U.S. Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)

Solar Technologies' Rapid Integration and Validation for Energy Systems (STRIVES)

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FOA Issue Date:	5/28/2024
Informational Webinar:	6/10/2024 1 p.m. ET
Submission Deadline for Concept Papers:	7/25/2024 5 p.m. ET
Submission Deadline for Full Applications:	10/25/2024 5 p.m. ET
Expected Submission Deadline for Replies to Reviewer Comments:	12/06/2024 5 p.m. ET
Expected Date for EERE Selection Notifications:	March 2025
Expected Timeframe for Award Negotiations:	March–June 2025

- 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.

Modifications

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

Mod. No.	Date	Description of Modification
000001	10/16/2024	Extend the submission deadline for full applications as shown on the cover page

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I. Funding Opportunity Description

A. Background and Context

i. Background and Purpose

This funding opportunity announcement (FOA) is being issued by the U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy (EERE) Solar Energy Technologies Office (SETO). Building a clean and equitable energy economy and addressing the climate crisis is a top priority of the Biden Administration. This FOA will advance the Biden Administration's goals to achieve carbon pollution-free electricity by 2035 and to "deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions economy-wide by no later than 2050"[1] to the benefit of all Americans. DOE is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of underserved communities.

The research, development, and demonstration (RD&D) activities to be funded under this FOA will support the government-wide approach to the climate crisis by driving innovation that can lead to the deployment of clean energy technologies, which are critical for climate protection. Specifically, SETO's Rapid Integration and Validation for Energy Systems (STRIVES) FOA will fund RD&D projects to improve power systems simulation software tools and demonstrate new business models for distribution systems operations to integrate and optimize the value of inverter-based resources (IBRs) and distributed energy resources (DERs), including solar, wind, energy storage, and other technologies such as buildings and electric vehicles (EVs).[2] This FOA is part of a collaborative effort announced in a Notice of Intent released by EERE to issue multiple FOAs totaling over $100 million for field demonstration projects and other research to support better planning and operations of the electric grid.[3]

In September 2021, DOE released the *Solar Futures Study*,[4] which provides a vision for solar power's role in cost-effectively contributing to the nation's decarbonization goals. According to the *Solar Futures Study*, solar power will need to grow from supplying over 5% of U.S. electricity demand in 2023 to 40%

[1] Executive Order 14008. January 27, 2021. "Tackling the Climate Crisis at Home and Abroad."
[2] North American Electric Reliability Corporation (NERC). June 2023. "An Introduction to Inverter-Based Resources on the Bulk Power System." www.nerc.com/pa/Documents/2023_NERC_Guide_Inverter-Based-Resources.pdf.
[3] EERE. EERE Wide Joint Notice of Intent for Field Validation. www.energy.gov/eere/eere-wide-joint-notice-intent-field-validation?auHash=tCYsv9_xguTLWOrI2HRJ_3xYCKmGafprPKFM_GIq9kc.
[4] SETO. Solar Futures Study. www.energy.gov/eere/solar/solar-futures-study.

by 2035. This will require the United States to install an average of 30 gigawatts alternating current[5] (GW_{ac}) of solar generation capacity each year between now and 2025 and ramp up to 60 GW_{ac} per year from 2025 to 2030. With supportive policies, electrification, and aggressive cost reductions, solar installations in the United States could supply 1 terawatt (TW_{ac}) of generating capacity for the power grid by 2035 and 1.6 TW_{ac} of capacity by 2050.

The 2022 Inflation Reduction Act (IRA) provides federal tax incentives for solar deployment and domestic solar manufacturing that significantly support SETO's mission. These include extension of a tax credit that can be claimed for solar installations and a new tax credit for solar component manufacturing in the United States.[6] DOE estimates that the IRA tax credits will expand the deployment of solar energy and help reduce carbon emissions to 40% below 2005 levels by 2030.[7]

Achieving this vision requires that the solar industry achieve SETO's 2030 cost reduction targets. In many parts of the country, solar electricity is already the lowest-cost form of new electricity generation capacity, but solar electricity is not yet cost-effective everywhere. There are multiple pathways to achieve these goals, but all require sustained innovation across solar and other DER technologies.

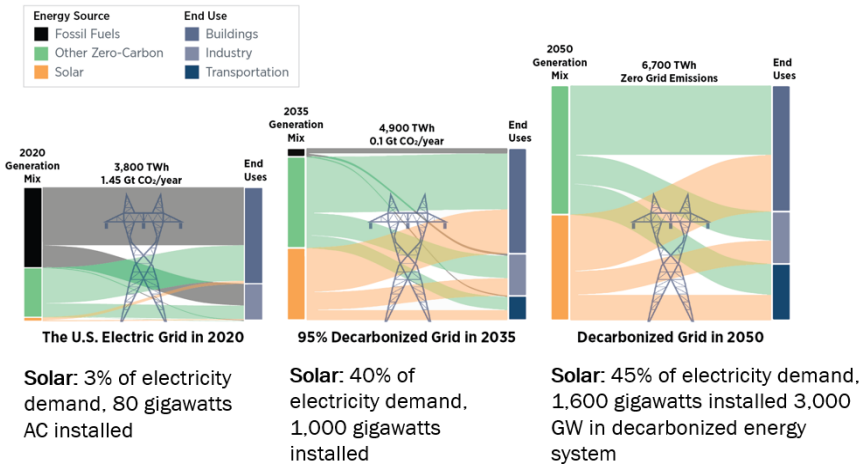

Figure 1. Illustration of how the mix of energy sources in the United States will need to change to meet the 2050 grid decarbonization goals

[5] Power grid capacity values are described in watts of alternating current (ac). Photovoltaic modules (panels) and the rated power of systems that use them are described in watts of direct current (dc). The ratio of dc watts to ac watts is called the "inverter loading ratio," which is typically in the range of 1.3 ± 0.2.

[6] SETO. August 2023. Federal Solar Tax Credits for Businesses. www.energy.gov/eere/solar/federal-solar-tax-credits-businesses.

[7] DOE Office of Policy. August 18, 2022. "DOE Projects Monumental Emissions Reduction From Inflation Reduction Act." www.energy.gov/articles/doe-projects-monumental-emissions-reduction-inflation-reduction-act.

ii. Technology Space and Strategic Goals

SETO works to enable the safe, reliable, secure, and cost-effective integration of solar energy to the nation's electricity grid through RD&D activities. These activities, shown in Figure 2, address the key technical challenges in power system planning and operations, solar forecasting and variability management, control optimization, system protection and stabilities, energy storage integration, power electronics, real-time situational awareness, and cybersecurity.[8] Collaboration with other DOE program offices, such as the Wind Energy Technologies Office (WETO), the Office of Electricity (OE), the Building Technologies Office, the Office of Cybersecurity, Energy Security, and Emergency Response, and the Vehicle Technologies Office, is essential to develop these technological advances.

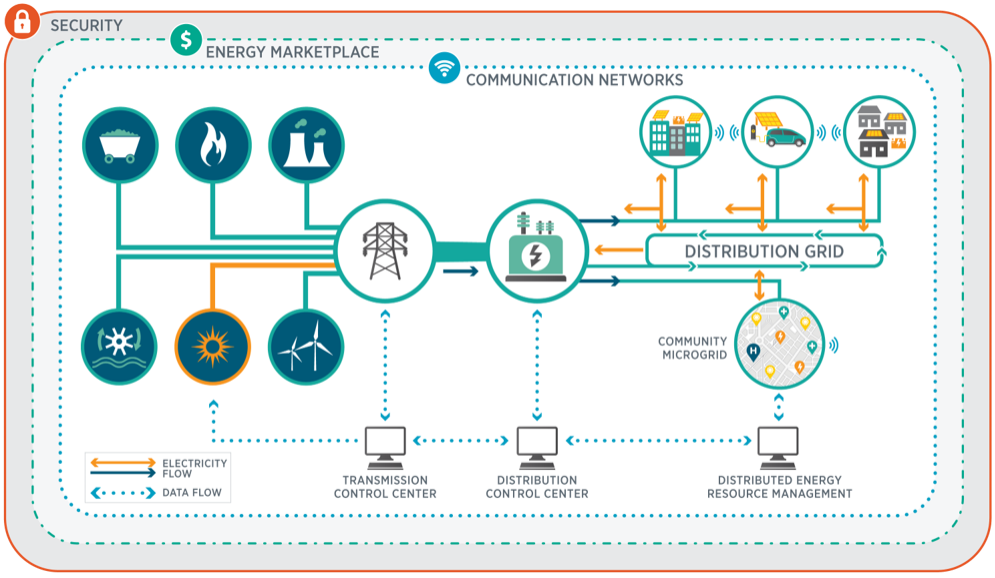

Figure 2. SETO systems integration

The rapid deployment of IBRs, such as solar and wind plants and battery energy storage systems (BESS), have presented new challenges for power system planning and operations.[9] IBRs rely on a piece of equipment known as an inverter to convert the direct current electrical energy that they produce or store into alternating current that is compatible with the electrical grid.[10] SETO has funded research to mitigate these challenges, increasing the confidence of grid planners and operators in solar energy generation.

[8] SETO. Systems Integration. www.energy.gov/eere/solar/systems-integration.
[9] NERC. 2023. "Quick Reference Guide: Inverter-Based Resource Activities." www.nerc.com/pa/Documents/IBR_Quick%20Reference%20Guide.pdf.
[10] SETO. Solar Integration: Inverters and Grid Services Basics. www.energy.gov/eere/solar/solar-integration-inverters-and-grid-services-basics.

These efforts are focused on the development of hardware and software tools that will enable the widespread deployment and rapid integration of solar plus storage into the transmission and distribution (T&D) systems.[11, 12, 13, 14] The transmission system is the high-voltage system used to move large amounts of power between regions, while the low-voltage distribution system delivers power to consumers. These tools include sensors and communications technologies to increase real-time situational awareness and visibility of the impact of solar generation on the T&D system, which enables system operators to make optimal decisions.[15, 16] Other research efforts have focused on the operations of power systems during weather and human-made extreme events, including physical or cyberattacks, to enhance grid security and resilience, using solar photovoltaics (PV), energy storage, and other DERs.[17, 18]

The large-scale deployment of IBRs and other DERs, such as electric vehicles/electric vehicle supply equipment (EV/EVSE), buildings, and other clean energy technologies, is changing the characteristics of power grid operations. Traditional operations of power systems are based on a centralized approach where electricity is generated in one location and transmission lines carry the power flow to the distribution system and then to the users. With the introduction of IBRs, the traditional centralized power grid is transitioning to a more decentralized and distributed grid that will require coordination of large numbers of diverse and geographically dispersed IBRs, DERs, and other clean energy technologies. Furthermore, utility-scale PV systems, microgrids, rooftop PV systems, and commercial and industrial solar energy systems generate different amounts of electricity at variable times. Coordinating the operations of these assets is crucial to ensure alignment of supply with demand and maintain grid reliability.

[11] SETO. Solar Research and Development Funding Programs. www.energy.gov/eere/solar/solar-research-and-development-funding-programs.
[12] SETO. Sustainable and Holistic Integration of Energy Storage and Solar PV (SHINES). www.energy.gov/eere/solar/sustainable-and-holistic-integration-energy-storage-and-solar-pv-shines.
[13] SETO. Funding Notice: Operation and Planning Tools for Inverter-Based Resource Management and Availability for Future Power Systems (OPTIMA). www.energy.gov/eere/solar/articles/funding-notice-operation-and-planning-tools-inverter-based-resource-management.
[14] SETO. Enabling Extreme Real-time Grid Integration of Solar Energy (ENERGISE). www.energy.gov/eere/solar/enabling-extreme-real-time-grid-integration-solar-energy-energise.
[15] SETO. Advanced Systems Integration for Solar Technologies (ASSIST): Situational Awareness and Resilient Solutions for Critical Infrastructure. www.energy.gov/eere/solar/advanced-systems-integration-solar-technologies-assist-situational-awareness-and.
[16] SETO. Solar and Wind Grid Services and Reliability Demonstration Funding Program. www.energy.gov/eere/solar/solar-and-wind-grid-services-and-reliability-demonstration-funding-program.
[17] SETO. Renewables Advancing Community Energy Resilience (RACER) Funding Program. www.energy.gov/eere/solar/renewables-advancing-community-energy-resilience-racer-funding-program.
[18] SETO. Solar Integration: Distributed Energy Resources and Microgrids. www.energy.gov/eere/solar/solar-integration-distributed-energy-resources-and-microgrids.

The transition to a digitally controlled, decentralized, and distributed grid will require novel methods for grid operations. These methods will take into consideration multiparty ownership and management of thousands of digitally controlled assets such as IBRs and DERs, including smart EV charging and home and building energy management systems. Furthermore, new operation methods are needed to ensure reliability and security at the device, plant, and system levels for T&D grids.

Beyond technical and operational challenges, the clean energy transition is also introducing new stakeholders who have not traditionally played a role in electricity generation, transmission, and distribution. These new stakeholders include non-utility DER asset owners and operators of different solar installations, such as community microgrids, aggregators, and virtual power plants (VPPs).[19] The role of the end customer will be vital as they adopt and actively manage more clean energy technologies. Involvement of these nontraditional stakeholders is creating opportunities for new distribution systems operator (DSO) models to provide equitable access and participation in electricity markets.[20]

Projects funded under this FOA will develop software tools to accurately represent solar IBRs to increase confidence in modeling of power systems. In addition, projects will experiment with design, implementation, and field demonstration of novel DSO models that consider technology development and demonstration as well as the roles and responsibilities of nontraditional stakeholders in potential distribution electricity services and markets.

Projects funded under this FOA will address near-term and long-term challenges in operating electric power grids with large deployments of solar energy systems and other DERs. This FOA has two topic areas:

Topic 1: Robust Experimentation and Advanced Learning for DSOs. This topic will fund the development and demonstration of DSO models and supporting technologies to enable fast, resilient, secure, and equitable integration and operation of distributed solar PV and energy storage while maximizing their value. The DSO models will also consider other distributed energy technologies, such as community microgrids, VPPs for residential, commercial, and industrial customers, EVs, and energy-efficient building and demand-side management services. The technical, market, and grid services requirements defined for the developed DSO models will be validated through rigorous field demonstrations.

[19] DOE. Virtual Power Plants. www.energy.gov/lpo/virtual-power-plants.
[20] Federal Energy Regulatory Commission (FERC). September 2020. "FERC Order No. 2222: Fact Sheet." ferc.gov/media/ferc-order-no-2222-fact-sheet.

Topic 2: Improved Simulation Tools for Large-Scale IBR Transient and Dynamic Studies. This topic is co-funded by SETO and EERE's Wind Energy Technologies Office (WETO). The topic will support the development of software tools and methodologies to improve the ability of power system engineers to study power systems dynamics accurately and efficiently in a system with large numbers of IBRs that are geographically dispersed.

Successful projects in both topics of this FOA will bring together diverse teams of research and development partners from:

- Universities and national laboratories
- Industry partners, such as original equipment manufacturers and software vendors
- Electric industry stakeholders, such as T&D utilities and independent system operators (ISOs)
- New electricity service stakeholders, such as DER owners, operators, and aggregators
- End-use stakeholders, such as local communities and individual customers.

Industry partners should work with researchers throughout the technology development phases to ensure practical designs are used and to create prototypes that are viable for commercialization and broad adoption. Project teams should include active participation by electric utilities to ensure that solutions are developed to aid the grid planners and operators and to accelerate their adoption and use. Project teams should also actively involve nontraditional generator owners and operators as well as end-use communities and customers to make sure the developed technologies and business models are meeting their needs.

iii. Teaming Partner List

DOE is compiling a Teaming Partner List to facilitate the formation of project teams for this FOA. The Teaming Partner List allows organizations that may wish to participate on a project to express their interest to other applicants and explore potential partnerships.

The Teaming Partner List will be available on EERE eXCHANGE and will be regularly updated to reflect new teaming partners who provide their organization's information.

SUBMISSION INSTRUCTIONS: View the Teaming Partner List by visiting the EERE eXCHANGE homepage and clicking on "Teaming Partners" within the left-hand

navigation pane. This page allows users to view published Teaming Partner Lists. To join the Teaming Partner List, submit a request within eXCHANGE. Select the appropriate Teaming Partner List from the drop-down menu and fill in the following information: Investigator Name, Organization Name, Organization Type, Topic Area, Background and Capabilities, Website, Contact Address, Contact Email, and Contact Phone.

DISCLAIMER: By submitting a request to be included on the Teaming Partner List, the requesting organization consents to the publication of the above-referenced information. By facilitating the Teaming Partner List, DOE is not endorsing, sponsoring, or otherwise evaluating the qualifications of the individuals and organizations that are identifying themselves for placement on this Teaming Partner List. DOE will not pay for the provision of any information, nor will it compensate any applicants or requesting organizations for the development of such information.

B. Topic Areas

i. Topic Area 1: Robust Experimentation and Advanced Learning for Distribution System Operators

Topic Objectives

This topic will fund the development and demonstration of DSO models and supporting technologies to enable fast, resilient, secure, and equitable integration and operation of distributed solar PV and energy storage and maximize the value of these assets. Project teams will address the technical and market opportunities and challenges associated with the adoption of DSO models considering the characteristics of IBRs and DERs in distribution systems and their efficient operations to provide system-wide services. The projects under this topic will also develop and demonstrate technologies to transform distribution systems operations, such as sensors, data analytics, communications technologies support, and distribution management software, including cybersecurity requirements, standards, and practices.

Projects funded under this topic will describe the system architecture and functions of the proposed DSO model and changes in distribution systems planning and operations, including those that are typically provided by traditional regulated distribution utilities. These planning and operations processes will be expanded to incorporate new functions that would enable grid services provided by aggregated and distributed behind-the-meter solar generation and energy storage located on the sub-transmission and distribution networks while minimizing solar curtailment. In addition, DSO models will enable the management of “systems of systems” such

as aggregation of community and merchant microgrids. It is envisioned that the projects will also investigate the viability of the integration of non-traditional participants, such as nonprofit or third-party for-profit organizations, and inform investments required for grid infrastructure upgrades. Under this topic, projects should also include the pathways for the evolution of existing regulated utilities. As such, the evaluations will be conducted with distribution utilities operating as potential DSOs and deploying the tools, business models, and grid management strategies of a DSO.

Furthermore, DSO models developed under this topic should consider solar generation assets located in underserved communities and facilitate their participation in electricity markets, whenever possible.

Background and Context

The increased deployment of different types of solar-plus-storage systems opens the door for new stakeholders to participate in power generation and electricity markets. The clean energy transition creates opportunities for exploration, experimentation, adoption, and deployment of DSO models.[21, 22, 23, 24, 25, 26, 27, 28]

In this FOA, a DSO model builds on a market-based platform to facilitate the efficient deployment and operations of distributed generation resources, including distributed solar PV and energy storage. A DSO would control the dispatch of energy from DERs into the electricity system within a distribution area to achieve one or more system-level objectives. Ideally, a DSO would facilitate market-based compensation of distribution grid services. This would allow customers with distributed solar energy resources and other controllable DER assets to monetize their grid value while providing more options and transparency for grid operators to

[21] Energy KnowledgeBase. Distribution system operator (DSO). energyknowledgebase.com/topics/distribution-system-operator.asp.
[22] Iberdrola. DSO (Distribution System Operator). www.iberdrola.com/innovation/distribution-system-operation.
[23] International Renewable Energy Agency (IRENA). 2019. "Future Role of Distribution System Operators: Innovation Landscape Brief." www.irena.org/-/media/Files/IRENA/Agency/Publication/2019/Feb/IRENA_Landscape_Future_DSOs_2019.pdf.
[24] Black & Veatch. "Distribution System Operator (DSO) Models for Utility Stakeholders." www.bv.com/perspectives/organizational-models-digital-distributed-modern-grid/.
[25] Kristov, L. August 2022. "DSO 101: Designing and Comparing DSO Models." gridworks.org/wp-content/uploads/2022/08/Kristov_DSO101_8.23.22.pptx.pdf.
[26] Gridworks. March 2022."Evaluating Alternative Distribution System Operator Models for California." gridworks.org/wp-content/uploads/2022/03/Evaluating-Alternative-DSO-Models-for-California.docx.pdf.
[27] Euroelectric. December 2020. "Distribution Grids in Europe." cdn.eurelectric.org/media/5089/dso-facts-and-figures-11122020-compressed-2020-030-0721-01-e-h-6BF237D8.pdf.
[28] Southern California Edison. Integrated Distributed Energy Resources Partnership Pilot. https://www.sce.com/business/savings-incentives/integrated-distributed-energy-resources-partnership-pilot.

ensure reliability.[29] In this FOA document, "DSO" will also be used to refer to similar roles, such as distribution network operators, distribution service providers, and energy service companies.[30, 31, 32]

Unlike traditional distribution systems, a digitally controlled, decentralized, distributed, and decarbonized grid must reliably operate under highly variable generation conditions. Furthermore, this modern grid must withstand extreme weather events and cyber threats.[33] In addition, non-traditional stakeholders such as community microgrid operators, distribution-level aggregators, and other organizations have increasing capabilities to participate in electricity markets.

Traditional business models for distribution systems are not able to address many of these new challenges. New or existing DSO models could enhance the reliability and resilience of the distribution system, provide grid services, and unlock the value of ubiquitous DERs. These DSO models could also facilitate equitable participation of non-traditional stakeholders, such as VPPS and community microgrids, operating in disadvantaged communities.[34, 35]

Historically, distribution utilities are regulated entities. However, since the start of the deregulation in the 1980s, there have been some attempts (such as in California, New York, and Texas) to bring competition to the retail function of distribution utilities.[36, 37, 38] The rapid deployment of distribution-level solar-plus-storage, in

[29] California Public Utilities Commission. 2020. "Appendix B: An Overview of Distribution System Operator Models." docs.cpuc.ca.gov/PublishedDocs/Published/G000/M386/K856/386856808.pdf.
[30] Anaya, K. L., and M. G. Pollitt. November 2015. "The Role of Distribution Network Operators in Promoting Cost-Effective Distributed Generation: Lessons from the United States of America for Europe." *Renewable and Sustainable Energy Reviews*, Vol. 15. doi.org/10.1016/j.rser.2015.05.046.
[31] Ross, S. C., et al. 2019. "Coordination between an Aggregator and Distribution Operator to Achieve Network-Aware Load Control." *2019 IEEE PowerTech*. doi.org/10.1109/PTC.2019.8810635.
[32] Just, L., and H. Wetzel. "Distributed Generation and Cost Efficiency of German Electricity Distribution Network Operators." Institute of Energy Economics at the University of Cologne (EWI). www.econstor.eu/bitstream/10419/240957/1/EWI-WP-20-09.pdf.
[33] DOE. October 2022. "Cybersecurity Considerations for Distributed Energy Resources on the U.S. Electric Grid." www.energy.gov/sites/default/files/2022-10/Cybersecurity%20Considerations%20for%20Distributed%20Energy%20Resources%20on%20the%20U.S.%20Electric%20Grid.pdf.
[34] Loutan, C., et al. 2017. "Demonstration of Essential Reliability Services by a 300-MW Solar Photovoltaic Power Plant." NREL. www.nrel.gov/docs/fy17osti/67799.pdf.
[35] DOE. Justice40 Initiative. www.energy.gov/justice/justice40-initiative.
[36] California Public Utilities Commission. Direct Access. www.cpuc.ca.gov/consumer-support/consumer-programs-and-services/electrical-energy-and-energy-efficiency/community-choice-aggregation-and-direct-access-/direct-access.
[37] Bade, G. May 2016. "New York PSC Enacts New Revenue Models for Utilities in REV Proceeding." Utility Dive. www.utilitydive.com/news/new-york-psc-enacts-new-revenue-models-for-utilities-in-rev-proceeding/419596/.
[38] Electric Choice. February 2021. "The Ultimate Guide to Texas Electricity Deregulation." www.electricchoice.com/blog/guide-texas-electricity-deregulation.

addition to other DERs, offers a new opportunity to experiment with DSO models through hardware-in-the-loop testing, technoeconomic and community benefits analysis, and field demonstrations. More research is needed to ensure DSO models would be technically, economically, and equitably viable for different regions of the United States with different electric power market regulations.

DSO models have also been adopted in different parts of the world.[39, 40] The design of these models is different depending on the countries and regions. A common trait of these DSO models is the interaction between operational technology (OT) and information technology (IT) from several organizations and entities that the model supports. The IT/OT interactions support critical functions for multiple stakeholders such as, but not limited to:

- Wholesale electricity providers and/or an ISO
- Distribution network, wires, and equipment owners
- DER owners and/or aggregators
- Merchant microgrid and VPP operators
- Consumers
- Market-based consumer services and products.[26, 32, 41]

For this FOA topic, a generic DSO model is illustrated in Figure 3. The organizations and functions shown in the figure are not meant to be all-inclusive or prescriptive. The figure shows critical layers and entities that should be considered in new DSO models, which serve as the platforms to provide electricity services and to balance the generation and load in distribution systems. In addition, software and hardware technologies, communications technologies, and cybersecurity are needed for the DSO models to be effectively implemented in different regions of the United States based on the local regulatory and organizational requirements and constraints. Roles and responsibilities for each entity must be determined and assigned to manage DERs for their robust dispatch and operation. DSO models should support reliability and resilience through grid services by DERs, including but not limited to voltage and frequency support, and islanding, including re-energization or black-start strategies. In addition, DSO models should enable financial market products to incentivize distribution network services, upgrades, and maintenance.

It is expected that the implemented DSO models should utilize several layers of control, information, and operational technologies and provide services to several

[39] Seetalabs. June 2023. "Energy Transition with Distribution System Operators in Europe." seetalabs.com/asset-management-strategies-of-european-distribution-system-operators/.
[40] Lyons, C., and J. Pang. "Decarbonization and RIIO in the United Kingdom." Scott Madden Management Consultants. www.scottmadden.com/insight/decarbonization-riio-united-kingdom/.
[41] Clean Coalition. Distribution System Operator (DSO): A New Model Whose Time Has Come for Modernizing Our Energy System. clean-coalition.org/distribution-system-operator-dso.

types of customers on distribution networks.[42] These may include industrial, commercial, and residential customers. The DSO functions are expected to include, but not be limited to, fast monitoring and control of active distributed solar energy sources, energy storage, and other DERs. In addition, projects under this topic will demonstrate the integration of conventional operational and information technologies with new technologies.

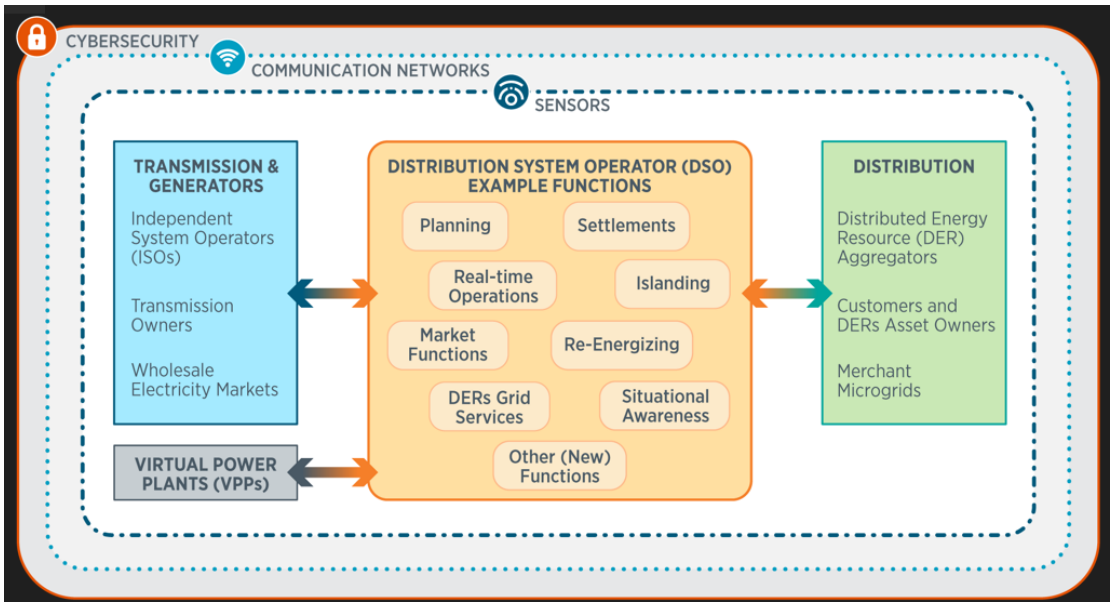

Figure 3. Generic DSO model illustration

Emerging Challenges and Problem Statement

Distribution network planning and operations have historically been performed by utilities as part of traditional grid functions. The planning and operating procedures must be modified for system-wide control and optimized coordination of IBRs and DERs. These modifications will support increasing distributed energy generation as well as capacity, the majority of which is solar PV plus battery energy storage, and the introduction of enhanced inverter control functions for reliability and resilience as well as economic operations.[43, 44, 45] Additionally, these modifications should consider grid services utilizing DER and solar capacity.[34] Furthermore, increasing

[42] Taft, J. D. November 2016. "Comparative Architecture Analysis: Using Laminar Structure to Unify Multiple Grid Architectures." DOE. gridarchitecture.pnnl.gov/media/advanced/Comparative%20Architecture%20Analysis-Final.pdf.
[43] Pacific Gas and Electric. October 2018. "Enabling Smart Inverters for Distribution Grid Services." www.pge.com/content/dam/pge/docs/about/corporate-responsibility-and-sustainability/PGE-EPIC-Project-2.03A-Joint-IOU-SI-White-Paper.pdf.
[44] Stenclik, D., et al. 2017. "Maintaining Balance: The Increasing Role of Energy Storage for Renewable Integration." *IEEE Power and Energy Magazine*, vol. 15, no. 6. ieeexplore.ieee.org/document/8070540.
[45] PNNL. Grid Architecture: Advanced Concepts. DOE. gridarchitecture.pnnl.gov/advanced-concepts.aspx.

curtailment of solar and wind has been reported recently.[46] DSOs' integrated planning and operation practices can help minimize these curtailments.[32] DSO models will be able to expand on and complement the traditional distribution planning and operation process to increase deployment of IBRs and DERs. Other concepts, such as flexible interconnection requirements and dynamic hosting capacity for solar PV, as opposed to today's prevalent "firm" interconnection requirements and static hosting capacity planning, can be adopted by DSOs to encourage higher penetration of rooftop PV and other DERs.

DSO models typically include planning and operations procedures in addition to requirements that can be more efficiently performed and met by utilizing existing electricity market products.[47] There are wholesale market products already in place for ISOs, which DSOs may use as baselines for DERs. The grid services supplied by DERs would be utilized to improve the reliability and resilience of the grid, reduce the cost of energy, and ease the planning and maintenance of the grid. These new DSO models must enable the use of different types of DER technologies and consider effects on adjacent or co-located systems or customers. These new models will need to provide more active load balancing to enable greater incorporation of new loads from buildings, industry, and transportation due to decarbonization. The competitive market structure and financial products offered for distribution networks through developed DSO models would facilitate and incentivize merchant microgrid and VPP operators, which could potentially contribute to resilience and equity in underserved communities.[48, 49, 50] New DSO models will support mitigating adverse transient events seen at sub-transmission and distribution systems levels due to aggregated amounts of distributed solar.[51] These events could lead to voltage and frequency stability problems and gaps in situational awareness. In addition, to mitigate adverse impacts to the system, models should provide grid congestion management in regions where distribution utilities have new deployment of solar.[52]

[46] Kamwa, I., et al. 2024. "Taming Wind and Solar Resources: Smart Inverters are Key [Editor's Voice]." *IEEE Power and Energy Magazine*, vol. 22, no. 2. ieeexplore.ieee.org/document/10444643/figures#figures.
[47] Klingel, J., and S. McCafferty. "The Business of Electricity: Will Distribution Markets Dominate?" Black & Veatch. www.bv.com/perspectives/business-electricity-will-distribution-markets-dominate/.
[48] Gregus, N. April 2022. "How to Leverage Commercial Microgrids." Energy Link. goenergylink.com/blog/how-to-leverage-commercial-microgrids/.
[49] Ton, D. T., and M. A. Smith. 2012. "The U.S. Department of Energy's Microgrid Initiative." *The Electricity Journal.* www.energy.gov/sites/prod/files/2016/06/f32/The%20US%20Department%20of%20Energy's%20Microgrid%20Initiative.pdf.
[50] Enchanted Rock. Reinventing Electrical Resiliency for the Retail and Distribution Industries. enchantedrock.com/grocery-and-distribution/#:~:text=A%20microgrid%20can%20support%20a,offset%20microgrid%20cost%20of%20ownership.
[51] NERC. April 2022. "Multiple Solar PV Disturbances in CAISO." www.nerc.com/pa/rrm/ea/Documents/NERC_2021_California_Solar_PV_Disturbances_Report.pdf.
[52] Ghazvini, M. A. F., et al. March 2019. "Congestion Management in Active Distribution Networks through Demand Response Implementation." *Sustainable Energy, Grids, and Networks*, Vol. 17. www.sciencedirect.com/science/article/pii/S2352467718300699.

DSO models will support coherent orchestration and management of several hundred devices capable of generating electricity and participating in the distribution electricity market. Smart home management systems could handle devices within residences and lessen the burden of the smart technologies required at the aggregation point. Such smart home management systems, when they become standard, will also enable the fast and secure interconnection of new rooftop PV, EV/EVSE, and BESS.

Electric power system operators and planners must gain confidence in DSO models and their ability to serve customers using mainly distributed solar generation and energy storage, with support from other DERs, while maintaining high levels of reliability and resilience. The DSO models need to be demonstrated at a scale representative of the power grid to set precedents for designing and introducing new tariff requirements, contract options, and electric power market products. Such demonstrations must be implemented under conditions where the instantaneous penetration of renewables is high enough to provide confidence in reaching the renewable and clean energy targets adopted by the federal government and many states. These demonstrations should provide enough historical data and experience to derive robust requirements for telecommunications infrastructure needed for real-time response from the distributed solar generation units, energy storage, and other participating DERs.

Past Funding Efforts

SETO's previous funding efforts focused on developing capabilities and applications for advanced distribution management systems and DER management systems are key for successfully implementing DSO models. Below are relevant examples of funding programs that built the foundation for technologies and concepts that could be utilized for this topic.

- The Sustainable and Holistic Integration of Energy Storage and Solar PV (SHINES) program funded the development and demonstration of integrated, scalable, and cost-effective technologies that incorporated PV solar, energy storage, and DERs and worked seamlessly to meet the needs of both the consumer and the electricity grid.
- The Operation and Planning Tools for Inverter-Based Resource Management and Availability for Future Power Systems (OPTIMA) funding program supported the development and demonstration of next-generation operations and planning tools.
- The ENabling Extreme Real-Time Grid Integration of Solar Energy (ENERGISE) program funded projects to improve the scalability of integrating large amounts of distributed PV to the grid by simulating very large electric networks and developing advanced analytical applications and hierarchical control architectures.

- The Advanced System Integration for Solar Technologies (ASSIST) program aimed at increasing the cyber-physical resilience of distribution networks to advance dynamic modeling of utility-scale solar plants, control and coordination strategies, real-time system monitoring, and telecom infrastructure.
- The Solar and Wind Grid Services program supported demonstration projects that integrate variable renewable generation with other large-scale or aggregated DER technologies to provide critical grid-supporting services.
- Data analytics and advanced modeling programs were supported through programs including solar Forecasting II, the Open Energy Data Initiative for System Integration (OEDI-SI) platform under the SETO Fiscal Year 2019–21 Lab Call, and the Big Data Synchrophasor Analysis and other efforts by OE.[53, 54, 55, 56, 57]
- Other DOE research efforts, such as the Connected Communities Program, are also focused on field validation of behind-the-meter technologies, including energy efficiency and demand response programs.[58]

Project Requirements

Projects will focus on enabling DERs to play an integral role in future DSO adoption and deployments. Requirements for the proposed DSO model include, but are not limited to:

- Description of the DSO model that will provide services in distribution networks with hundreds of smart PV and battery inverters that may be called upon to provide different types of grid services for network reliability and resilience support.
- Description of the requirements of the design, implementation, and deployment of any enabling analytics, algorithms, sensors, software/hardware technologies, and communication infrastructure and technologies to support the DSO model functions. The requirements in telecommunication and cybersecurity, including their specifications, should

[53] SETO. Funding Opportunity Announcement: Solar Forecasting 2. www.energy.gov/eere/solar/funding-opportunity-announcement-solar-forecasting-2.
[54] SETO. Solar Energy Technologies Office Lab Call FY2019–2021. www.energy.gov/eere/solar/solar-energy-technologies-office-lab-call-fy2019-21.
[55] SETO. Solar Energy Technologies Office Lab Call FY2022–24. www.energy.gov/eere/solar/solar-energy-technologies-office-lab-call-fy2022-24.
[56] DOE Office of Electricity. Big Data Synchrophasor Analysis. www.energy.gov/oe/big-data-synchrophasor-analysis.
[57] SETO. Solar Energy Technologies Office Fiscal Year 2021 Systems Integration and Hardware Incubator Funding Program. www.energy.gov/eere/solar/solar-energy-technologies-office-fiscal-year-2021-systems-integration-and-hardware.
[58] SETO. Connected Communities Funding Program. www.energy.gov/eere/solar/connected-communities-funding-program.

identify gaps between the existing technologies and the ones needed to successfully operate under the DSO model.

Applicants are encouraged to use DSO models shown to be feasible in the literature and in other countries as baselines. Projects should include descriptions of the requirements of the functionalities of the DSO models, including but not limited to the potential market products and coordination with other energy market entities. In addition, projects should describe how the model will handle congestion, DER aggregation, and measurement, including control data flows.

Projects will complete a field demonstration of their proposed DSO model. Demonstrations will include at least a utility team partner and other non-traditional stakeholders (e.g., community microgrids, aggregators, residential, commercial, and industrial solar installations). Projects will develop a field demonstration plan justifying site selection. Project teams will provide incentives to enable customer participation in the field demonstration. A successful demonstration will include scenarios that will show the DSO functions during normal and abnormal grid conditions (e.g., extreme weather events, grid faults, cyberattacks). In addition, demonstrations will be implemented in electrical networks representative of U.S. power systems.

1. Projects will conduct a comprehensive literature survey on existing DSO models to justify the selection of the DSO model design. Technical gaps will be identified and reported. These include but are not limited to enabling technologies such as faster analytics, controls, sensors, and others.
2. Projects will develop the specifications of selected models in the design phase, which include but are not limited to:
    - Operational requirements and infrastructure.
    - Planning activities required to support the DSO model to integrate traditional generation resources, along with distributed IBR and DER technologies.
    - A list of potential DSO market products that incentivize investments for infrastructure upgrades and deployment of new technologies.
    - Reliability and resilience metrics that must be incorporated.
    - Test scenarios and validation metrics for hardware-in-the-loop (HIL) and field demonstration under normal conditions and abnormal cyber and physical events.
    - A list of grid services, including those by IBRs and DERs, such as voltage/reactive support and fast frequency response, that will be supported by the DSO model.
    - Software and hardware technology innovations to support the proposed DSO model, including sensors, analytics, and algorithms with consideration of system constraints, e.g., stability margin, capacity limitations, operational envelope, and hosting capacity.

- Telecommunications and cybersecurity requirements.

3. Projects will conduct HIL testing to validate the feasibility and viability of the proposed DSO model. These include the following:
    - Must cover a minimum of a 3-month period of simulated DSO operation to cover various scenarios that will enable a thorough technoeconomic analysis.
    - The size of the modeled distribution system (including substations, feeders, and DER devices) must be large enough to meaningfully assess the performance of the DSO model used.
    - Must include supporting IT/OT technologies and tools, e.g., telecommunication, sensor, PV, and battery inverters, microgrid controllers, energy management software, and cybersecurity.
    - Must be scalable with increasing penetration levels of distributed solar PV plus BESS capacity relative to present-day distribution system peak load, from 50% up until 100% is reached.
    - It is encouraged that the HIL testing simulation includes other DER technologies that are supported by the selected DSO model, including EV/EVSE, home and building energy management systems, demand response programs, and microgrids.
    - Must simulate the DER energy and grid services market products in the DSO model.
4. Projects will conduct field demonstration of the proposed DSO model. This includes the following:
    - Must have a demonstration period of at least 3 months and take place during the season with the peak sun hours for the field demonstration location.
    - Must include the participation of a distribution grid operator—either vertically integrated or regulated distribution utility. The distribution utility will be able to interact with the balancing authority and/or ISO in its region.
    - The size of the distribution system must be large enough to meaningfully assess the performance of the DSO model.
    - Must include solar PV, BESS, and other owners/operators, as individual systems or in aggregate with significant installed capacities. It is encouraged to include community-owned microgrids or other solar installations located in disadvantaged communities.
    - Must demonstrate the ability of IBRs (individually or in aggregate) to respond to control signals of electric power markets, including those for grid services, under the proposed DSO model.
    - Must demonstrate DSO entities and their interactions, including ISOs, distribution utilities, VPPs, microgrid operators, and DER aggregators.
    - It is encouraged to include other DER technologies that are supported by a selected DSO model, including EV/EVSE, home and building

energy management systems, demand response programs, and microgrids.
    - Must demonstrate the DER energy and grid services market products in the DSO model.
5. Projects must conduct a technoeconomic analysis to determine the viability of implementation and adoption of the DSO model. In addition, the analysis will provide information about the system-wide benefits of adopting the selected DSO model in comparison to existing utility business models. Specific metrics should be established to measure the benefits and costs of implementing the selected DSO model.
6. Utilities, industry, national laboratories, academia, nonprofits, and for-profit organizations and others are encouraged to submit applications. Project teams must include a distribution utility as a demonstration partner. Different types of utilities, including vertically integrated utilities, are encouraged to participate in this program. In addition, teams should include non-traditional energy providers, including but not limited to community microgrids, VPPs, and DER aggregators.

DOE is taking a coordinated research approach in which selected projects will serve as a cohort to share challenges and best practices between project teams and publicly. This will allow DOE to synthesize information across many projects that include multiple building types, applications, vintages and sectors, climates, DERs, electricity regulatory and market environments, occupancy/programmatic approaches, business models, and occupant impact in an effort to scale innovation. The cohort will be supported by a national coordinator, which will result in additional convenings (virtual and in person) and additional reporting requirements across the cohort.

Applications Specifically Not of Interest for Topic 1

- Projects that do not include solar PV or include only utility-scale solar farms.
- Projects that are only focused on microgrid demonstrations.
- Projects that only focus on technology development and demonstration without experimentation and applications to DSO models, or vice versa.
- Projects that are only focused on conceptual feasibility studies of DSO models and do not include technology implementation and field demonstrations.
- Projects that are solely focused on demonstrations of new home and building management systems, or EV/EVSE technologies.

ii. Topic Area 2: Improved Simulation tools for Large-Scale IBR Transient and Dynamic Studies

Topic Objectives

This topic area is co-funded by SETO and the Wind Energy Technologies Office (WETO). WETO invests in wind energy RDD&D activities that enable and accelerate the innovations needed to:

- Advance offshore, land-based, and distributed wind systems
- Reduce the cost of wind energy
- Drive deployment in an environmentally conscious manner
- Facilitate the integration of high levels of wind energy with the electrical grid.[59]

This topic area seeks to fund the development of software tools that will improve the ability of power system engineers to study the dynamics of power systems with large numbers of IBRs more accurately and efficiently. Such improved simulation tools should enable studies of a larger number of accurately modeled IBRs and larger sections of the power grid. Project teams should validate the improved speed and accuracy of their tools on emerging dynamic use cases that are challenging to address with current state-of-the-art tools.

Since these tools will be needed to effectively plan and operate a digitally controlled, decentralized, and distributed grid, projects must include a planned roadmap for near-term industry adoption. Various pathways for industry adoption can be considered under this topic area, including:

- Improvements to existing prototype or open-source software to encourage further industry adoption, such as better user interfaces or overall ease of use.
- Major high-risk developments to existing commercial software platforms.
- Partnerships between universities or national labs and software developers to develop plans to commercialize research efforts.

Applicants should be aware of another recent funding effort co-funded by both SETO and WETO, the Solar and Wind Interconnection for Future Transmission (SWIFTR) FOA released under the Interconnection Innovation e-Xchange program to improve the efficiency and speed of interconnection studies that use electromagnetic transient (EMT) analysis.[60, 61] The SWIFTR FOA also includes a topic that similarly seeks to improve the computational speed of EMT analysis. However, the focus there is on existing commercial EMT software packages used by industry

[59] WETO. Renewable Systems Integration. www.energy.gov/eere/wind/renewable-systems-integration.
[60] DOE. Funding Notice: i2X Solar and Wind Interconnection for Future Transmission (SWIFTR). www.energy.gov/eere/i2x/funding-notice-i2x-solar-and-wind-interconnection-future-transmission-swiftr.
[61] EERE. i2X: The Interconnection Innovation e-Xchange. www.energy.gov/eere/i2x/interconnection-innovation-e-xchange.

and methods of speeding up the use of these packages specifically to perform interconnection studies. In contrast, the goal of this topic area is to broadly consider the challenges of simulating the dynamics of large numbers of IBRs as well as large sections of the power system at sufficient fidelity to capture the emerging transient and dynamic behavior related to IBRs. Therefore, proposals under this topic will be required to develop tools that enable the study of a broader range of emerging system dynamics and stability issues, beyond interconnection studies.

Background and Context

Power system planners and operators rely on models of their electrical networks to simulate how electricity will flow through the network for a given state of the system or when changes to the system, such as a sudden loss of generation or a fault, cause electric power flows to change dynamically. Traditional simulation tools to study power system dynamics rely on the balanced nature of the three-phase bulk power system and its representation in the phasor domain to simplify computations and make large-scale studies possible. These are typically referred to as positive sequence tools, such as Siemens's PSS®E, GE's PSLF, or PowerWorld, and they rely on these simplifying assumptions to run simulations in millisecond time steps.[62] However, the faster dynamics and nonlinearities that are introduced by IBRs, such as solar and wind generators, cannot be accurately represented in these traditional tools.[63, 64] This has led engineers to utilize EMT simulation tools to study cases that involve large numbers of IBRs, such as future power system scenarios where a decarbonized grid may be largely supplied by IBRs.

EMT simulation tools were originally designed to capture faster dynamics of the power system where the electromagnetic dynamics of transmission lines and equipment would have noticeable impacts on network equipment, such as lighting propagation and switching surges. However, to accurately model and capture these faster dynamics, more complex equipment models and much smaller simulation time steps are required. As shown in Figure 4, these fast time scale power system phenomena require study at orders of magnitude smaller time scales than most power system dynamics, which results in specialized EMT simulation software being developed separately from other power system simulation tools.

[62] Ciemny, K. October 2023. "EMT Inverter-Based Resource Plant Modeling: How Consultants, Developers, OEMs, and Grid Operators Can Create Best Practices Together." Telos Energy. www.esig.energy/download/emt-inverter-based-resource-plant-modeling-kelsey-ciemny/?wpdmdl=10756&refresh=653fe6ba9180c1698686650.
[63] Boemer, J., et al. March 2021. "State of the Art Gap Analysis of PV Models." EPRI. publicdownload.epri.com/PublicAttachmentDownload.svc/AttachmentId=74498.
[64] Rahimi, E. August 2023. "EMT Studies in CAISO." ORNL. emtworkshop.ornl.gov/wp-content/uploads/2023/09/2.-CAISO_ORNL_EMT_Workshop.pdf.

In more recent years, existing commercial EMT simulation platforms, such as PSCAD[65] or EMTP,[66] have been updated to also include highly accurate IBR models, including the power electronic switching devices running the actual code on an inverter in the field. However, integrating IBR models into EMT platforms to run traditional dynamic studies results in much slower computation times, by up to several orders of magnitude compared to traditional simulation tools, or on the order of tens of hours to days.[67] In addition to the slower computation time, building EMT-level models of networks and equipment and validating the larger sets of parameters typically take more engineering resources and time.

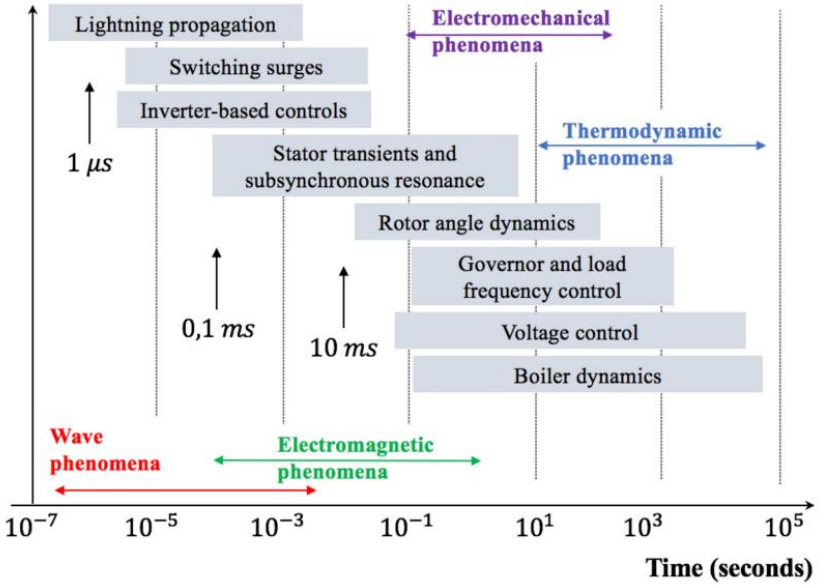

Figure 4. Time scales of different power system phenomena[68]

While commercial EMT software packages tailored for power systems are the primary tools currently used by the industry to study these issues, other tools are under development that may become attractive alternatives. For example, the Electric Power Research Institute (EPRI) maintains an open-source power system solver, originally developed for distribution networks, that has recently been expanded to include dynamic simulation.[69] In Europe, the use of slightly more complex time-domain, unbalanced, dynamic simulation tools, such as DIgSILENT

[65] PSCAD. www.pscad.com/.
[66] EMTP. www.emtp.com/.
[67] Choi, J., and S. Debnath. April 2021. "Electromagnetic Transient (EMT) Simulation Algorithm for Evaluation of Photovoltaic (PV) Generation Systems." DOE Office of Scientific and Technical Information. www.osti.gov/biblio/1817500.
[68] Hatziargyriou, N., et al. July 2021. "Definition and Classification of Power System Stability – Revisited & Extended." *IEEE Transactions on Power Systems*, vol. 36, no. 4. ieeexplore.ieee.org/document/9286772/.
[69] EPRI. OpenDSS Dynamics Mode. opendss.epri.com/OpenDSSDynamicsMode.html.

PowerFactory,[70] was found to be sufficient for most IBR stability studies, as opposed to EMT simulation.[71] Another platform widely used in the research community but not in commercial practice is the Hierarchical Engine for Large-scale Infrastructure Co-Simulation platform that was developed under DOE's Grid Modernization Laboratory Consortium funding.[72, 73] With this platform, users can tie together multiple different simulation platforms running different time scales and system scales, including T&D co-simulation. Pacific Northwest National Laboratory (PNNL) has also developed a platform to enable the use of parallel or high-performance computing platforms for power system simulations, called GridPACK™.[74]

Simply put, the most accessible, commercially available tools used in the North American power industry were either designed for large power systems with predominantly electromechanical dynamics that can take advantage of many simplifying assumptions or for small, highly detailed sections of the power system studied for very limited windows of time. Power systems engineers currently do not have simulation tools that were designed and optimized to study the high-speed dynamics of a large power system with many IBRs. Therefore, within the context of this topic area, when referring to transient and dynamic simulations, it should be understood that the time scales of interest include both inverter-based controls and electromechanical controls, as shown in Figure 4. Therefore, proposed solutions should consider dynamics across all time scales that are relevant to the inverter-based phenomena being studied, which would include traditionally EMT-level to phasor-domain time scales, as necessary.

Emerging Challenges and Problem Statement

Recent disturbance reports issued by North American Electric Reliability Corporation (NERC) have highlighted how transient events can impact IBRs (both solar and wind generation plants) across wide geographic areas.[75, 76] For example, Figure 4 shows solar plants that tripped offline across a very large geographic region due to a fault near Odessa, Texas, in 2022. Current simulation tools do not model how the solar plant controls and protection systems would respond to dynamics seen across such

[70] DIgSILENT. www.digsilent.de/en/.
[71] Fortmann, J. October 2023. "German Grid Code Compliance Assessment Practice." 2023 ESIG Fall Technical Workshop. www.esig.energy/download/german-grid-code-compliance-assessment-practice-jens-fortmann/?wpdmdl=10766&refresh=653fe6bb54c711698686651.
[72] HELICS. helics.org/.
[73] GMLC. Grid Modernization Laboratory Consortium. gmlc.doe.gov/.
[74] GridPACK. gridpack.pnnl.gov/wiki/index.php/Main_Page.
[75] NERC. August 2023. "2023 Southwest Utah Disturbance." www.nerc.com/comm/RSTC_Reliability_Guidelines/NERC_2023_Southwest_UT_Disturbance_Report.pdf.
[76] NERC. August 2022. "Panhandle Wind Disturbance." www.nerc.com/pa/rrm/ea/Documents/Panhandle_Wind_Disturbance_Report.pdf.

a large section of the power system to sufficiently predict and mitigate such an event.

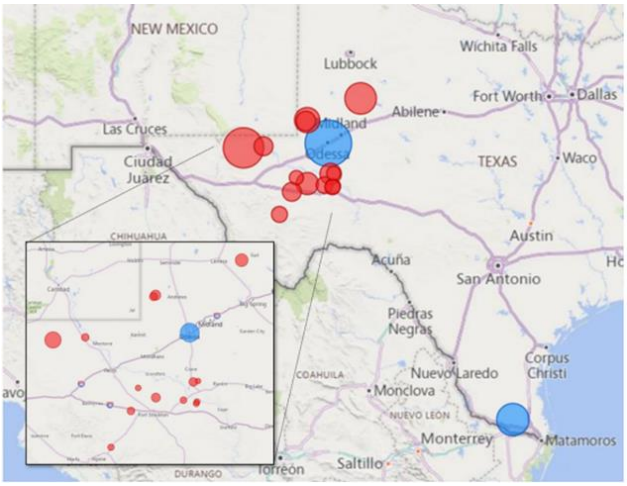

Figure 5. Map of solar plants (red) and other generation (blue) that went offline or stopped producing due to the disturbance reported in the NREC 2022 Odessa Disturbance Report[77]

In addition to the large area of network affected by these events, NERC has concluded that many of the causes of the loss of generation, stemming from the protection and control of the plants' inverters, cannot be sufficiently studied using traditional positive-sequence simulation tools. Therefore, NERC is recommending an increase in the use of EMT-level models and tools to more accurately capture the dynamics presented by IBRs. However, modeling and simulating large areas of the power system network with large numbers of plants modeled at the EMT-level is challenging.

Some of the emerging issues requiring higher-fidelity models and simulations of wide areas of the power grid are the emerging inter-area power oscillations that are thought to be driven by IBR control interactions.[78] Recently, low-frequency power oscillations were observed between IBR plants on Kauai Island, Hawaii, but the observed dynamics could not be replicated using the existing positive-sequence model of the island's grid. However, researchers were eventually able to replicate the dynamics and recommend mitigation strategies by upgrading the power system network model to the EMT domain using vendor-provided IBR models.[79] As these

[77] NERC. December 2022. "June 2022 Odessa Disturbance." www.nerc.com/comm/RSTC_Reliability_Guidelines/NERC_2022_Odessa_Disturbance_Report%20(1).pdf.
[78] Cheng, Y., et al. 2023. "Real-World Subsynchronous Oscillation Events in Power Grids with High Penetrations of Inverter-Based Resources." *IEEE Transactions on Power Systems*, vol. 38, no. 1. research-hub.nrel.gov/en/publications/real-world-subsynchronous-oscillation-events-in-power-grids-with--2.
[79] Tan, J., et al. August 2023. "EMT Simulations for Hawaii Oscillation Events." NREL. emtworkshop.ornl.gov/wp-content/uploads/2023/09/3.-NREL_EMT_Simulation_EMT_Workshop.pdf.

new IBR-related oscillations become more prevalent in power systems, engineers will need tools to identify, locate, and mitigate the source of the oscillations.[80]

Contingency analyses and protection studies are also requiring new simulation methods when studying areas with high penetrations of IBRs. The dynamics of IBRs can cause traditional transmission line relays to not operate as expected.[81] In particular, the power-swing dynamics change based on the amount of IBR generation, which can impact power-swing protection schemes.[82] To understand the impact of these new generation sources on existing protection devices, high-fidelity models and simulations that accurately represent how IBRs behave during and after faults are required. IBR models are being updated in existing software used for protection studies, but more work is needed to drive model standardization, especially as new IBR control standards are adopted.[83]

Another application that requires significant detail to accurately simulate is the black-start procedure. Due to the decreasing number of black-start capable generators in service, engineers at Southern California Edison have recently investigated the use of grid-forming (GFM) BESS as a black-start resource. EMT models of the power system and BESS are used to ensure the BESS can properly energize equipment and motor loads. However, these studies are still time-consuming, and efforts to speed them up are being explored.[84]

Overall, when planning for a decarbonized grid of the future, IBRs will need to be relied upon to provide the same stabilizing operational services that current forms of generation are relied upon to provide.[85, 86] Stability assessments of large regions of the power system may be necessary to understand what proportion of IBRs must be running GFM controls or actively providing ancillary services to support the grid.

[80] Sibeko, B. October 2023. "Operations Challenges Driven by Oscillatory Modes in the Southern African Region." Eskom. www.esig.energy/download/operations-challenges-driven-by-oscillatory-modes-in-the-southern-african-region-bonginkosi-sibeko/?wpdmdl=10788&refresh=653fe6bc8dbd31698686652.
[81] EPRI. July 2019. Impact of Inverter-Based Resources on Protection Schemes Based on Negative Sequence Components. www.epri.com/research/products/000000003002016197.
[82] Bapary, A. "Protection Challenges and Practices for Interconnecting Inverter Based Resources to Utility Transmission Systems." IEEE. resourcecenter.ieee-pes.org/publications/technical-reports/pes_tp_tr81_psrc_wgc32_071520.
[83] Farantatos, E. November 2018. "Short Circuit Modeling for Inverter-Based Resources." EPRI. www.nerc.com/comm/PC/Power%20Plant%20Modeling%20and%20Verification%20Task%20Force/NERC_PPMVTF_Nov6-2018.pdf.
[84] Beskar, M. "Grid Forming Battery Energy Storage System for Black Start Studies." ORNL. emtworkshop.ornl.gov/wp-content/uploads/2023/09/3.-SCE-EMT-Workshop.pdf.
[85] EPRI. July 2021. "Grid Services in the Distribution and Bulk Power Systems: A Guideline for Contemporary and Evolving Service Opportunities for Distributed Energy Resources." www.epri.com/research/products/000000003002022405.
[86] Kahrl, F., et al. October 2021. "Variable Renewable Energy Participation in U.S. Ancillary Services Markets: Economic Evaluation and Key Issues." LBNL. emp.lbl.gov/publications/variable-renewable-energy.

Current software tools fall short of accurately modeling IBRs at the scale and complexity needed to understand these system-level needs.[87]

Past Funding Efforts

DOE has funded many projects to develop software tools to improve the ability of researchers and engineers to accurately model the power system, including the initial development of EMT software at Bonneville Power Administration in the 1960s.[88] Through more recent funding opportunities, SETO has contributed to funding R&D that improves the ability of simulation tools to accurately represent IBR dynamics.

Through the ENERGISE funding program, announced in 2017, SETO funded the development of simulation platforms capable of co-simulating distribution and transmission networks up to 1 million nodes. As part of SETO's FY 2019 funding opportunity, projects were funded to identify the technical gaps in dynamic models of solar inverters. In particular, the EPRI PV-MOD[89] project has identified technology gaps in IBR models in multiple domains, including short-circuit, harmonic, root mean square dynamic, and EMT, and proposed iterative methods for model quality testing and validation. Another project, the Library of Advanced Models of Large-Scale PV, led by Oak Ridge National Laboratory, explored different PV plant model fidelities, including quasi-dynamic and EMT, to achieve both accurate and faster simulations. The project succeeded in replicating a recent PV plant outage to allow the utility to better understand the root cause of the event.[90]

As part of SETO's FY 2022–2024 Lab Call, several projects were funded to study modeling and simulating transient and dynamic behaviors of a power grid that includes distributed PV.[46] One major initiative, OEDI-SI, is an extension of DOE's Open Energy Data Initiative [91] program that will provide a platform to host public-domain data sets and use case study scenarios and algorithms that can run on a variety of commercial and open-source software.[92] Other projects are continuing to improve the dynamic models of IBRs, such as PNNL's DistribuDyn project, so that developing generic phasor and EMT IBR models, including standardized formats, can

[87] Anderson, S. October 2023. "Operational Readiness for Inverter-Based Resources." ESIG. www.esig.energy/download/operational-readiness-for-inverter-based-resources-scott-anderson/?wpdmdl=10787&refresh=653fe6bc7e4481698686652.
[88] EMTP. EMTP® History. www.emtp.com/about-us/emtp-history.
[89] EPRI. Adaptive Protection and Validated MOdels to Enable Deployment of High Penetrations of Solar PV (PV-MOD). www.epri.com/pvmod.
[90] Debnath, S., and J. Choi. 2023. "High Fidelity Modeling of Large-scale PV Plant (IBR) for EMT Simulations." ORNL. emtworkshop.ornl.gov/wp-content/uploads/2023/09/1.-ORNL_High-Fidelity-IBR-EMT-Models_EMT_Workshop.pdf.
[91] OEDI. data.openei.org/.
[92] OEDI. What Is OEDI SI? openei.org/wiki/OEDI-SI/Overview.

be more broadly used in the industry.[93] Other projects under this funding effort are exploring improvements for the fundamentals of the mathematical solvers that form the basis of all dynamic simulation platforms, including Argonne National Laboratory's Scalable Multi-Timescale Analysis Platform and Brookhaven National Laboratory's Solar PLUSprojects.[94, 95] Another notable project is the National Renewable Energy Laboratory's I-PEP[96] project, which is currently exploring several scalability and computational efficiency improvements through phasor-EMT network partitioning and high-performance computing-ready solution parallelization. In addition, WETO and OE are funding PNNL to incorporate wind dynamics and transient models into GridPACK for improved system simulation with high penetrations of wind.[97]

Additionally, in 2021, SETO and WETO funded the Universal Interoperability for Grid-Forming Inverters Consortium to bring together researchers and industry to advance and further define the next generation of inverters—those with GFM capabilities.[98] Under its stated goals, regarding modeling and simulation, the consortium will:

- Develop and validate new GFM models, including open-source EMT, impedance-based, and phasor models.
- Develop model order reduction methods.
- Develop tools to accelerate simulations of various types of IBR studies.
- Improve the industry's understanding of which aspects of power systems physics and controls must be sufficiently modeled to explore different IBR phenomena.

Project Requirements

Successful projects will describe their proposed technologies or research activities to address each of the following four numbered areas of interest. The bullets below each numbered area provide examples of technologies or research activities that would apply to that area.

[93] Du, W. May 2023. "Model Benchmarking of a Droop-Controlled, Grid-Forming Inverter Model (REGFM_A1)." PNNL. www.wecc.org/Administrative/WDu-MVS-Model%20Benchmarking%20REGFM_A1%20Model_May%202023.pdf.
[94] Zhang, P. November 2021. "Solar PLUS: Solar Integration through Physics-Aware Learning Based Ultra-Scalable Modeling and Analytics." BNL. www.energy.gov/sites/default/files/2021-12/Day%202%20-%20Speaker%2011%20-%20Peng%20Zhang%20-%20BNL.pdf.
[95] Zhao, D. November 2021. "Scalable Multi-Timescale Analysis Platform Based on System Transient and Dynamic Models." ANL. www.energy.gov/sites/default/files/2021-12/Day%202%20-%20Speaker%2010%20-%20Dongbo%20Zhao%20-%20ANL.pdf.
[96] Xiong, M., et al. September 2023. "An Open-Source Parallel EMT Simulation Framework." NREL. www.nrel.gov/docs/fy23osti/87164.pdf.
[97] PNNL. GridPACK™: An Open Source Framework for Developing High Performance Computing Simulations of the Power Grid. www.pnnl.gov/projects/gridpacktm-open-source-framework-developing-high-performance-computing-simulations-power.
[98] unifi Consortium. unifing inverters & grids. sites.google.com/view/unifi-consortium/home.

1. Developing simulation software that will improve the ability of power systems engineers to more rapidly and accurately study IBR-related dynamics and transients and their impact on power system stability, for example through:
    - Development and testing of novel simulation platforms that bridge the gap between dynamic phasor analysis and high-fidelity, EMT analysis. This could include co-simulation platforms that link parallel simulations at different time scales, simulation platforms that seamlessly transition between time scales, or platforms that use advanced techniques such as artificial intelligence (AI) or machine learning (ML) to dynamically adjust time scales.
    - Improvements to existing prototype, early-development, or open-source platforms to reduce the barriers to entry and learning curve for new users, including the development of training materials, graphical user interfaces and visualization tools, debugging tools, and streamlined workflows.
    - Validating simulation accuracy and simplification assumptions, as well as system scalability, with real-world data provided by industry stakeholders.
2. Improving the computational efficiency of dynamic and transient simulations of many IBRs in large power systems, for example by:
    - Leveraging sparsity, network segmentation, or equivalent modeling approaches to address large power system networks. This could include platforms that use advanced equivalencing techniques on sections of the power system, such as through AI/ML methods, or platforms that can dynamically adjust the fidelity of regions of the power system network model based on the geographic reach of an event under study.
    - Developing and testing computationally efficient simulation platforms, such as parallel processing, cloud-based solutions, software as a service, or real-time solutions.
    - Further developing other methods to improve simulation time, such as event-based processing, variable time steps, or dynamic model fidelity.
    - Platforms that include detailed and equivalenced (or aggregated) models of the distribution system will also be considered.
3. Developing guidelines for the use of simulation tools and desired outcomes to address real-world challenges related to IBR dynamics and stability, such as:

- Mapping study scenarios of real-world issues (e.g., large phase shift, transient overvoltage) to the necessary fidelity of simulation for study accuracy (e.g., time step, model representation, simplification assumptions).
- Providing guidelines on the size and complexity of system network models required to accurately simulate various dynamic scenarios (e.g., transmission line models, maximum radius of impact for a given fault type).

4. Providing education and training, and disseminating material, such as by:
   - Disseminating results at industry working group meetings, particularly those that will lead to published industry guides.
   - Publishing white papers, articles in industry periodicals, and publicly available training materials, such as websites, webinars, and online videos.
   - Hosting workshop events or developing and running a training course on a small cohort of potential end users to receive feedback on future improvements that will drive further industry adoption.

Table 3 provides a summary of general project requirements.

Table 1. Topic 2 Project Requirements

Features	Requirements
Scalability of power system network under study	• Capable of simulating > 10,000 nodes. • Capable of simulating > 100 detailed IBR plant models consecutively. • Must be capable of simulating wide-area, transmission-level power system networks, but distribution co-simulation or flexible tools that can be used at either transmission or distribution level will be considered.
Level of renewable sources	• Bulk power system network model under study is capable of being modeled up to 100% instantaneous power penetration by IBRs, including solar and battery energy storage resources. • Specific use case based on a real-world event or potential event of interest to utility partner with > 50% instantaneous power penetration of renewable sources, including solar energy.

Minimum set of study cases to validate	• Projects should work with utility partners to develop at least one representative benchmark test case for each of the following study cases:
	  ○ Large-signal disturbances (e.g., faults) that result in:
	  ▪ Sudden phase jump
	  ▪ Instantaneous over/under voltage
	  ▪ Instantaneous over/under frequency
	  ▪ Inverter AC overcurrent
	  ▪ Inverter DC bus voltage unbalance
	  ▪ Inverter PLL loss of synchronism.
	  ○ Inter-area oscillations

	○ Sub-synchronous oscillations, including sub-synchronous control instability ○ IBR islanded operation and loss of last synchronous generator ○ Single-phase switching and unbalanced operation ○ Automatic line reclosing and consecutive faults ○ Operating at/around IBR nonlinear regions ○ Harmonic distortion and flicker.
Improved computational efficiency	• Reduced computation time of a benchmark test case run on a current commercial software platform by > 100x. • Scalability and accessibility of computational resources are viable for most end users.
Improved accuracy of reduced-order simulations	• Demonstrate simulation results within 95% accuracy of an EMT-level simulation with simplified assumptions. • Accuracy must be benchmarked against industry-accepted ground truth test cases representing real-world scenarios of IBR-related challenges.
Validation and data requirements	• Software improvements must be validated against real-world use cases provided by utility stakeholders representing emerging IBR-related challenges. • Project teams must have access to the necessary data for validation, including power system network models, equipment or field measurements, or other validated simulation results.
Training and industry feedback	• Training material must be developed to improve industry access to the project results, such as manuals, websites, or instructional videos. • Project workplans must describe methods to collect end-user feedback on how the software can be improved for greater industry adoption, such as through workshops, surveys, or end-user training cohorts.
Cybersecurity	• Workplan describes how cybersecurity is considered for the proposed tools, especially if they use cloud-based systems.
Commercialization	• Workplan describes how the technology will become more broadly used by industry or developed/integrated into a commercial product in the short term after project completion. • Proposal describes how software developed under this FOA will be distributed (e.g., open source, as part of an existing commercial software package).
Outreach and Dissemination	• Workplan describes plan to disseminate project results broadly to the power system industry, via public webinars, workshops, tutorials, publicly available (online) videos, project websites, and industry periodical articles.
Team partners	• Active participation from utilities and/or ISOs to develop use cases and provide relevant data, including network models, field measurements, or industry validated simulation results. • Active participants in the project must be responsible for contributing to project tasks and milestones and have an associated budget reflecting this participation.

Applications Specifically Not of Interest for Topic 2

- Projects that focus on improvements to the generation interconnection study process, such as proposals for improved engineering workflows, automated study processing, screening tools, or policy studies.

- Projects or project tasks that primarily focus on the development or validation of equipment models, such as inverter, IBR, or aggregated DER and loads, unless necessary for the development of a novel simulation method.
- Development of simulation software focused on the device level, such as for power electronics hardware development.
- Incremental improvements to existing software platforms that would likely be carried out through normal product development without the need for federal funding, such as introducing/improving device models or analysis algorithms.

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

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 Sections 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).

D. Diversity, Equity, and Inclusion

It is the policy of the Biden Administration that:

[T]he Federal Government should pursue a comprehensive approach to advancing equity[99] for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. Affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments, and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity.

[99] The term "equity" means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders, and other persons of color, members of religious minorities, lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons, persons with disabilities, persons who live in rural areas, and persons otherwise adversely affected by persistent poverty or inequality.

By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone.[100]

As part of this whole of government approach, this FOA seeks to encourage the participation of underserved communities[101] and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented[102, 103] in STEM on their project teams. As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from underrepresented groups in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project, along with the extent the project activities will be located in, or benefit underserved communities. The plan should include at least one specific, measurable, assignable, realistic, and time-related (SMART) milestone per budget period supported by metrics to measure the success

[100] Executive Order 13985. January 20, 2021. "Advancing Racial Equity and Support for Underserved Communities Through the Federal Government."

[101] The term "underserved communities" refers to populations sharing a particular characteristic, as well as geographic communities, that have been systematically denied a full opportunity to participate in aspects of economic, social, and civic life, as exemplified by the list of in the definition of "equity." E.O. 13985. For purposes of this FOA, as applicable to geographic communities, applicants can refer to economically distressed communities identified by the Internal Revenue Service as Qualified Opportunity Zones, communities identified as disadvantaged or underserved communities by their respective States, communities identified on the Index of Deep Disadvantage referenced at news.umich.edu/new-index-ranks-americas-100-most-disadvantaged-communities/, and communities that otherwise meet the definition of "underserved communities" stated above.

[102] According to the National Science Foundation's 2019 report titled, "Women, Minorities and Persons with Disabilities in Science and Engineering," women, persons with disabilities, and underrepresented minority groups—Blacks or African Americans, Hispanics or Latinos, and American Indians or Alaska Natives—are vastly underrepresented in the STEM fields that drive the energy sector. That is, their representation in STEM education and STEM employment is smaller than their representation in the U.S. population. See ncses.nsf.gov/pubs/nsf19304/digest/about-this-report. For example, in the United States, Hispanics, African Americans, and American Indians or Alaska Natives make up 24% of the overall workforce, yet they only account for 9% of the country's science and engineering workforce. DOE seeks to inspire underrepresented Americans to pursue careers in energy and support their advancement into leadership positions. See www.energy.gov/articles/introducing-minorities-energy-initiative.

[103] Note that Congress recognized in section 305 of the American Innovation and Competitiveness Act of 2017, Public Law 114-329:

> (1) [I]t is critical to our Nation's economic leadership and global competitiveness that the United States educate, train, and retain more scientists, engineers, and computer scientists; (2) there is currently a disconnect between the availability of and growing demand for STEM-skilled workers; (3) historically, underrepresented populations are the largest untapped STEM talent pools in the United States; and (4) given the shifting demographic landscape, the United States should encourage full participation of individuals from underrepresented populations in STEM fields.

of the proposed actions. This plan will be evaluated as part of the technical review process and incorporated into the award if selected.

Further, Minority Serving Institutions (MSIs),[104] Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or entities located in an underserved community that meet the eligibility requirements (see Section III) are encouraged to apply as the prime applicant or participate on an application as a proposed partner to the prime applicant. The Selection Official may consider the inclusion of these types of entities as part of the selection decision.

E. Authorizing Statutes

The programmatic authorizing statute is Energy Act of 2020 Division Z Sec. 3004(b)(2)(B) (42 U.S.C. 16238(b)(2)(B)).

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

i. Estimated Funding

EERE expects to make a total of approximately $31,000,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 12 to 15 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $1,000,000 and $3,000,000.

[104] MSIs, including Historically Black Colleges and Universities/Other Minority Institutions as educational entities recognized by the Office of Civil Rights (OCR), U.S. Department of Education, and identified on the OCR's Department of Education U.S. accredited postsecondary minorities' institution list. See www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

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

Topic Area Number	Topic Area Title	Anticipated Number of Awards	Anticipated Minimum Award Size for Any One Individual Award (Fed Share)	Anticipated Maximum Award Size for Any One Individual Award (Fed Share)	Approximate Total Federal Funding Available for All Awards	Anticipated Period of Performance (months)
1	Robust Experimentation and Advanced Learning for Distribution System Operators	8-10	$2,500,000	$3,000,000	$22,000,000	36
2	Improved Simulation Tools for Large-Scale IBR Transient and Dynamic Studies	4 – 5	$1,000,000	$2,500,000	$9,000,000	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.

i. Period of Performance

EERE anticipates making awards that will run from 24 months up to 36 months, comprised of one or more budget periods. Project continuation will be contingent upon several elements, including satisfactory performance and Go/No-Go decision. For a complete list, see Section VI.B.xv.

ii. New Applications Only

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

B. EERE Funding Agreements

Through cooperative agreements and other similar agreements, EERE provides financial and other support to projects that have the potential to realize the FOA objectives. EERE does not use such agreements to acquire property or services for the direct benefit or use of the 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.x. of the FOA for more information on what substantial involvement may involve.

ii. Funding Agreements with Federally Funded Research and Development Center (FFRDCs)[105]

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

III. Eligibility Information

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

A. Eligible Applicants

i. Domestic Entities

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

1. Institutions of higher education;
2. For-profit entities;
3. Nonprofit entities; and

[105] FFRDCs are public-private partnerships that conduct research for the U.S. government. A listing of FFRDCs can be found at http://www.nsf.gov/statistics/ffrdclist/.

4. State and local governmental entities and federally recognized Indian Tribes (Indian Tribes).

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

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

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

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

Entities banned from doing business with the 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.

B. Cost Sharing

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

Cost Share 20% and 50%

The cost share must be at least 20% of the total project costs[106] for research and development projects and 50% of the total project costs for demonstration and commercial application projects.[107]. The cost share must come from non-federal sources unless otherwise allowed by law.

The topic area requirements by topic area are as follows:

Topic Area	Cost Share Requirement
1	20% and 50%
2	20%

Examples of activities that would be considered demonstrations under Topics 1 include upgrading fielded controllers, such as IBR firmware or hardware, installing new sensors and communication equipment in solar facilities or on the electric grid, operating and monitoring fielded equipment during a pilot test phase, or testing how software responds to real-time data from field measurements.

If both 20% and 50% cost share are anticipated throughout the project period, each cost share should be labeled as such in the budget justification. DOE will have the final determination regarding cost share requirements.

To help applicants calculate 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 entire project, 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.

[106] Total project costs is the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.
[107] 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.

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 entire project 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.K.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.

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 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:

- 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.
- Use of software already owned or developed by the Recipient or Subrecipient.

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;
- 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 FFRDCs 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:

a. 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.

b. 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.

c. Funding, Cost Share, and Subaward with FFRDCs

The value of and funding for the FFRDC portion of the work will not normally be included in the award. DOE/NNSA FFRDCs participating as a subrecipient on a project will be funded directly through the DOE field work proposal (WP) process. Non-DOE/NNSA FFRDCs participating as a subrecipient will be funded through an interagency agreement with the sponsoring agency. Although the FFRDC portion of the work is excluded from the award, the applicant's cost share requirement will be based on the total cost of the project, including the applicant's, the subrecipient's, and the FFRDC's portions of the project.

Unless instructed otherwise by the DOE Contracting Officer for the DOE award, all FFRDCs are required to enter into a Cooperative Research and Development Agreement[108] (CRADA) or, if the role of the DOE/NNSA FFRDC is limited to technical assistance and intellectual property is not anticipated to be generated from the DOE/NNSA FFRDC's work, a Technical Assistance Agreement (TAA), with at least the prime recipient before any project work begins. Any questions regarding the use of a CRADA or TAA should be directed to the cognizant DOE field intellectual property (IP) counsel.

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

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.

[108] A cooperative research and development agreement is a contractual agreement between a national laboratory contractor and a private company or university to work together on research and development. For more information, see https://www.energy.gov/gc/downloads/doe-cooperative-research-and-development-agreements

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 includes multiple 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;
- 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 who experience technical difficulties 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 larger than 50MB cannot be uploaded and hence cannot be submitted for review. If a file is larger than 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.

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, the project location(s), and any statements regarding confidentiality.
Technology Description	4 pages maximum	Applicants are required to succinctly describe: • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state of the art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • 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 pages maximum	Applicants are required to describe succinctly the qualifications, experience, and capabilities of the proposed project team, including: • 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 • 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. 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 must 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
SF-424: Application for Federal Assistance	PDF	n/a	ControlNumber_LeadOrganization_App424
Technical Volume	PDF	15	ControlNumber_LeadOrganization_TechnicalVolume
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
Diversity Equity and Inclusion Plan	PDF	4	ControlNumber_LeadOrganization_DEIP
Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary

Component	File Format	Page Limit	File Name
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, (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 for prime applicant and subrecipients	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Foreign Entity Waiver Requests and Foreign Work Waiver Requests	PDF	n/a	ControlNumber_LeadOrganization_Waiver
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

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. SF-424: Application for Federal Assistance

Applicants must complete the SF-424 Application for Federal Assistance, which is available on 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".

iii. 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 15 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 technical review 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.

Technical Volume Content Requirements	
SECTION/PAGE LIMIT	**DESCRIPTION**
Cover Page	The cover page should include the project title, the specific FOA Topic Area being addressed (if applicable), both the technical and business points of contact, names of all team member organizations, names of the project managers, PI, Senior/Key Personnel and their organizations, the project location(s), and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The applicant should discuss the background of its 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 30% of the Technical Volume)	The Technical Description should contain the following information: • 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 40% of the Technical Volume)	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go decision points, and Project Schedule. A detailed SOPO is separately requested. The Workplan should contain the following information:

Technical Volume Content Requirements	
SECTION/PAGE LIMIT	**DESCRIPTION**
	• 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. • WBS and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this FOA. The summary provided should be consistent with the SOPO. The SOPO will contain a more detailed description of the WBS and tasks. • Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a Specific, Measurable, Attainable, Realistic, and Timely (SMART) technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the FOA, the minimum requirement is that each project must have at least one milestone per quarter for the duration of the project with at least one SMART technical milestone per year (depending on the project, more milestones may be necessary to comprehensively demonstrate progress). The applicant should also provide the means by which the milestone will be verified. The summary provided should be consistent with the Milestone Summary Table in the SOPO. • Go/No-Go Decision Points (See Section VI.B.xv. for more information on the Go/No-Go Review): The applicant should

Technical Volume Content Requirements	
SECTION/PAGE LIMIT	**DESCRIPTION**
	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. • 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: o The overall approach to and organization for managing the work; o The roles of each project team member; o Any critical handoffs/interdependencies among project team members; o The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices; o The approach to project risk management; o A description of how project changes will be handled; o If applicable, the approach to Quality Assurance/Control; o How communications will be maintained among project team members. • Market Transformation Plan: The applicant should provide a market transformation plan, including the following:

Technical Volume Content Requirements	
SECTION/PAGE LIMIT	**DESCRIPTION**
	○ 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)	The Technical Qualifications and Resources should contain the following information: • 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; • 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: ○ 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

iv. Resumes

A resume provides information that can be used by reviewers to evaluate the individual's potential for leadership within the scientific community relevant, skills and experience of the key project personnel. Applicants must submit a resume (limited to three pages) for each Project Manager, 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 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".

v. 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.

vi. Statement of Project Objectives (SOPO)

Applicants must complete a SOPO. A SOPO template is available on EERE Funding Application and Management Forms and on EERE eXCHANGE at https://eere-eXCHANGE.energy.gov/. 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".

vii. Diversity, Equity, and Inclusion Plan

As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, and Inclusion Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from groups underrepresented in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities (also see Section I.A.iii.). The plan should include at least one SMART milestone per Budget Period supported by metrics to measure the success of the proposed actions and will be incorporated into the award if selected. The Diversity, Equity, and Inclusion Plan should contain the following information:

- Equity Impacts: the impacts of the proposed project on underserved communities, including social and environmental impacts.

- Benefits: The overall benefits of the proposed project, if funded, to underserved communities; and
- How diversity, equity, and inclusion objectives will be incorporated in the project.

The following is a non-exhaustive list of actions that can serve as examples of ways the proposed project could incorporate diversity, equity, and inclusion elements. These examples should not be considered either comprehensive or prescriptive. Applicants may include appropriate actions not covered by these examples.

a. Include persons from groups underrepresented in STEM as PI, co-PI, and/or other senior personnel;
b. Include persons from groups underrepresented in STEM as student researchers or post-doctoral researchers;
c. Include faculty or students from Minority Serving Institutions as PI/co-PI, senior personnel, and/or student researchers, as applicable;
d. Enhance or collaborate with existing diversity programs at your home organization and/or nearby organizations;
e. Collaborate with students, researchers, and staff in Minority Serving Institutions;
f. Disseminate results of research and development in Minority Serving Institutions or other appropriate institutions serving underserved communities;
g. Implement evidence-based, diversity-focused education programs (such as implicit bias training for staff) in your organization;
h. Identify Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses and Veteran Owned Businesses to solicit as vendors and sub-contractors for bids on supplies, services and equipment.

The Diversity, Equity, and Inclusion Plan must not exceed 4 pages. Save the Diversity, Equity and Inclusion Plan in a single PDF file using the following convention for the title “ControlNumber_LeadOrganization_DEIP”.

viii. Budget Justification Workbook

Applicants must complete the Budget Justification Workbook, which is available on EERE Funding Application and Management Forms and on EERE eXCHANGE at https://eere-eXCHANGE.energy.gov/. Applicants must complete each tab of the Budget Justification Workbook for the project, including all work to be 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".

ix. Summary for Public Release

Applicants must submit a one-page summary 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). This document must not include any proprietary or business-sensitive information as DOE may make it available to the public after selections are made. The summary must not exceed one 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".

x. 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;
- Project title, prime recipient, PI, and Senior/Key Personnel information; and
- Requested EERE funds and proposed applicant cost share.

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

xi. 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".

xii. 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".

xiii. 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".

xiv. SF-LLL: Disclosure of Lobbying Activities

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

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

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

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

xv. 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.A. 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.K.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".

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 or lead project manager and all 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 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 approved common disclosure format available at Common Form for Current and Pending (Other) Support (nsf.gov).

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

Definitions:

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

Foreign Government-Sponsored Talent Recruitment Program – An effort directly or indirectly organized, managed, or funded by a foreign government, or a foreign government instrumentality or entity, to recruit science and technology professionals or students (regardless of citizenship or national origin, or whether having a full-time or part-time position). Some foreign government-sponsored talent recruitment programs operate with the intent to import or otherwise acquire from abroad, sometimes through illicit means, proprietary technology or software, unpublished data and methods, and intellectual property to further the military modernization goals and/or economic goals of a foreign government. Many, but not all, programs aim to incentivize the targeted individual to 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.[109]

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."

[109] 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.

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 physical address;
2. The identity of all owners, principal investigators, project managers, and Senior/Key Personnel who are a party to any *Foreign Government-Sponsored Talent Recruitment Program* of a foreign country of risk (i.e., China, Iran, North Korea, and Russia);
3. The existence of any joint venture or subsidiary that is based in, funded by, or has a foreign affiliation with any foreign country of risk, including the People's Republic of China;
4. Any current or pending contractual or financial obligation or other agreement specific to a business arrangement, or joint venture-like arrangement with an enterprise owned by a foreign state or any foreign entity;
5. Percentage, if any, that the proposed recipient or subrecipient has foreign ownership or control;
6. Percentage, if any, that the proposed recipient or subrecipient is wholly or partially owned by an entity in a foreign country of risk;
7. 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 percent;

12. A summary table identifying all rounds of financing, the purchase dates, the investors for each round, and all the associated governance and information rights obtained by investors during each round of financing; and
13. An organization chart to illustrate the relationship between your entity and the immediate parent, ultimate parent, and any intermediate parent, as well as any subsidiary or affiliates. Identify where each entity is incorporated.

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

Save the Transparency of Foreign 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 DOE Contracting Officer in writing of the potential duplication and eliminate any inappropriate duplication of funding.

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

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.

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.xx. Participants and Collaborating Organizations);
- Current and Pending Support (See Sections IV.E.xvii. and VI.B.xxi. Current and Pending Support);
- An Intellectual Property Management Plan (if applicable) describing how the project team/consortia members will handle intellectual property rights and issues between themselves while ensuring compliance with federal intellectual property laws, regulations, and policies. Intellectual Property Management Plan;
- 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.xxiv.;
- 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. ET 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.

ii. Pre-Award Costs

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

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.

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 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, DOE 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 DOE. Appendix C lists the 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 DOE'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

Foreign travel costs are not allowable under this FOA.

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.

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

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

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:

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 vectors of undue foreign influence in evaluating risk. If high risks are identified and cannot be sufficiently mitigated, DOE may elect to not fund the applicant. As part of the research, technology, and economic security risk review, DOE may contact the applicant and/or proposed project team members for additional information to inform the review.

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
- Other items as required by DOE.

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

a. Prohibition

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

b. Definitions

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

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

xii. 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.

DOL's Office of Federal Contractor Compliance Programs (OFCCP) uses a neutral process to schedule compliance evaluations. Consult OFCCP's Technical Assistance Guide[110] 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.

xiii. Foreign Collaboration Considerations

a. Consideration of new collaborations with foreign entities, organizations, and governments. The recipient will be required to provide DOE with advanced written notification of any potential collaboration with foreign entities, organizations, or governments in connection with its DOE-funded award scope. The recipient will then be required to await further guidance from DOE prior to contacting the proposed foreign entity, organization, or

[110] 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

government regarding the potential collaboration or negotiating the terms of any potential agreement.

b. Existing collaborations with foreign entities, organization, 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;
- 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 technical review criteria shown below. All sub-criteria are of equal weight.

Criterion 1: Technical Merit, Innovation, and Impact (50%)
This criterion involves consideration of the following factors:

Technical Merit and Innovation

- Extent to which the proposed technology, process, or project is innovative or replicable;
- Degree to which the current state of the technology and the proposed advancement to development, demonstration and commercialization 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 development, demonstration, and commercialization;
- 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;
- Extent to which project has buy-in from needed stakeholders to ensure success of development and demonstration (applicable for Topic 1);
- Extent to which project has the potential to reduce emissions and provide clean energy acceleration benefits for a community or region; and
- Sufficiency of existing infrastructure to support addition of proposed demonstration.

Impact of Technology Advancement

- Ability of the project to advance industry adoption;
- 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;
- Extent to which demonstration is replicable and may lead to future demonstrations; and

- Extent to which the project facilitates stakeholder relationships across new or existing stakeholders to gain technical buy-in and increase potential for future deployments.

Project Management

- Adequacy of proposed project management systems including the ability to track scope, cost, and schedule progress and changes;
- Reasonableness of budget and spend plan as detailed in the budget justification workbook for proposed project and objectives;
- Adequacy of contingency funding based on quality of cost estimate and identified risks;
- Adequacy, reasonableness, and soundness of the project schedule, as well as periodic Go/No-Go decisions prior to further funds disbursement, interim milestones, and metrics to track process;
- Adequacy, reasonableness, and soundness of the project schedule, as well as annual Go/No-Go decisions prior to a budget period continuation application, interim milestones, and metrics to track process;
- Adequacy of the identification of risks, including labor and community opposition or disputes, and "timely" and appropriate strategies for mitigation and resolution; and
- Soundness of a plan to expeditiously address environmental, siting, and other regulatory requirements for the project, including evaluation of resilience to climate change.

Criterion 2: Project Research and Market Transformation Plan (25%)
This criterion involves consideration of the following factors:

Research Approach, Workplan, and SOPO

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

Identification of Technical Risks

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

Baseline, Metrics, and Deliverables

- 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, Open-source Software Distribution Plan, etc., and product distribution.

Industry Adoption Plan

- Identification of the interest and extent of 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;
- Diversity of expertise and perspectives of the team and the inclusion of industry partners that will amplify impact;
- 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 and how well they are integrated into the Workplan; and
- Reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Diversity, Equity, and Inclusion (10%)
This criterion involves consideration of the following factors:

- The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and
- Extent to which the project benefits underserved communities.

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

D. Evaluation and Selection Process

i. Overview

The evaluation process consists of multiple phases; each includes an initial eligibility review and a thorough technical review. Rigorous technical reviews of eligible submissions are conducted by reviewers that are experts in the subject matter of the FOA. Ultimately, the Selection Official considers the recommendations of the reviewers, along with other considerations such as program policy factors and risk reviews, 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 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 (see 41 U.S.C. 2313).

The applicant, at its option, may review information in the entity information domain in 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.

DOE will consider any written comments by the applicant, in addition to the other information in the entity information domain in 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, risk reviews, 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 provided from reviewers 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 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.K.ii. of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

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

vi. Unsuccessful Applicants

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

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions 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. **This step is required to apply to this FOA.** The eXCHANGE registration does not have a delay; however, **the remaining registration requirements below could take several weeks to process and are necessary for a potential applicant to receive an award under this FOA.**

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

3. **FedConnect**
   Register in FedConnect at https://www.fedconnect.net. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at 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 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.

National Historic Preservation Act (NHPA)

All recipients selected for an award must comply with the requirements of Section 106 of the National Historic Preservation Act (NHPA) prior to using Federal funds. Section 106 applies to historic properties that are listed in or eligible for listing in the National Register of Historic Places. DOE and recipients selected for an award must consider the effects of project activities on historic properties, pursuant to Section 106 of the NHPA. DOE will perform a NHPA review under the umbrella of its NEPA review.

vii. Flood Resilience

Applications should indicate whether the proposed project location(s) is within a floodplain, how the floodplain was defined, and how flooding will factor into the project's design. The base floodplain long used for planning has been the 100-year floodplain, which has a 1% chance of flooding in any given year. As directed by Executive Order 13690, Establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input (2015), federal agencies, including DOE, must continue to avoid development in a floodplain to the extent possible. When doing so is not possible, federal agencies are directed to "expand management from the current base flood level to a higher vertical elevation and corresponding horizontal floodplain to address current and future flood risk and ensure that projects funded with taxpayer dollars last as long as intended." The higher flood elevation is based on one of three approaches: climate-informed science (preferred), freeboard value, or 0.2% annual flood change (500-year floodplain). EO 13690 and related information is available at: https://www.energy.gov/nepa/articles/eo-13690-establishing-federal-flood-risk-management-standard-and-process-further.

viii. Applicant Representations and Certifications

1. Lobbying Restrictions

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

2. **Corporate Felony Conviction and Federal Tax Liability Representations**
In submitting an application 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 contactors from lawfully reporting waste, fraud, or abuse to a designated investigative or law enforcement representative of a federal department or agency authorized to receive such information.

   b. It **does not and will not** use any federal funds to implement or enforce any nondisclosure and/or confidentiality policy, form, or agreement it uses unless it contains the following provisions:

      (1) *''These provisions are consistent with and do not supersede, conflict with, or otherwise alter the employee obligations, rights, or liabilities created by existing statute or Executive order relating to (1) classified information, (2) communications to Congress, (3) the reporting to an Inspector General of a violation of any law, rule, or regulation, or mismanagement, a gross waste of funds, an abuse of authority, or a*

substantial and specific danger to public health or safety, or (4) any other whistleblower protection. The definitions, requirements, obligations, rights, sanctions, and liabilities created by controlling Executive orders and statutory provisions are incorporated into this agreement and are controlling."

(2) The limitation above shall not contravene requirements applicable to Standard Form 312 Classified Information Nondisclosure Agreement (https://fas.org/sgp/othergov/sf312.pdf), Form 4414 Sensitive Compartmented Information Disclosure Agreement (https://fas.org/sgp/othergov/intel/sf4414.pdf), or any other form issued by a federal department or agency governing the nondisclosure of classified information.

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

ix. 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.

x. 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.

xi. Subject Invention Utilization Reporting

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.

xii. 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.

xiii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement.

xiv. 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 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;[111] 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.

xv. Conference Spending

The recipient shall not expend any funds on a conference not directly and programmatically related to the purpose for which the grant or cooperative agreement was awarded that would defray the cost to the United States government of a conference held by any Executive branch department, agency, board, commission, or office for which the cost to the 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

[111] 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.

an Inspector General), of the date, location, and number of employees attending such conference.

xvi. 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 million 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.

xvii. 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); acknowledgement that the recipient shall not sell or encumber the property or permit any encumbrance without prior written DOE approval; current fair market value of the property; and an estimated useful life or depreciation schedule for equipment.

When the property is no longer needed for authorized project purposes, the recipient must request disposition instructions from DOE. For-profit entity disposition requirements are set forth in 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

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

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

xix. 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.

xx. 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.

xxi. U.S. Manufacturing Commitments

A primary objective of DOE's multi-billion-dollar RD&D 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 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.

xxii. Interim Conflict of Interest Policy for Financial Assistance

The DOE interim Conflict of Interest Policy for Financial Assistance (COI Policy)[112] 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.

xxiii. 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.

[112] 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.

xxiv. 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.

xxv. Human Subjects Research

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

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

B. Government Right to Reject or Negotiate

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

C. Commitment of Public Funds

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

D. Treatment of Application Information

Applicants should not include trade secrets or 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]

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.

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: Applicants not covered by a Class Patent Waiver or the Bayh-Dole Act 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.xxii. U.S. Manufacturing Commitments of this FOA. A copy of the DEC can be found at https://www.energy.gov/gc/determination-exceptional-circumstances-decs. Pursuant to 37 CFR § 401.4, any nonprofit organization or small business firm as defined by 35 U.S.C. 201 affected by any DEC has the right to appeal it by

providing written notice to DOE within 30 working days from the time it receives a copy of the determination.

- DOE may issue and publish further DECs 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, subrecipients, and contractors 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 government contractors.

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

M. Copyright

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

N. Export Control

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

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

O. Prohibition on Certain Telecommunications and Video Surveillance Services or Equipment

As set forth in 2 CFR 200.216, recipients and subrecipients are prohibited from obligating or expending project funds (federal funds and recipient cost share) to procure or obtain; extend or renew a contract to procure or obtain; or enter into a contract (or extend or renew a contract) to procure or obtain equipment, services, or systems that 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.

R. Informational Webinar (Optional)

EERE will conduct one informational webinar during the FOA process. It will be held after the initial FOA release but before the due date for Concept Papers.

Attendance is not mandatory and will not positively or negatively impact the overall review of any applicant submissions. The webinar will be open to all applicants who wish to participate. Applicants should refrain from asking questions or communicating information that would reveal confidential and/or proprietary information specific to their project. The webinar date is listed on the cover page of the FOA.

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 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

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 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 million in federal funds with four tasks requiring different non-federal cost share percentages:

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

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

Each task must be calculated individually as follows:

Task 1
$1,000,000 divided by 80% = $1,250,000 (Task 1 Cost)
Task 1 Cost minus federal share = non-federal share
$1,250,000 - $1,000,000 = $250,000 (non-federal share)

Task 2
$500,000 divided 80% = $625,000 (Task 2 Cost)
Task 2 Cost minus federal share = non-federal share
$625,000 - $500,000 = $125,000 (non-federal share)

Task 3
$400,000 / 50% = $800,000 (Task 3 Cost)
Task 3 Cost minus federal share = non-federal share
$800,000 - $400,000 = $400,000 (non-federal share)

Task 4
Federal share = $100,000
Non-federal cost share is not mandated for outreach = $0 (non-federal share)

The calculation may then be completed as follows:

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

Blended Cost Share %
Non-federal share ($775,000) divided by Total Project Cost ($2,775,000) = 27.9% (non-federal)
Federal share ($2,000,000) divided by Total Project Cost ($2,775,000) = 72.1% (federal)

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

1. Waiver for Foreign Entity Participation

Many of the technology areas DOE funds fall in the category of critical and emerging technologies (CETs). CETs are a subset of advanced technologies that are potentially significant to United States national and economic security.[113] 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.xxii.); and
e. The foreign entity will satisfy other conditions that may be deemed necessary by DOE to protect United States government interests.

Content for Waiver Request

A Foreign Entity waiver request must include the following:

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

[113] See Critical and Emerging Technologies List Update (whitehouse.gov).

ownership/control by foreign entities, foreign shareholders, foreign state or foreign individuals;

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

DOE may also require:

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

DOE may require additional information before considering the waiver request.

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

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

As set forth in Section IV.K.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

United States to perform work outside of the United States. A request for a foreign work waiver must include the following:

1. The rationale for performing the work outside the United States ("foreign work");
2. A description of the work proposed to be performed outside the United States;
3. An explanation as to how the foreign work is essential to the project;
4. A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the United States economy;
5. The associated benefits to be realized and the contribution to the project from the foreign work;
6. How the foreign work will benefit the United States, including manufacturing, contributions to employment in the United States and growth in new markets and jobs in the United States;
7. How the foreign work will promote 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 additives[114] —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

[114] BIL, § 70917(c)(1).

purchase, construction, or improvement of a private home for personal use, for example, would not constitute an infrastructure project.

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

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

B. Buy America Requirements for Infrastructure Projects ("Buy America" requirements)
In accordance with Section 70914 of the BIL, none of the project funds (includes federal share and recipient cost share) may be used for a project for infrastructure unless:

(1) all iron and steel used in the project are produced in the United States--this means all manufacturing processes, from the initial melting stage through the application of coatings, occurred in the United States;

(2) all manufactured products used in the project are produced in the United States—this means the manufactured product was manufactured in the United States; and the cost of the components of the manufactured product that are mined, produced, or manufactured in the United States is greater than 55 percent of the total cost of all components of the manufactured product, unless another standard for determining the minimum amount of domestic content of the manufactured product has been established under applicable law or regulation; and

(3) all construction materials[115] are produced in the United States—this means that all manufacturing processes for the construction material occurred in the United States.

The Buy America requirements only apply to articles, materials, and supplies that are consumed in, incorporated into, or affixed to an infrastructure project. As such, it does not apply to tools, equipment, and supplies, such as temporary scaffolding, brought to the construction site and removed at or before the completion of the infrastructure project. Nor does the Buy America requirements apply to equipment and furnishings, such as movable chairs, desks, and portable computer equipment, that are used at or within the finished infrastructure project, but are not an integral part of the structure or permanently affixed to the infrastructure project.

These requirements must flow down to all sub-awards, all contracts, subcontracts, and purchase orders for work performed under the proposed project, except where the prime

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

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

APPENDIX F – LIST OF ACRONYMS

AI	Artificial Intelligence
AMI	Advanced Metering Infrastructure
ASSIST	Advanced System Integration for Solar Technologies
BESS	Battery Energy Storage Systems
COI	Conflict of Interest
CRADA	Cooperative Research and Development Agreement
DEC	Determination of Exceptional Circumstances
DEI	Diversity, Equity, and Inclusion
DER	Distributed Energy Resources
DMP	Data Management Plan
DOE	Department of Energy
DOI	Digital Object Identifier
DSO	Distribution Systems Operator
EERE	Energy Efficiency and Renewable Energy
EIA	U.S. Energy Information Administration
EMT	Electromagnetic Transient
ENERGISE	Enabling Extreme Real-Time Grid Integration of Solar Energy
EPRI	Electric Power Research Institute
EV	Electric Vehicle
EVSE	Electric Vehicle Supply Equipment
FAR	Federal Acquisition Regulation
FCOI	Financial Conflicts of Interest
FFATA	Federal Funding and Transparency Act of 2006
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FFRDC	Federally Funded Research and Development Center
FY	Fiscal Year
GAAP	Generally Accepted Accounting Principles
GFM	Grid Forming
GTO	Geothermal Technologies
GW_{ac}	Gigawatts alternating current
HIL	Hardware-in-the-loop
IPMP	Intellectual Property Management Plan
IRB	Institutional Review Board
IRA	Inflation Reduction Act
ISO	Independent System Operator
IT	Information Technology
kWh	Kilowatt hours
M&O	Management and Operating
MFA	Multi-Factor Authentication
ML	Machine Learning
MPIN	Marketing Partner ID Number

MSI	Minority Serving Institution
MYPP	Multi-Year Program Plan
NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
NNSA	National Nuclear Security Agency
NSF	National Science Foundation
OE	Office of Electricity
OEDI-SI	Open Energy Data Initiative for System Integration
OIG	Office of Inspector General
OMB	Office of Management and Budget
OPTIMA	Operation and Planning Tools for Inverter-Based Resource Management and Availability for Future Power Systems
OSTI	Office of Scientific and Technical Information
OT	Operational Technology
OTA	Other Transactions Authority
PII	Personal Identifiable Information
PNNL	Pacific Northwest National Laboratory
PV	Photovoltaics
R&D	Research and Development
RD&D	Research, Development, and Demonstration
RDD&D	Research, Development, Demonstration and Deployment
RFI	Request for Information
RFP	Request for Proposal
SAM	System for Award Management
SciENcv	Science Experts Network Curriculum Vita
SETO	Solar Energy Technologies Office
SHINES	Sustainable and Holistic Integration of Energy Storage and Solar PV
SMART	Specific, Measurable, Attainable, Realistic, and Timely
SOPO	Statement of Project Objectives
SPOC	Single Point of Contact
STEM	Science, Technology, Engineering, and Mathematics
STRIVES	Solar Technologies' Rapid Integration and Validation for Energy Systems
SWIFTR	Solar and Wind Interconnection for Future Transmission
TAA	Technical Assistance Agreement
TIA	Technology Investment Agreement
TRL	Technology Readiness Level
T&D	Transmission & Distribution
TW_{ac}	Terawatt alternating current
UCC	Uniform Commercial Code
UEI	Unique Entity Identifier
VPP	Virtual Power Plant
WBS	Work Breakdown Structure

WETO	Wind Energy Technologies Office
WP	Work Proposal