one or more of the following challenges:

- Development of membranes with improved long-term resistance to fouling and/or capability for regeneration
- Development of membranes with improved longevity and stability under realistic industrial conditions (e.g., high temperatures, corrosive or acidic environments, mixed streams with plasticizing agents)
- Reductions in membrane manufacturing, process integration, and/or operating costs
- Scale-up of membrane processes based on innovative materials or driving forces (e.g., temperature difference, sweep operation, light, electrical fields)

Approaches to address these challenges include, but are not limited to, the use of innovative membrane materials, module designs, manufacturing methods, surface treatments, and process configurations.

While demonstrations will necessarily occur in the context of a single subsector, concept papers and proposals must establish cross-sectoral relevance of the proposed technology. Applications must thoroughly describe and justify the pathway to impacts in multiple subsectors (e.g., the chemicals industry and the food and beverage industry).

Not of Interest: For Topic 2, Area of Interest 1, the following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D):

²⁶ Farve, E. (2022). The future of membrane separation processes: A prospective analysis, *Frontiers in Chemical Engineering*. 4, 2673, <https://www.frontiersin.org/articles/10.3389/fceng.2022.916054>.

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- Applications focused on membrane reactors, fuel cells, electrolyzers, water treatment or desalination, or CO₂ separation;
- Technologies relevant to only a single subsector or application (e.g., a membrane specific to olefin/paraffin separation); and
- CCUS, onsite electricity generation, or the production of fuels/chemicals from byproducts or wastes.

Candidate Metrics and Targets: Proposals should justify that their technology will have a significant impact on reducing fossil fuel consumption and/or CO₂ emissions. Applications will be evaluated based on the potential to reduce carbon emissions annually within the industrial sector at the national level if broadly implemented.

For Topic 2, Area of Interest 1, applicants should conduct a systems-level analysis to ensure that GHG emissions are not simply displaced to another process step. This analysis should include a comparison between processes incorporating the proposed technology and those incorporating a traditional thermal separation technology using identical separation requirements and illustrating any system-wide changes to process configuration.

Applicants must clearly explain how the proposed technology will meet the following metric:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Reduce carbon intensity compared to thermal separation	% carbon intensity change as measured by ton CO ₂ equivalent (CO ₂ e)/kg product	30% reduction	> 85% reduction	<i>Applicant Defined</i>

Additional metrics and critical criteria that will lead to successfully meeting the goal above should also be identified, including key performance parameters for the identified membrane process and non-energy/non-emissions co-benefits. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Examples of applicant-identified metrics include energy intensity of the separation (e.g., reducing energy use per unit product by 20%), capital costs (e.g., reducing cost by 30%), or operating costs, including maintenance and/or replacement (e.g., reducing cost per year by 30%).

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Area of Interest 2 – Industrial Heat Exchangers

Background and Opportunity: Heat exchangers are critical subsystems in technologies that advance decarbonization and improve energy efficiency, including heat pumps, thermal energy storage, waste heat recovery, and low-carbon heat generation and delivery. Advanced heat exchangers can enable improvements in industrial processes through higher efficiency heat delivery or improved waste heat recovery.²⁷ In addition, advanced heat exchangers are anticipated to help overcome barriers to process intensification in the chemicals industry, where reductions in plant size and material usage are important considerations.²⁸

There is opportunity for development of high-temperature and high-pressure heat exchangers to meet the needs of industrial processes. Conventional metallic heat exchangers are susceptible to corrosion, especially at high temperatures.²⁹ Furthermore, most medium- to high-temperature waste streams are contaminated with corrosive chemicals or particulate matter. Industrial waste heat is often unrecoverable because equipment lacks adequate resistance to corrosion, oxidation, and fouling—processes which are accelerated at high temperatures.³⁰

Heat exchangers also face integration challenges in real-world systems. Heat exchangers are engineered for specific applications based on the heat source, heat transfer medium, and physical constraints of the industrial process. In addition, high-temperature and high-pressure heat exchangers face significant technological barriers in scale up. Modular systems may be able to provide the flexibility needed to be widely deployed in industry, but these systems face their own integration cost barriers, and component developments and validation for large-scale systems are needed to demonstrate a pathway to cost effectiveness and increase industry adoption.

Technology Focus: Area of Interest 2 will focus on research, development, and demonstration of durable heat exchangers that can improve efficiencies of industrial heat processes.

²⁷ Thonon (2005) Advanced and High-Performance Heat Exchangers for the Hydrocarbon-Processing Industries, *Heat Transfer Engineering*, 26:5, 73-84, <http://doi.org/10.1080/01457630590927390>.

²⁸ Creative Energy. "European Roadmap for Process Intensification," 2007. http://www.efce.info/efce_media/p-531.pdf?rewrite_engine=id.

²⁹ Sommers et al. (2010). Ceramics and ceramic matrix composites for heat exchangers in advanced thermal systems: A review. *Applied Thermal Engineering*. <http://doi.org/10.1016/j.applthermaleng.2010.02.018>.

³⁰ US DOE. Quadrennial Technology Review 2015. 6M: Waste Heat Recovery. <https://www.energy.gov/quadrennial-technology-review-2015-omnibus#chap6ta>.

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For Tier 1 applications, DOE is interested in novel heat exchanger materials and designs that can withstand harsh industrial conditions. Applications must address one of the two focus areas below:

- Heat exchangers for high temperature industrial processes (> 800 C) that use materials such as high-performance alloys or ceramics.
- Novel polymer- or composite-based heat exchangers for lower temperature processes, which can be lightweight, inexpensive, and easy to manufacture while offering a wide range of geometric design possibilities, corrosion resistance, and high-temperature stability.

Within these two focus areas, DOE is also interested in technologies that address challenges around corrosion, fouling, and flexibility. Potential solutions for waste heat recovery from corrosive gas streams could include coatings, adhesion layers, and protective surface treatments that resist wear and corrosion damage from chemical attack, high-flowrate gases, and particulates in the waste stream. Alternatively, radiative heat exchangers may be used to avoid direct contact with high-temperature fluids. Additionally, heat exchangers that can operate with variable capacity can enable industrial flexibility that will be increasingly valuable as industry decarbonizes.

For Tier 2 applications, DOE is interested in high temperature (> 800 C) demonstrations for systems at least 0.5 MW in size. R&D should focus on heat exchangers that are broadly applicable to a variety of industrial processes and enable capital cost reductions of decarbonization technologies.

For both Tier 1 and 2 applications, concept papers and proposals must specify use cases of their heat exchanger systems, detailing integration issues and how they will overcome them. Applications must thoroughly address and justify the potential impacts of their technologies in multiple subsectors.

Not of Interest: For Topic 2, Area of Interest 2, the following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D):

- Applications focused on power generation, including combined heat and power (CHP) and waste heat to power (WHP);
- Applications with a primary focus on modeling, manufacturability, and/or materials development without significant proposed progress toward novel design;
- Technologies relevant to only a single subsector or application; and
- CCUS, onsite electricity generation, or the production of fuels/chemicals from byproducts or wastes.

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Candidate Metrics and Targets: Applicants must include the following metrics and must clearly explain how the proposed technology will meet the identified targets:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Increase heat exchanger effectiveness	% increase in number of transfer units (NTU)	<i>Applicant Defined</i>	<i>Applicant Defined</i>	<i>Applicant Defined</i>
Increase heat transfer rate	Heat Transfer Coefficient (U) * Surface Area (A)	<i>Applicant Defined</i>	<i>Applicant Defined</i>	<i>Applicant Defined</i>
Durability	Tier 1: <i>Applicant defined based on material and failure mode (e.g., creep, corrosion, fatigue)</i> Tier 2: lifetime	<i>Applicant Defined</i>	<i>Applicant Defined</i>	<i>Applicant Defined</i>

Additional metrics and criteria that will lead to successfully meeting the FOA objectives should also be identified, including key performance parameters. Metrics should be specific to the proposed technology and must define appropriate benchmarks or baselines, minimum targets, and stretch targets. Examples include cost (e.g., \$25/kW), manufacturability (e.g., production throughput), improvements in process flexibility, and reductions in energy intensity.

Topic Area 3: Decarbonizing Organic Wastewater and Wet Waste Treatment

Background and Opportunity: Wet organic waste management and treatment represents a significant source of direct and indirect GHG emissions across several industrial subsectors. Aerobic treatments are employed in pulp and paper, municipal wastewater, and in some instances, the food and beverage industries. Supplying the necessary oxygen for aerobic treatments requires a significant amount of energy. Aerobic processes in open-air environments, including those in water resource recovery facilities (WRRFs), produce GHGs such as nitrous oxide (N₂O) and methane (CH₄), which are far more potent greenhouse gases than CO₂.

Manure lagoons at concentrated animal feeding operations (CAFOs), which are often uncovered, and the disposal of organic sludges in landfills yield substantial CH₄ emissions. Land application of manures and sludges, one of the most common

disposal options, also creates N₂O under certain conditions (though further scientific investigation of the entire lifecycle is needed). The majority of manure from CAFOs and dairies is applied to the land. This presents a challenge when the amount of manure to dispose of is greater than the nutrient needs of the surrounding agricultural land. Applying manure to agricultural land is also not a viable option all year round because it is only productive to apply fertilizer at certain times in the growing cycles, which vary by crop.

The Environmental Protection Agency (EPA) estimates roughly 83 MMT CO₂e per year of direct emissions from manure management, most of which is CH₄ from treatment lagoons and storage piles.³¹ There are significant R&D opportunities to reduce manure volumes by producing other products, particularly those that displace fossil-based inputs, such as chemicals, plastics, and textiles.

WRRFs (previously known as either wastewater treatment plants (WWTPs) or publicly owned treatment works (POTWs)) represent another significant opportunity to reduce GHG emissions. EPA estimates that GHG emissions from WRRFs total approximately 44 MMT CO₂e, only slightly less than those from the cement industry.³² The bulk of these emissions are composed of N₂O and CH₄. The EPA estimates are widely thought to be low by a factor of two or more on a life cycle basis,^{33,34,35} and they do not include other indirect emissions, some of which are also relevant to pulp and paper.

Sources of other emissions connected to WRRFs include:

- Indirect emissions from energy consumption drawn from fossil sources, particularly electricity.^{36,37}

³¹ EPA, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2020*. 2022, EPA: Washington, DC.
<https://www.epa.gov/ghgemissions/inventory-us-greenhouse-gas-emissions-and-sinks-1990-2020>.

³² Ibid.

³³ Willis, J.L., Z.G. Yuan, and S. Murthy, *Wastewater GHG Accounting Protocols as Compared to the State of GHG Science*. Water Environment Research, 2016. **88**(8): p. 704-714.

³⁴ Demir, O. and P. Yapicioglu, *Investigation of GHG emission sources and reducing GHG emissions in a municipal wastewater treatment plant*. Greenhouse Gases-Science and Technology, 2019. **9**(5): p. 948-964.

³⁵ Li, L.Q., et al., *Carbon neutrality of wastewater treatment-A systematic concept beyond the plant boundary*. Environmental Science and Ecotechnology, 2022. **11**.

³⁶ Zib, L., et al., *Operational carbon footprint of the US water and wastewater sector's energy consumption*. Journal of Cleaner Production, 2021. **321**.

³⁷ Yapicioglu, P. and O. Demir, *Minimizing greenhouse gas emissions of an industrial wastewater treatment plant in terms of water-energy nexus*. Applied Water Science, 2021. **11**(12).

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- Emissions from manure and sludge disposal, especially CH₄ from landfills, and N₂O from land application.^{38,39,40}
- Diesel fuel consumption for manure, sludge, and biosolids transportation, which is growing in importance as land application and landfill regulations become increasingly stringent.^{41,42,,43}
- The portion of direct CO₂ emissions from fossil sources, which can range from 5-15% of total CO₂ releases from WRRFs.^{44,45,46} This could also be applicable to the pulp and paper industries.
- GHG emissions from the production of chemicals and other materials used in large quantities at some wet organic waste treatment facilities (e.g., sodium hydroxide).

The primary objective of this Topic Area is to reduce GHG emissions from individual unit processes within larger treatment trains by at least 50% without increasing overall costs.

Technology Focal Areas: There are multiple opportunities to reduce the GHG footprint of wet organic waste treatment.

Reducing the mass of manure, sludge, and biosolids requiring disposal would lessen emissions and could also include additional benefits. Because sludge disposal in landfills creates CH₄ emissions and land application may emit N₂O under certain circumstances, decreasing the mass of this waste would also decrease CH₄ and N₂O emissions. Further, as manure and sludge are typically transported for disposal in diesel trucks, reducing the mass of waste for disposal would decrease air pollutants from diesel emissions—particularly important for disadvantaged communities who

³⁸ Chen, W.H., et al., *The GHG mitigation opportunity of sludge management in China*. Environmental Research, 2022. **212**.

³⁹ Liu, B.B., et al., *Life cycle GHG emissions of sewage sludge treatment and disposal options in Tai Lake Watershed, China*. Science of the Total Environment, 2013. **447**: p. 361-369.

⁴⁰ Obi-Njoku, O., et al., *Greenhouse gas emissions following biosolids application to farmland: Estimates from the DeNitrification and DeComposition model*. Science of the Total Environment, 2022. **823**.

⁴¹ Woo, D.C.Y., et al., *A technoeconomic analysis of sewage sludge valorization for carbon emission reduction*. Biomass Conversion and Biorefinery.

⁴² Yoshida, H., J.J. Gable, and J.K. Park, *Evaluation of organic waste diversion alternatives for greenhouse gas reduction*. Resources Conservation and Recycling, 2012. **60**: p. 1-9.

⁴³ NEBRA. *PFAS in Biosolids ("sludge") and Residuals*. 2020 [cited 2021 March 31]; Available from: <https://www.nebiosolids.org/pfas-biosolids>.

⁴⁴ Law, Y., et al., *Fossil organic carbon in wastewater and its fate in treatment plants*. Water Research, 2013. **47**(14): p. 5270-5281.

⁴⁵ Schneider, A.G., A. Townsend-Small, and D. Rosso, *Impact of direct greenhouse gas emissions on the carbon footprint of water reclamation processes employing nitrification-denitrification*. Science of the Total Environment, 2015. **505**: p. 1166-1173.

⁴⁶ Tseng, L.Y., et al., *Identification of Preferential Paths of Fossil Carbon within Water Resource Recovery Facilities via Radiocarbon Analysis*. Environmental Science & Technology, 2016. **50**(22): p. 12166-12178.

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often live near WRRFs. Reducing waste mass would also lessen ratepayer pressures for WRRFs, as solids disposal can comprise as much as 40–50% of WRRF operating costs and increasing regulatory pressures are restricting sludge disposal options.^{47,48,49}

WRRFs can also decrease emissions by reducing or eliminating aeration in wastewater treatment processes. Aeration is responsible for up to 80% of electricity demand at WRRFs—as much as 0.7 kWh/m³ in older systems.^{50,51,52,53} Secondary treatment (activated sludge) and conventional nitrification/denitrification (biological nitrogen removal) require the majority of electricity for aeration. These two-unit processes can also be sources of direct GHG emissions, particularly N₂O. Replacing them with innovative alternative processes presents a significant opportunity to reduce carbon emissions, as well as operating costs for WRRFs.

Energy recovery from wet organic wastes presents an additional opportunity to reduce net carbon emissions. Conventional anaerobic digestion does not capture all the latent energy in wastewater. It is also economically challenging at smaller scales and can miss an important opportunity to minimize the overall net GHG impact of wet organic wastes facilities.

Finally, opportunities also exist to produce higher-value products from wet organic wastes and the various sludges from wet organic waste treatment. These products have the potential to replace fossil fuel-derived products, and thus contribute to decarbonization goals.^{54,55} For example, cost-effective recovery of nutrients, particularly nitrogen and phosphorous, could facilitate displacement of fossil-fuel-

⁴⁷ Seiple, T.E., A.M. Coleman, and R.L. Skaggs, *Municipal wastewater sludge as a sustainable bioresource in the United States*. Journal of Environmental Management, 2017. **197**: p. 673-680.

⁴⁸ Zhao, G., et al., *Greenhouse Gas Emission Mitigation of Large-Scale Wastewater Treatment Plants (WWTPs): Optimization of Sludge Treatment and Disposal*. Polish Journal of Environmental Studies, 2021. **30**(1): p. 955-964.

⁴⁹ Wei, L.L., et al., *Development, current state and future trends of sludge management in China: Based on exploratory data and CO₂-equivalent emissions analysis*. Environment International, 2020. **144**.

⁵⁰ Drewnowski, J., et al., *Aeration Process in Bioreactors as the Main Energy Consumer in a Wastewater Treatment Plant. Review of Solutions and Methods of Process Optimization*. Processes, 2019. **7**(5).

⁵¹ Contreras, J.A., E.I. Valenzuela, and G. Quijano, *Nitrate/nitrite-dependent anaerobic oxidation of methane (NAOM) as a technology platform for greenhouse gas abatement in wastewater treatment plants: State-of-the-art and challenges*. Journal of Environmental Management, 2022. **319**.

⁵² Bao, Z.Y., S.C. Sun, and D.Z. Sun, *Assessment of greenhouse gas emission from A/O and SBR wastewater treatment plants in Beijing, China*. International Biodeterioration & Biodegradation, 2016. **108**: p. 108-114.

⁵³ Tomczak, W. and M. Gryta, *Energy-Efficient AnMBRs Technology for Treatment of Wastewaters: A Review*. Energies, 2022. **15**(14).

⁵⁴ Li, S.Y., et al., *Techno-economic uncertainty analysis of wet waste-to-biocrude via hydrothermal liquefaction*. Applied Energy, 2021. **283**.

⁵⁵ Skaggs, R.L., et al., *Waste-to-Energy biofuel production potential for selected feedstocks in the conterminous United States*. Renewable & Sustainable Energy Reviews, 2018. **82**: p. 2640-2651.

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based methods for fertilizer production and application.^{56,57} Additionally, technologies that transform manure or sludges into replacements for fossil fuel-based products have the benefit of reducing the mass of material that must be disposed. This approach could be applied for agricultural and industrial wastes, particularly when the amount of manure generated by CAFOs exceeds the nutrient needs of adjacent agricultural lands.

Examples of possible solution spaces include, but are not limited to:

- Applications that propose replacing aeration in secondary treatment with anaerobic or other processes.
- Alternatives to traditional nitrification/denitrification that reduce or eliminate direct GHG emissions, especially N₂O, the electricity requirements for aeration, or the need for external carbon sources.
- Projects that propose dramatic reductions in sludge production by replacing traditional sludge handling methods (e.g., dewatering, drying, stabilization, anaerobic digestion) with novel processes or treatment trains.
- Alternatives to traditional anaerobic digestion, which could be relevant to all wet organic waste streams.

Applications that propose other credible methods to reduce GHG emissions from wet organic waste treatment will also be considered if they meet the metrics stipulated below.

Topic 3 seeks both Tier 1 and Tier 2 applications.

Area of Interest 1: This topic seeks projects that meet or exceed the GHG emissions and/or cost reductions enumerated above for a specific unit process within wet organic waste treatment trains, with a strong emphasis on GHG reductions while maintaining or decreasing operating costs. As noted above, applications must specify which processes they propose to replace in their process flow diagram (PFD) and in the text, and provide justifications for why these processes were chosen, and articulate feasible technical paths to meet the specified metrics. **For this topic, the metrics will be applied at the unit process level (i.e., proposed projects must achieve a 50% reduction in emissions without increasing total wet organic waste handling operating costs).** Defining a credible baseline for state-of-the art processes will thus be a key element of successful applications.

⁵⁶ Puyol, D., et al., *Resource Recovery from Wastewater by Biological Technologies: Opportunities, Challenges, and Prospects*. Frontiers in Microbiology, 2017. **7**.

⁵⁷ Nancharaiyah, Y.V., S.V. Mohan, and P.N.L. Lens, *Recent advances in nutrient removal and recovery in biological and bioelectrochemical systems*. Bioresource Technology, 2016. **215**: p. 173-185.

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Additionally, by the end of the project, successful applications must achieve:

- 100 continuous hours onstream;
- 500 total hours onstream; and
- Minimum throughput of 5 liters per day (L/D), with solids percentage appropriate to their proposed point of insertion into the overall treatment train.

All of these objectives must be met using real wet organic wastes for all go/no go milestones, although synthetic alternatives may be used in preliminary testing.

Applications under this topic area should also meet the following requirements:

- Applicants must propose to perform techno-economic analysis (TEA) and life cycle assessment (LCA) of their potential projects. These analyses must also include a comparison of the current, commercially available state-of-the-art technology with the proposed unit process(es) or treatment train, including comparisons of functionality. The comparison should include an initial TEA and an initial LCA that considers: 1) current, commercially available state-of-the-art technology; 2) relevant preliminary data that demonstrates the current developmental stage of the proposed system, whether experimental, literature-based, or both; and 3) the proposed system's targets that will be achieved by end of project. The preliminary TEA and LCA of the three scenarios, which must be included in the technical volume of the application, should be conducted using credible methodologies and assumptions and will need to be updated throughout the life of selected projects. Technologies that are not able to demonstrate economic and decarbonization feasibility will not be considered.
- Applicants must include a process flow diagram (PFD) of the proposed advances. The PFD should clearly depict how the proposed unit processes or treatment trains would fit into an existing wastewater treatment ecosystem, from collection to discharge. Influent and effluent characteristics should be detailed, and the diagram also needs to include rough estimates of energy inputs and outputs, with energy and mass balances clearly indicated, as well as GHG emissions. Note that the process flow diagram will not count towards the Technical Volume page limits in Section IV.D.
- Applications must quantify how their advanced resource recovery system could, if successful, reduce net GHG emissions and/or operating costs.

Eligibility Considerations: This topic is explicitly targeted at the widespread adoption and deployment of GHG reduction solutions at facilities that process wet organic wastes, in the full understanding that costs will be a key element in such adoption. Thus, participation from these facilities (and optionally engineering firms that tend

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to design and build actual installations) is essential. Accordingly, this FOA includes restricted eligibility requirements. Please see Section III, “Eligibility Information” for the FOA eligibility requirements.

Not of Interest: For Topic 3, the following types of applications will be deemed nonresponsive and will not be reviewed or considered (See Section III.D):

- Applications proposing incremental improvements to existing processes that do not meet the GHG or cost reduction targets.
- Projects that rely primarily on modeling, simulation, or digital twins. Successful applications must propose physical validation of their key innovations.
- Applications that propose deployment of currently commercial technologies, such as conventional anaerobic digestion or thermal hydrolysis.
- Applications which propose the use of synthetic, as opposed to real waste feedstocks for major milestones and Go/No Go decision points.

Candidate Metrics and Targets: Proposals should justify that their technology will have a significant impact on reducing CO₂ emissions. Applicants must clearly explain how the proposed technology will meet the following metrics:

Objective/ Goal	Metric	Minimum	Stretch Target	Baseline Performance
Reduce GHG emissions from waste treatment unit processes	CO ₂ e	50%	75%	<i>Applicant Defined</i>
Avoid cost increases	USD	No increase	25% decrease, particularly in sludge disposal costs	<i>Applicant Defined</i>

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).

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D. R&D Community Benefits Plan

DOE is committed to investing in research and development (R&D) of innovations that deliver benefits to the American public and lead 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 Plan)⁵⁸ that addresses the three objectives stated above. See Section IV.D.xv. and Appendix G for the more information on the R&D Community Benefits Plan content requirements.

E. Authorizing Statutes

The programmatic authorizing statutes are §6003 of the Energy Act of 2020, as codified at 42 U.S.C. § 17113 et seq. (Topics 1 and 2) and §911(a)(2)(C) of the Energy Policy Act of 2005, as codified at 42 U.S.C. § 16191(a)(2)(C) (Topic 3).

Awards made under this announcement will fall under the purview of 2 CFR Part 200 as amended by 2 CFR Part 910.

II. Award Information

A. Award Overview

iii. Estimated Funding

EERE expects to make a total of approximately \$38,000,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 11-20 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between \$1,000,000 and \$5,000,000.

EERE may issue awards in one, multiple, or none of the following topic areas:

⁵⁸ 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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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	Electrification of Industrial Heat	4-8	\$1 million	\$5 million	\$15 million	24-36
2	Efficient Energy Use in Industrial Systems	3-7	\$1 million	\$5 million	\$12 million	24-36
3	Decarbonizing Organic Wastewater and Wet Organic Waste Treatment	4-5	\$2 million	\$2.5 million	\$11 million	24-36

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.

iv. Period of Performance

EERE anticipates making awards that will run from 24 months up to 36 months in length, comprised of 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 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.

v. 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.

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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 U. S. 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 some 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. See Section III.E.ii.

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. 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.

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 U.S. 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, EERE 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 EERE's decision concerning a waiver request.

iii. Topic Area Eligibility

For Topic Areas 1 (Electrification of Industrial Heat) and 2 (Efficient Energy Use in Industrial Systems) Only:

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; and
3. Nonprofit entities.

State, local, and tribal government entities are eligible to participate as a subrecipient.

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

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

For Topic Area 3 (Decarbonizing Organic Wastewater and Wet Waste Treatment) Only:

For Topic Area 3, a waste facility must be either the prime applicant or a subrecipient. *Waste facility* is defined as a facility that currently treats wet organic wastes (at least 50% water content) from municipal, agricultural, or industrial sources. Note that educational institutions which operate their own on-site waste treatment facilities do qualify as a *waste facility*.

Applications will be accepted only from the following eligible prime applicants:

- Waste facilities;
- Municipalities and their agencies/departments;
- Local, Tribal, and intrastate government agencies and instrumentalities, including sanitation districts and similar authorities with jurisdiction over wastewater treatment;
- For-profit entities that are incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and have a physical location for business operations in the United States;
- Non-profit organizations that are not 501(c)(4) organizations engaged in lobbying activities; and
- For Tier 1 applications only, institutions of higher education and DOE/NNSA FFRDCs.

The following entities are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient:

- Federal agencies and instrumentalities (other than DOE);
- Foreign entities;
- For Tier 2 applications only, institutions of higher education, except those that qualify as a *waste facility* above, and DOE/NNSA FFRDCs.

B. Cost Sharing

Applicants are bound by the cost share proposed in their Full Applications if selected for award negotiations.

The cost share must be at least 20% of the total project costs⁵⁹ for research and development projects and 50% of the total allowable costs for demonstration and commercial application projects.⁶⁰ The cost share must come from non-federal sources unless otherwise allowed by law.

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 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. Cost share may be provided in the form of cash or cash equivalents, or in-kind contributions. Cost share must come from non-federal sources (unless otherwise allowed by law), such as project participants, state or local governments, or other third-party financing. Federal financing, such as DOE Loan Guarantee, cannot be leveraged by applicants to provide the required cost share or otherwise support the same scope that is proposed under a project.

⁵⁹ Total project costs is the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.

⁶⁰ Energy Policy Act of 2005, Pub. L. 109-58, sec. 988. Also see 2 CFR 200.306 and 2 CFR 910.130 for additional cost sharing requirements.

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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 federal government did not provide the funding to the state or local government.

The 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 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

DOE 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 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

All applicant submissions must:

- Comply with the applicable content and form requirements listed in Section IV. of the FOA;

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- Include all required documents;
- Be uploaded and submitted to EERE eXCHANGE <https://eere-eXCHANGE.energy.gov>; and
- Be submitted by the deadline stated in the FOA.

EERE 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 before the submission deadline), applicants should allow at least one 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 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/NNSA 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.

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 FFRDCs 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

DOE will not fund DOE/NNSA FFRDCs participating as a subrecipient through the DOE field work authorization process. DOE will not fund non-DOE/NNSA FFRDCs through an interagency agreement with the sponsoring agency. Therefore, the prime recipient and FFRDC are responsible for entering into an appropriate subaward that will govern, among other things, the funding of the FFRDC portion of the work from the prime recipient under its DOE award. Such an agreement must be entered into before any project work begins.

The applicant should prepare the budgets using rates appropriate for funding the FFRDCs through subawards. 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.

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.

v. *Limit on FFRDC Effort*

The scope of work to be performed by the FFRDC may not be more significant than the scope of work to be performed by the applicant.

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

An entity may submit more than one Concept Paper and Full Application to this FOA, provided that each application describes a unique, scientifically distinct project and an eligible Concept Paper was submitted for each Full Application.

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 apply in response to this FOA lies solely with the applicant.

IV. Application and Submission Information

A. Application Process

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

All submissions must conform to the form and content requirements described below, including maximum page lengths.

- 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" 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;

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- A **control number** will be issued when an applicant begins the EERE eXCHANGE application process. The control number must be included with all application documents. Specifically, the control number must be prominently displayed on the upper right corner of the header of every page and included in the file name (i.e., *Control Number_Applicant Name_Full Application*);
- 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.

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.

Applicants that experience issues with submission PRIOR to the FOA deadline should contact the EERE eXCHANGE helpdesk for assistance (EERE-eXCHANGESupport@hq.doe.gov).

B. Application Forms

The application forms and instructions are available at [EERE Funding Application and Management Forms](#) and on EERE eXCHANGE. To access these materials on EERE eXCHANGE, 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

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

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.

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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), the relevant funding tier (i.e., Tier 1 or Tier 2), both the technical and business points of contact, names of all team member organizations, the project location(s), 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 scale of the proposed work, including, as appropriate, mass flow, energy flow, heat flux, reactor volume, and other quantitative measures; • 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; • How the proposed location of the proposed project will support technology development and long-term success; • 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 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; and

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- 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. See Section VI.A.

D. Content and Form of the Full Application

Applicants must complete the following application forms found at [EERE Funding Application and Management Forms](#) and on the EERE eXCHANGE website at <https://eere-eXCHANGE.energy.gov/>.

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.

i. Full Application Content Requirements

Each Full Application shall be limited to a single concept. Full Applications must conform to the following requirements and must not exceed the stated page limits:

Component	File Format	Page Limit	File Name
Technical Volume	PDF	25	ControlNumber_LeadOrganization_TechnicalVolume
Technical Volume – CONFIDENTIAL (Optional)	PDF	25	ControlNumber_LeadOrganization_TechnicalVolume_CONFIDENTIAL
Resumes	PDF	3 pages each	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	10	ControlNumber_LeadOrganization_SOPO
Statement of Project Objectives – CONFIDENTIAL (Optional)	MS Word	10	ControlNumber_LeadOrganization_SOPO_CONFIDENTIAL
SF-424: Application for Federal Assistance	PDF	n/a	ControlNumber_LeadOrganization_App424

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Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification
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 2)	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 Waiver Requests and Foreign Work Waiver Requests	PDF	n/a	ControlNumber_LeadOrganization_Waiver
Community Benefits Plan	PDF	5	ControlNumber_LeadOrganization_CBP
Current and Pending Support	PDF	n/a	ControlNumber_LeadOrganization_CPS
Location(s) of Work	Excel	n/a	ControlNumber_LeadOrganization_LOW
Transparency of Foreign Connections	PDF	n/a	ControlNumber_LeadOrganization_TFC
Potentially Duplicative Funding Notice	PDF	n/a	ControlNumber_LeadOrganization_PDFN
Process Flow Diagrams (PFDs) (Topic 3 only)	PDF	3	ControlNumber_LeadOrganization_PFD

Note: The maximum file size that can be uploaded to the EERE eXCHANGE website is 50MB. See Section IV.B.

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

ii. Technical Volume

The Technical Volume must conform to the following content and form requirements. This volume must address the technical review criteria as discussed in Section V. of the FOA.

Save the Technical Volume in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TechnicalVolume".

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 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.

Optional: If an applicant chooses to submit trade secrets or business-sensitive, proprietary, or otherwise confidential information as described in Section VIII.D., save the version of the Technical Volume containing confidential information in a single PDF file using the following convention for the title
"ControlNumber_LeadOrganization_TechnicalVolume_CONFIDENTIAL".

SECTION/PAGE LIMIT	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), the relevant funding tier (i.e., Tier 1 or Tier 2), both the technical and business points of contact, names of all team member organizations, names of the PI, Senior/Key Personnel and their organizations, the project location(s), and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	<p>The Project Overview should contain the following information:</p> <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.
Technical Description, Innovation, and Impact (Approximately 45% of the Technical Volume)	<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.
Workplan and Market Transformation Plan (Approximately 25% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Tasks, Go/No-Go Decision Points, and Project Schedule. A detailed SOPO is separately requested and should include detailed descriptions of the work breakdown structure (WBS), tasks, subtasks,

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	<p>milestones, and Go/No-Go decision points. The Workplan should serve as a high-level complement to the SOPO; it is not intended to be duplicative of the SOPO. 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. • Task and Milestone 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 around budget periods and provide a narrative description of how the tasks to be performed contribute to achievement of the final project goal(s). The Workplan shall contain a concise summary of the activities to be conducted over the life of the project and should summarize major SMART (Specific, Measurable, Achievable, Relevant, and Timely) milestones that demonstrate success over the course of the project. The summary provided should be consistent with the SOPO. The SOPO will contain the complete, detailed description of the WBS and tasks. • Go/No-Go Decision Points (See Section VI.B.xiii. for more information on the Go/No-Go Review): The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. 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. The applicant should also provide the specific technical 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 two 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"> • A description of the project team's unique qualifications and expertise, including those of key subrecipients; • A description of the project team's existing equipment and facilities, or equipment or facilities already in place on the proposed project site, 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;

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	<ul style="list-style-type: none"> • Relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives; • The time commitment of the key team members to support the project; • A description of the technical services to be provided by DOE/NNSA FFRDCs, if applicable; • The skills, certifications, or other credentials of the construction and ongoing operations workforce; • For multi-organizational projects, describe succinctly: <ul style="list-style-type: none"> ○ The roles and the work to be performed by the PI and Senior/Key Personnel at the prime and sub levels; ○ Business agreements between the applicant and sub; ○ How the various efforts will be integrated and managed; ○ Process for making decisions on technical direction; ○ Publication arrangements; ○ Intellectual property issues; and ○ Communication plans
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iii. Resumes

A resume provides information reviewers can use to evaluate an 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 Senior/Key Personnel that includes the following:

1. Contact information;
2. Education and training: Provide name of 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 may be provided in addition to or substituted for publications. An

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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 10 years or since age 18, whichever period is shorter.

As an alternative to 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/>, also available at https://www.nsf.gov/bfa/dias/policy/researchprotection/commonform_biographicalsketch.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.

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

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third-party cost share providers. If applicable, the letter must state that the third party is committed to providing a specific minimum dollar amount or value of in-kind contributions allocated to cost sharing. The following information for each third party contributing to cost sharing should be identified: (1) the name of the organization; (2) the proposed dollar amount to be provided; and (3) the proposed cost sharing type (cash-or in-kind contributions). Each letter must not exceed one page.

Save the letters of commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOCs".

Letters of support or endorsement for the project from entities that do not have a substantive role in the project will not be accepted.

v. Statement of Project Objectives (SOPO)

Applicants must complete a SOPO. The SOPO should include detailed descriptions of the WBS, tasks, subtasks, milestones, and Go/No-Go decision points. Descriptions in the SOPO 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 responsibility to

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prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA.

A SOPO template is available at: [EERE Funding Application and Management Forms](#). The SOPO, including the Milestone Table, must not exceed 10 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".

Optional: If an applicant chooses to submit trade secrets or business-sensitive, proprietary, or otherwise confidential information as described in Section VIII.D., save the version of the SOPO containing confidential information in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_SOPO_CONFIDENTIAL".

vi. SF-424: Application for Federal Assistance

Applicants must complete the SF-424 Application for Federal Assistance, which is available at: [EERE Funding Application and Management Forms](#).

Effective January 1, 2020, the System for Award Management (SAM) is the central repository for common government-wide certifications and representations required of Federal grants recipients. As registration in SAM is required for eligibility for a federal award and registration must be updated annually, Federal agencies use SAM information to comply with award requirements and avoid increased burden and costs of separate requests for such information, unless the recipient fails to meet a Federal award requirement, or there is a need to make updates to their SAM registration for other purposes.

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 must complete the Budget Justification Workbook, available at: [EERE Funding Application and Management Forms](#). Applicants must complete each tab of the Budget Justification Workbook for the project, including all work to be

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performed by the prime recipient and its subrecipients and contractors. Applicants should include costs associated with required annual audits and incurred cost proposals in their proposed budget documents. 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 for Public Release

Applicants must submit a one-page summary/abstract of their project that is 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 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 must provide a single slide summarizing the proposed project. The Summary Slide template is available on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov/> and must include 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;
- Topline community benefits;
- Project title, prime recipient, PI, and Senior/Key Personnel information; and

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- 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% 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 is to perform a portion of the work, the applicant must provide a DOE work proposal (WP) in accordance with the requirements in DOE Order 412.1A, Work Authorization System, Attachment 2, 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".

xiii. SF-LLL: Disclosure of Lobbying Activities.

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.

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Prime recipients and subrecipients are required to complete and submit SF-LLL, “Disclosure of Lobbying Activities” ([EERE Funding Application and Management Forms](#)) 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. Foreign Entity Waiver Requests and Foreign Work Waiver Requests (if applicable)

Foreign Entity Participation

For projects selected under this FOA, all recipients and subrecipients must qualify as domestic entities. 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 information that must be included in a waiver request.

Performance of Work in the United States (Foreign Work Waiver Request)

As set forth in Section IV.J.iii., all work for projects selected under this FOA must be performed in the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix C lists the 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. Community Benefits Plan

The Community Benefits Plan must set forth the applicant’s approach to ensuring the Federal investments advance the following three objectives: (1) DEIA; (2) energy equity; and (3) investing in America’s workforce. The below sections set forth the content requirements for the Community Benefits Plan, which addresses each of these objectives. Applicants must address all three sections.

The applicant’s Community Benefits Plan must include at least one Specific,

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Measurable, Attainable, Realistic, and Timely (SMART) milestone per budget period to measure progress on the proposed actions. The Community Benefits Plan will be evaluated as part of the technical review process. If a project is selected, EERE will incorporate the Community Benefits Plan into the award and the recipient must implement its Community Benefits Plan when carrying out its project. EERE will evaluate the recipient's progress throughout the life of the award, 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 organization's 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 I, applicants are encouraged to leverage promising practices and develop a plan tailored to their project.

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

The 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 take that integrates into the research goals and 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 if the innovation is successful. Like cost reductions and

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commercialization plans, the Community Benefits Plan requires description of the equity implications of the innovation.

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 if the innovation is successful.

See Appendix G for more guidance.

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;
- 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 through end date); and
- The person-months of effort per year 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

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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/researchprotection/commonform_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 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

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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 physically relocate 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, 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 a DOE award.⁶¹

⁶¹ 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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xvii. Locations of Work

The applicant must provide a list of locations where project work will be performed by the prime recipient or subrecipient(s) including the following information for each location:

- Location Type
- Location Type Category
- Is this a Principal Place of Performance?
- Prime or Subrecipient Location?
- If Subrecipient, Subrecipient/Community Name
- Facility Name (if applicable)
- Is location in a foreign country?
- Street Address, City, State, 5-Digit Zip Code - +4
- Briefly describe the primary activity at this location or with this population. For example, management headquarters; construction, operations, production; raw materials extraction, etc.
- Latitude/Longitude
- Does the location or community qualify as a disadvantaged community (DAC) according to the Climate and Economic Justice Screening Tool (CEJST)?
- If DAC, add the census tract number or describe the distributed disadvantaged community served (e.g., migrant workers)
- % of work performed at this location

For your convenience, a Locations of Work template is available on EERE eXCHANGE at <https://eere-eXCHANGE.energy.gov/>. Applicants are strongly encouraged to use the template. If the template is not used, the submission must include all of the elements described above, and as outlined in the template.

Applicants must provide the Locations of Work Documentation as a Microsoft Excel file using the following convention for the title: "Control Number_LeadOrganization_LOW."

xviii. Transparency of Foreign Connections

Applicants must provide the following as it relates to the proposed recipient and subrecipients. Include a separate disclosure for the applicant and each proposed subrecipient. 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;
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. 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;
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 5%;
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.

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

Save the Transparency of Foreign Connections information in a single PDF file using the following convention for the title
“ControlNumber_LeadOrganization_TFC.”

xix. Potentially Duplicative 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 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 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.”

xx. Process Flow Diagrams

As detailed in Section I.B, Process Flow Diagrams are required for Topic Area 3. Save the Process Flow Diagrams in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_PFD.”

E. Content and Form of Replies to Reviewer Comments

EERE will provide applicants with reviewer comments following the evaluation of all eligible Full Applications. Applicants will have a brief opportunity to prepare a short Reply to Reviewer Comments (Reply). The Reply must not exceed three pages. If a Reply is more than three pages in length, EERE will review only the first three pages and disregard additional pages. Applicants may use the Reply to respond to one or more comments or to supplement their Full Application. The Reply may include text, graphs, charts, or data.

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 if 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 a Reply.

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.

Applicants are not required to submit a Reply to Reviewer Comments. EERE will review and consider each eligible Full Application, even if no Reply is submitted or if the Reply is found to be ineligible.

F. Post Selection Information Requests

If selected for award negotiations, EERE reserves the right to require that selected applicants provide additional or clarifying information regarding the application submissions, the project, the project team, the award requirements, and any other matters related to anticipated award. The following is a list of examples of information that may be required:

- Personnel proposed to work on the project and collaborating organizations (See Section VI.B.xviii. Participants and Collaborating Organizations);
- Current and Pending Support (See Sections IV.E.xvii. and VI.B.xix. Current and Pending Support);
- 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.xxii.;
- Indirect cost information;
- Other budget information;
- Letters of Commitment 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) register in the SAM at <https://www.sam.gov> before submitting an application; (2) provide a valid UEI in the application; and (3) 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. If an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, 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 use 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. Pursuant to 2 CFR 910.352, the cost principles in the Federal Acquisition Regulations (48 CFR 31.2) apply to for-profit entities. The cost principles contained in 2 CFR Part 200, Subpart E apply to all entities other than for-profits.

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ii. **Pre-Award Costs**

Applicants selected for award negotiations (selectee) 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.

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 overrides the requirement 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

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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.

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 United States 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.

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vi. Equipment and Supplies

To the greatest extent practicable, all equipment and products purchased with funds made available under this FOA should be American-made. This requirement does not apply to used or leased equipment.

Property disposition will be required at the end of a project if the current fair market value of property exceeds \$5,000. 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. Build America 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 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 D 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 issued on April 18, 2022, 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 "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 to: (1) fulfill the commitments made in its application regarding the procurement of U.S.-produced products and (2) fulfill the commitments made in its application regarding the procurement of other key component metals and domestically manufactured products 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 D 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” ([EERE Funding Application and Management Forms](#)) 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.

ix. Risk Assessment

Pursuant to 2 CFR 200.206, DOE will conduct an additional review of the risk posed by applications submitted under this FOA. Such risk assessment will consider:

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1. Financial stability;
2. Quality of management systems and ability to meet the management standards prescribed in 2 CFR 200 as amended and adopted by 2 CFR 910;
3. History of performance;
4. Audit reports and findings; and
5. The applicant's ability to effectively implement statutory, regulatory, or other requirements imposed on non-federal entities.

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

Depending on the severity of the findings and whether the findings were resolved, DOE may elect not to fund the applicant.

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 threats to United States research, technology, and economic security from undue foreign government influence when evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant.

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;
- Analogous information for some subrecipients; and

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- 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

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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. Affirmative Action and Pay Transparency Requirements

All applicants must comply with all applicable federal labor and employment laws, including but not limited to Title VII of the Civil Rights Act of 1964, the Fair Labor Standards Act, the Occupational Safety and Health Act, and the National Labor Relations Act, which protects employees' right to bargain collectively and engage in concerted activities for the purpose of workers' mutual aid or protection.

All federally assisted construction contracts exceeding \$10,000 annually will be subject to the requirements of Executive Order 11246:

- (1) Recipients, subrecipients, contractors, and subcontractors are prohibited from discriminating in employment decisions on the basis of race, color, religion, sex, sexual orientation, gender identity, or national origin.
- (2) Recipients and contractors are required to take affirmative action to ensure that equal opportunity is provided in all aspects of their employment. This includes flowing down the appropriate language to all subrecipients, contractors, and subcontractors.
- (3) Recipients, subrecipients, contractors, and subcontractors are prohibited from taking adverse employment actions against applicants and employees for asking about, discussing, or sharing information about their pay or, under certain circumstances, the pay of their co-workers.

DOE's Office of Federal Contractor Compliance Programs (OFCCP) uses a neutral process to schedule compliance evaluations. Consult OFCCP's Technical Assistance Guide⁶² to gain an understanding of the requirements and possible actions the recipients, subrecipients, contractors, and subcontractors must take. Additional guidance may also be found in the National Policy Assurances, produced by DOE.

⁶² See OFCCP's Technical Assistance Guide at:

<https://www.dol.gov/sites/dolgov/files/ofccp/Construction/files/ConstructionTAG.pdf?msclkid=9e397d68c4b111ec9d8e6fecb6c710ec> Also see the National Policy Assurances <http://www.nsf.gov/awards/managing/rtc.jsp>

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xiii. Foreign Collaboration Considerations

- a. Consideration of new collaborations with foreign entities and governments. The recipient will be required to provide DOE with advanced written notification of any potential collaboration with foreign entities 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 entity or government regarding the potential collaboration or negotiating the terms of any potential agreement.
- b. Existing collaborations with foreign entities 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, how the technology is unique and innovative, and how the technology will advance the current state of the art;
- For Topics 1 and 2, the applicant clearly describes and justifies the potential for the technology to have impact in multiple industrial subsectors;
- The applicant has identified risks and challenges of the technology, regulatory and financial aspects of the proposal 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 (45%)

This criterion involves consideration of the following factors:

Technical Merit and Innovation

- Extent to which the proposed technology, process, or project is innovative or replicable;
- 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, with analyses that support the viability of the proposed work.

Impact of Technology Advancement

- Extent to which the project supports the topic area objectives and target specifications and metrics;
- Potential impact of the project on advancing the state-of-the-art; and
- For Topics 1 and 2, potential impact of the project on achieving GHG emissions reductions, energy efficiency improvements, and co-benefits in multiple industrial subsectors.

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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;
- 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; and
- Adequacy, reasonableness, and soundness of the project schedule, as well as periodic Go/No-Go decisions, interim milestones, and metrics to track process.

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

- Level of clarity in the definition of the baseline, metrics, and milestones; and
- Relative to a clearly defined project baseline, the strength of the quantifiable metrics, milestones, and mid-point deliverables 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.
- Identification of the potential for industry adoption of the technology/process.

Criterion 3: Team and Resources (15%)

This criterion involves consideration of the following factors:

- 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;

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-
- Sufficiency of the facilities to support the work;
 - Degree to which the proposed consortia/team demonstrates the ability to facilitate and expedite further demonstration, development and commercial deployment of the proposed technologies;
 - Level of participation by project participants as evidenced by letter(s) of commitment, how well they are integrated into the Workplan, and the level of industrial participation; and
 - Reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Community Benefits Plan (15%)

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 commitment and ability to track progress toward meeting each of the DEIA goals; and
- Extent of engagement of organizations that represent disadvantaged communities as a core element of their mission, including Minority Serving Institutions (MSIs), Minority Business Entities, and nonprofit 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 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

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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.

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;
- The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);

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- The degree to which the proposed project incorporates applicant or team members from Minority Serving Institutions (e.g., Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions (OMIs)); and partnerships with Minority Business Enterprises, minority-owned businesses, woman-owned businesses, veteran-owned businesses, or Indian tribes;
- The degree to which the proposed project, when compared to the existing DOE project portfolio and other projects to be selected from the subject FOA, contributes to the total portfolio meeting the goals reflected in the Community Benefits Plan criteria;
- The degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials;
- The degree to which the proposed project contributes to the diversity of organizations and organization types and sizes selected from the subject FOA when compared to the existing DOE project portfolio;
- The degree to which the proposed project avoids duplication/overlap with other publicly or privately funded work; and
- The degree to which the project's solution or strategy will maximize deployment or replication.

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. Pre-Selection Interviews

As part of the evaluation and selection process, EERE may invite one or more applicants to participate in Pre-Selection Interviews. Pre-Selection Interviews are distinct from and more formal than pre-selection clarifications (See Section V.D.iii. of the FOA). The invited applicant(s) will meet with EERE representatives to provide clarification on the contents of the Full Applications and to provide EERE an opportunity to ask questions regarding the proposed project. The information provided by applicants to EERE through Pre-Selection Interviews contributes to EERE's selection decisions.

EERE will arrange to meet with the invited applicants in person at EERE's offices or a mutually agreed upon location. EERE may also arrange site visits at certain applicants' facilities. In the alternative, EERE may invite certain applicants to

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participate in a one-on-one conference with EERE via webinar, videoconference, or conference call.

EERE will not reimburse applicants for travel and other expenses relating to the Pre-Selection Interviews, nor will these costs be eligible for reimbursement as pre-award costs.

EERE may obtain additional information through Pre-Selection Interviews that will be used to make a final selection determination. EERE may select applications for funding and make awards without Pre-Selection Interviews. Participation in Pre-Selection Interviews with EERE does not signify that applicants have been selected for award negotiations.

iii. Pre-Selection Clarification

EERE may determine that pre-selection clarifications are necessary from one or more applicants. Pre-selection clarifications are distinct from and less formal than pre-selection interviews. These pre-selection clarifications will solely be for the purposes of clarifying the application. The pre-selection clarifications may occur before, during or after the merit review evaluation process. Information provided by an applicant that is not necessary to address the pre-selection clarification question will not be reviewed or considered. Typically, a pre-selection clarification will be carried out through either written responses to EERE's written clarification questions or video or conference calls with EERE representatives.

The information provided by applicants to EERE through pre-selection clarifications is incorporated in their applications and contributes to the merit review evaluation and EERE's selection decisions. If EERE contacts an applicant for pre-selection clarification purposes, it does not signify that the applicant has been selected for negotiation of award or that the applicant is among the top ranked applications.

EERE will not reimburse applicants for expenses relating to the pre-selection clarifications, nor will these costs be eligible for reimbursement as pre-award costs.

iv. Recipient Responsibility and Qualifications

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 responsibility and qualification information about the applicant that is in the entity information domain in [SAM.gov](https://sam.gov) (see 41 U.S.C. 2313).

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The applicant, at its option, may review information in the entity information domain in [SAM.gov](https://sam.gov) and comment on any information about itself that a federal awarding agency previously entered and is currently in the entity information domain in [SAM.gov](https://sam.gov).

DOE will consider any written comments by the applicant, in addition to the other information in the entity information domain in [SAM.gov](https://sam.gov), 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.

v. 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. EERE may include general comments on an applicant's Concept Paper in the encourage/discourage notifications.

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

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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.

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. Applicants Selected for Award Negotiations

Successful applicants will receive written notification that they have been selected for award negotiations. 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 nor is it a guarantee of federal government funding. Applicants do not receive an award unless and 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

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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 applicants must take before applying to this FOA. Some of these may take several weeks, so it is vital applicants build in enough time to complete them. Failure to complete these actions could interfere with application or negotiation deadlines or the ability to receive an award if 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.

To access [EERE eXCHANGE](#), potential applicants must have a [Login.gov](#) account. 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.

Each organization or business unit, whether acting as a team or a single entity, should 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.**

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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 https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf.

4. Grants.gov

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

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, may be 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

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award. DOE concurrence may be required before a foreign national can participate in the performance of any work under an award.

DOE may elect to deny a foreign national's participation in the award. Likewise, DOE may elect to deny a foreign national's access to a DOE site, 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.

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

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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 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 manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations, a corporation is any for-profit or nonprofit 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].

3. Nondisclosure and Confidentiality Agreements Representations

In submitting an application 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*

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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. 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, subrecipients, and contractors 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.

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. A Go/No-Go Review 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

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evaluated, prior to beginning the execution of future phases. 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 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) 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;⁶³ 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,

⁶³ A continuation application is 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 its continuation application, which includes the following information:

- i. A progress report on the project objectives, including 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 SOPO and/or Milestone Summary Table.

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board, commission, or office for which the cost to the U. S. 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 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. Real Property and Equipment

Real property and equipment purchased with project funds (federal share and recipient cost share) are subject to the requirements at 2 CFR 200.310, 200.311, 200.313, and 200.316 (non-federal entities, except for-profit entities) and 2 CFR 910.360 (for-profit entities).

For projects selected for awards under this FOA, the recipients may (1) take disposition action on the real property and equipment; or (2) continue to use the real property and equipment after the conclusion of the award period of performance with Contracting Officer approval. 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 when the recipient expects to submit disposition instructions); a acknowledgement that the recipient shall not sell or encumber the property or

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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 in 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

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

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

xviii. 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 prior to award. 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.

xix. 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.E.xvii.

xx. 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 and any subrecipient and contractor must agree to a U.S. Competitiveness provision requiring that any

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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 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.

xxi. Interim Conflict of Interest Policy for Financial Assistance

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy)⁶⁴ 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 its 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. Data Management Plan

Each applicant whose Full Application is selected for award negotiations will be required to submit a Data Management Plan (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 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.

⁶⁴ 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.gov. 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.

xxiv. 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:

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[HUMAN SUBJECTS Human Subjects Pr... | U.S. DOE Office of Science \(SC\)
\(osti.gov\).](#)

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 described below. Questions regarding this FOA must be submitted to IEDOCSTFOA@ee.doe.gov no later than three (3) business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this FOA will be posted on EERE eXCHANGE at: <https://eere-exchange.energy.gov>. **You must first select the FOA Number 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.

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D. Treatment of Application Information

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

If an application includes trade secrets or business-sensitive, proprietary, or otherwise confidential information, it is furnished to the federal government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the 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 federal government's right to use the information if it is obtained from another source.

If an applicant chooses to submit trade secrets or business-sensitive, proprietary, or otherwise confidential information, the applicant must provide **two copies** of the submission (e.g., Concept Paper, Full Application). The first copy should be marked "non-confidential," with the information believed to be confidential deleted. The second copy should be marked "confidential" and must clearly and conspicuously identify the trade secrets or business-sensitive, proprietary, or otherwise confidential information and 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 federal government is not liable for the disclosure or use of unmarked information and may use or disclose such information for any purpose as authorized by law.

The cover sheet of the Full Application, and other applicant submission must be marked as follows and identify the specific pages containing trade secrets or business-sensitive, proprietary, or otherwise confidential information:

Notice of Restriction on Disclosure and Use of Data:

Pages [list applicable pages] of this document may contain trade secrets or business-sensitive, proprietary, or otherwise confidential 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 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]

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In addition, (1) the header and footer of every page that contains trade secrets or business-sensitive, proprietary, or otherwise confidential information must be marked as follows: “Contains Trade Secrets or Business-Sensitive, Proprietary, or Otherwise Confidential Information Exempt from Public Disclosure,” and (2) every line or paragraph containing such information must be clearly marked with double brackets or highlighting. DOE will make its own determination about the confidential status of the information and treat it according to its determination.

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) 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.

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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;
- 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. 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.xx. U.S. Manufacturing Commitments of this FOA. A copy of the DEC can be found at

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<https://www.energy.gov/gc/determination-exceptional-circumstances-decs>.

Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by providing written notice to DOE within 30 working days from the time it receives a copy of the determination.

- DOE may issue and publish further DEC's on the website above prior to the issuance of awards under this FOA. DOE may require additional submissions or requirements as authorized by any applicable DEC.

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 United States 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

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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.

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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 use *covered telecommunications equipment or services* as a substantial or essential component of any system, or as critical technology as part of any system. As described in Section 889 of Public Law 115-232, *covered telecommunications equipment* is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

See Public Law 115-232, Section 889, 2 CFR 200.216, and 2 CFR 200.471 for additional information.

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, 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 terms in the titles specific to regulations applicable to cost sharing. EERE almost always uses “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 two 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, it is allowable as cost share. Conversely, if the cost is not allowable under the cost principles and not eligible for reimbursement, 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:

- 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 above regulations, other factors may also come into play such as timing of donations and length of the project period. For example, the value of 10 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 cost of the item or service is reimbursed, 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, and 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. Consult your DOE contact if you have questions 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

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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 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

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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)

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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 economic security.⁶⁵ 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 United States Competitiveness Provision (see Section VI.B.xx.); 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

⁶⁵ See [Critical and Emerging Technologies List Update \(whitehouse.gov\)](https://www.whitehouse.gov/critical-emerging-technologies/).

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- ownership breakdown of the foreign entity, and the percentage of 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. Performance of Work in the United States (Foreign Work Waiver)

As set forth in Section IV.J.iii., all work funded 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

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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 U.S. 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 manufacturing of products and/or services in the United States;
8. A description of the likelihood of 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
11. 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 additives⁶⁶—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

⁶⁶ BIL, § 70917(c)(1).

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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 materials⁶⁷ 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.

⁶⁷ Excludes cement and cementitious materials, aggregates such as stone, sand, or gravel, or aggregate binding agents or additives.

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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 non-profit 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:

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 domestically manufactured products 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%.

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;
 - 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; and
 - 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. There may be instances where an award qualifies, in whole or in part, for an existing waiver described at [DOE Buy America Requirement Waiver Requests](#).

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

APPENDIX E – 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

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APPENDIX F – LIST OF ACRONYMS

AOI	Area of Interest
ARPA-E	Advanced Research Projects Agency - Energy
CAFO	Concentrated animal feeding operation
CAGR	Compound annual growth rates
CBP	Community Benefits Plan
CCUS	Carbon capture, utilization, and storage
CH ₄	Methane
CHP	Combined heat and power
CO	Carbon monoxide
CO ₂	Carbon dioxide
CO ₂ e	Carbon dioxide equivalent (greenhouse gas emissions)
COI	Conflict of Interest
CRADA	Cooperative Research and Development Agreement
CST	Cross-Sector Technologies
DEC	Determination of Exceptional Circumstances
DEIA	Diversity, Equity, Inclusion and Accessibility
DMP	Data Management Plan
DOE	Department of Energy
EERE	Energy Efficiency and Renewable Energy
EPA	Environmental Protection Agency
FAR	Federal Acquisition Regulation
FCOI	Financial Conflicts of Interest
FECM	Office of Fossil Energy and Carbon Management
FFATA	Federal Funding and Transparency Act of 2006
FFRDC	Federally Funded Research and Development Center
FOA	Funding Opportunity Announcement
GAAP	Generally Accepted Accounting Principles
GHG	Greenhouse gas
GWP	Global warming potential
HBCU	Historically Black College or University
IEDO	Industrial Efficiency and Decarbonization Office
IHP	Industrial heat pump
LCA	Lifecycle assessment
LCFFES	Low-carbon fuels, feedstocks, and energy sources
LPO	Loan Programs Office
M&O	Management and Operating
MESC	Office of Manufacturing and Energy Supply Chains
MFA	Multi-Factor Authentication
MMT	Million metric tonnes
MPIN	Marketing Partner ID Number
MSI	Minority-Serving institution

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NAICS	North American Industrial Classification System
NDA	Non-Disclosure Acknowledgement
NE	Office of Nuclear Energy
NEPA	National Environmental Policy Act
N ₂ O	Nitrous oxide
NNSA	National Nuclear Security Agency
NO _x	Nitrogen oxides
NSF	National Science Foundation
OCED	Office of Clean Energy Demonstrations
OIG	Office of Inspector General
OMB	Office of Management and Budget
OMI	Other Minority Institution
OSTI	Office of Scientific and Technical Information
PII	Personal Identifiable Information
PM	Particulate matter
POTW	Publicly Owned Treatment Works
R&D	Research and Development
RD&D	Research, Development, and Demonstration
RDD&D	Research, Development, Demonstration, and Deployment
SAM	System for Award Management
SC	Office of Science
SciENCv	Science Experts Network Curriculum Vita
SMART	Specific, Measurable, Attainable, Realistic, and Timely
SOPO	Statement of Project Objectives
TAA	Technical Assistance Agreement
TAM	Total addressable market
TEA	Technoeconomic analysis
TIA	Technology Investment Agreement
TRL	Technology Readiness Level
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
U.S.	United States
USD	United States Dollar
WBS	Work Breakdown Structure
WHP	Waste heat to power
WP	Work Proposal
WRRF	Water resource recovery facility
WWTP	Wastewater Treatment Plant

APPENDIX G – COMMUNITY BENEFITS PLAN GUIDANCE

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 justice⁶⁸ 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),⁶⁹ it is important to consider the impacts of the successful commercial deployment of any innovations resulting from this FOA on the current and future workforce.

The goal of the Community Benefits Plan is to allow the application to illustrate engagement in critical thought about implications of how the proposed work will benefit the American people and lead to broadly shared prosperity, including for workers and disadvantaged communities.⁷⁰ The three sections of the Community Benefits Plans are considered together because there may be significant overlap among 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 Community Benefits Plan. Applicants are not required to implement any of these specific examples and should propose activities that best fit 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. Tapping all the available talent requires intentional approaches and yields broad benefits.

Equity extends beyond diversity to equitable treatment. Equitable access to

⁶⁸ DOE defines 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 definition, the remainder of this document refers to “energy equity” to encompass energy justice and DOE’s efforts related to Justice40. <https://www.energy.gov/diversity/articles/how-energy-justice-presidential-initiatives-and-executive-orders-shape-equity>

⁶⁹ <https://www.federalregister.gov/documents/2021/02/01/2021-02177/tackling-the-climate-crisis-at-home-and-abroad>

⁷⁰ See footnote 2 for guidance on the definition and tools to locate and identify disadvantaged communities.

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opportunity for members of the project team is paramount. This includes ensuring 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:⁷¹

- 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 also 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 to promote DEIA, justice, and workforce participation. Minority Serving Institutions, Minority Business Enterprises, minority-owned businesses, disability-owned businesses, 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 how

⁷¹ <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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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. For instance, 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 do not hinder 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 MSIs, 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

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- at MSIs;
- 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 cite 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 burden);⁷² 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;
- Describing how the proposed research strategy and methodology was informed by input from a wide variety of stakeholders;
- Creating 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 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 its 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,

⁷² 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>

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disruptions to existing industry 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 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 BIL-funded demonstration and deployment projects, may be useful for R&D projects.

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 United States;
- 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 workforce training to address needs for successful innovation;
- Voluntary recognition of a union and informing employees of their rights, regardless of its 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 Community Benefits Plan include one Specific, Measurable, Attainable, Realistic and Timely (SMART) milestone for each budget period. An exemplary SMART milestone clearly answers the following questions:

- What needs to be accomplished?
- What measures and deliverables will be used to track progress

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toward accomplishment?

- What evidence suggests that the accomplishment is achievable?
- Why choose this milestone?
- When will the milestone be reached?