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

Vehicle Technologies Office Fiscal Year 2021 Research Funding Opportunity Announcement

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FOA Issue Date:	12/10/2020
Submission Deadline for Concept Papers:	02/12 ~~05~~/2021 5:00pm ET
Anticipated Concept Paper Recommendation Notification	03/10 ~~03~~/2021
Submission Deadline for Full Applications:	04/07/2021 5:00pm ET
Expected Timeframe for EERE Selection Notifications:	July 2021
Expected Timeframe for Award Negotiations:	July 2021 - September 2021

- Applicants must submit a Concept Paper by 5:00pm ET on the due date listed above to be eligible to submit a Full Application.

- To apply to this FOA, applicants must register with and submit application materials through the ~~EERE Program Information Center (EPIC)~~ EERE Exchange at https://eere-exchange.energy.gov ~~https://epicweb.ee.doe.gov~~, EERE's online application portal.

- Applicants must designate primary and backup points-of-contact in ~~EPIC~~ 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.

AMENDMENTS

All changes to the Funding Opportunity Announcement as a result of this amendment are highlighted in yellow.

Amendment No.	Date	Description of Amendment
000001	01/06/2021	The purpose of this amendment is to update the restricted eligibility, remove the requirement for FFRDCs to submit a Field Work Proposal, add an email address for submitting sensitive questions and correct typographical errors.
000002	01/22/2021	The purpose of this amendment is to change the submission method for applications from EPIC to EERE Exchange due to technical issues with EPIC, extend the due date for concept paper submissions and to delete the term relating to Executive Order 13950.

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I. Funding Opportunity Description

A. Background and Context

The Office of Energy Efficiency and Renewable Energy (EERE) is issuing, on behalf of the Vehicle Technologies Office (VTO), a Funding Opportunity Announcement (FOA) entitled, "Fiscal Year 2021 Vehicle Technologies Research Funding Opportunity Announcement." The activities supported by this FOA are authorized under the Energy Policy Act of 2005 (EPACT 2005) Public Law 109-58, TITLE IX - Energy Efficiency, Section 911. These provisions are found in the United States Code at 42 U.S.C. § 16191. Additional authorities include the following;

- Title VII, Subtitles B, C, D of EPACT 2005 (42 U.S.C. §§ 16061-16093)
- Sections 131-136 of EISA 2007 (42 U.S.C. §§ 17011-17013)
- Title VI, Subtitle A of EPACT 1992 (42 U.S.C. §§ 13281-13286) (Electric vehicle demonstration)
- Title VI, Section B of EPACT 1992 (42 U.S.C. §§ 13291-13296) (Electric vehicle infrastructure)

i. Background and Purpose

Vehicles move our national economy. Annually, vehicles transport 11 billion tons of freight – more than $35 billion worth of goods each day[1]– and move people more than 3 trillion vehicle-miles.[2] Growing our economy requires transportation, and transportation requires energy. The transportation sector accounts for about 30% of total U.S. energy needs[3] and the average U.S. household spends over 15% of its total family expenditures on transportation[4], making it the most expensive spending category after housing.

The Vehicle Technologies Office (VTO) funds a broad portfolio of research and proof-of-concept deployment to develop new affordable, efficient and clean transportation options to enable industry to accelerate the development and widespread use of a variety of innovative transportation technologies. The research pathways focus on electrification, fuel diversification, vehicle efficiency, energy storage, lightweight materials, and new mobility technologies to improve the overall energy efficiency and affordability of the transportation system. In

[1] Bureau of Transportation Statistics, DOT, Transportation Statistics Annual Report 2018, Table 4-1. HYPERLINK "https://www.bts.gov/tsar" https://www.bts.gov/tsar

[2] Transportation Energy Data Book 37th Edition, ORNL, 2019. Table 3.8 Shares of Highway Vehicle-Miles Traveled by Vehicle Type, 1970-2017.

[3] Transportation Energy Data Book Edition 37, ORNL, Table 2.1 U.S. Consumption of Total Energy by End-Use Sector

[4] Transportation Energy Data Book Edition 37, ORNL, Table 10.1.

partnership with industry, VTO has established aggressive targets to focus research on cost-reduction, efficiency, emissions reduction and performance. VTO-funded research has reduced the cost of advanced batteries by 80% since 2008, and nearly every plug-in electric vehicle (PEV) on the road today uses VTO-developed battery technology. However, to enable greater affordability and PEV accessibility for all Americans, VTO seeks new battery chemistries and cell technologies to reduce the cost of electric vehicle battery packs by more than half, to below $80/kWh, while increasing driving range to 300 miles and decreasing charge time to 15 minutes or less by 2028. In addition, building on prior research, VTO has identified opportunities to significantly increase the power density of electric drive systems. New innovations in motor technology – printable magnets, high-conductivity windings, and novel architectures – could lead to much smaller, very high energy density systems with twice the useful life that can enable more affordable, better performing PEVs. DOE is working to lower the cost of the power electronics and motors in an Electric Vehicle (EV) to $7/kW by 2022 from $30/kW in 2012.

Similarly, there are benefits to be gained with advanced combustion engine research. The optimization of engines, including through new models and algorithms using High Performance Computing (HPC) tools, has the potential to achieve significantly higher efficiencies than possible with current fuels and engines, improving passenger fuel economy by as much as 35% by 2030 (vs. a 2015 baseline of 36 miles per gallon). In addition, the integrated research of advanced materials, such as high-temperature alloys, and combustion strategies can not only expand engine operating parameters but also enable lighter-weight engines for better performance and efficiency.

There are also efficiency opportunities beyond vehicle components and systems. Advances in connectivity and automation have the potential to dramatically improve transportation system-level energy efficiency, energy productivity, and affordability. Leveraging high performance computing resources unique to the national laboratory system, VTO has developed robust modeling, simulation, and big data analytics capabilities, while research of advanced sensing and perception technologies, system controls, and other connected and automated technologies has advanced rapidly. Partnerships between academia and industry can apply advanced computing and data analytics capabilities with new mobility technologies to create state-of-the-art testbeds that validate and support new, optimized, highly-efficient, and affordable transportation systems.

ii. Technology Space and Strategic Goals

This funding opportunity announcement (FOA) seeks research projects to address priorities in the following areas: batteries and electrification; materials;

technology integration and energy efficient mobility systems; energy-efficient commercial off-road vehicle technologies; and co-optimized advanced engine and fuel technologies to improve fuel economy. Detailed technical descriptions of the specific areas of interest (AOI) are provided in the sections that follow.

B. Topic Areas

AOI Number	Title
1a	Next-generation Liquid Electrolytes for Li-ion Cells Under Extreme Conditions
1b	Liquid Electrolytes for Li-S Cells ~~Introduction~~
2	Development of State-of-the-art Lithium Sulfur and Lithium Air Battery Cells
3	High Power Density Inverters
4	Integrated Simulation of Combustion and Aftertreatment - Optimizing for Near-Zero Emissions (ISCA-ONE)
5	Demonstration of Lightweight Multi-Material Glider System
6	Low-cost Infrastructure-based Enablers for Cooperative Driving Automation
7	Implementation of Energy Efficient Mobility Systems Technologies into Real-World System Applications
8	Transportation and Energy Analysis

AOI 1: Next-generation Liquid Electrolytes for Li-ion and Lithium Sulfur (Li-S) Cells

Overview

Liquid electrolytes are anticipated to continue as the primary electrolytes using in lithium-ion (Li-ion) and lithium-sulfur (Li-S) cells in the near-term. Yet the stability of these liquid electrolytes and their abilities to form stable interfaces with electrodes in both battery systems remains a challenge. This FOA topic, in both AOI 1a and AOI 1b, works to address the critical challenges of these liquid electrolytes for both Li-ion (AOI 1a) and Li-S cells (AOI 1b).

AOI 1a: Next-generation Liquid Electrolytes for Li-ion Cells Under Extreme Conditions

Introduction

Today's Li-ion cells have demonstrated marked improvements in the increasingly extreme conditions they are being utilized in, including operating at higher voltages, within a wide temperature range, under intense abuse conditions, and utilizing extreme fast charging. Yet, performance under these more extreme uses is often limited by the stability and properties of the liquid electrolytes within the cells.

Traditional liquid electrolytes are composed of lithiumhexafluorophosphate ($LiPF_6$) salt dissolved in mixed carbonate solvents, which include ethylene carbonate (EC), propylene carbonate (PC), ethyl methyl carbonate (EMC), dimethyl carbonate (DMC) and/or diethyl carbonate (DEC), and an array of additives included to improve performance against the utilized electrodes. These volatile and flammable organic solvents, which can easily undergo drastic degradation processes, often act as a limiting factor in the performance under extreme conditions including operating at high voltage, in a wide temperature range, under extreme fast charging, and/or under extreme abuse. As such, there is a need to develop novel liquid electrolytes which can operate under such extreme conditions with enhanced performance and stability.

Objective

The objective of this area of interest is to research, develop, and test liquid electrolytes for next-generation Li-ion cells (liquid electrolytes against **graphite anodes** and **moderate/high voltage cathodes**) with improved performance under an array of extreme conditions.

The following four extreme conditions area of focus in this FOA topic. Their corresponding challenges and effects on Li-ion cell performance are discussed below.

Extreme conditions of focus:

1. High Voltage Cells: In order to increase the overall energy density of cells, Li-ion cells are continually being cycled at higher voltages, 4.5 V or higher. These cells typically utilize high-nickel nickel manganese oxide (NMC) 811 or higher. In many cases, these cells are limited in their voltage range by the liquid electrolyte which undergo drastic degradation at high voltages due the organic and volatile solvents.
2. Wide Operating Temperature: At low temperatures, down to **-40°C**, liquid electrolytes have issues with phase stability (freezing) and resultant poor ion movement through the electrolyte-electrode interface. Similarly, at high temperatures, up to **+40°C**, [or as high as **+66°C** in some cases], liquid electrolytes have phase stability issues, with gassing often occurring due to the volatility of the organic solvents utilized. Improving performance of one temperature regime often leads to poorer performance within the other.
3. Extreme Fast Charging: VTO has a fast charge goal of 15-min recharge time in order to ensure mass adoption of electric vehicles. As such, it is of interest for next-generation Li-ion cells to be able to charge at high c-rates of 4C or higher. Fast charging may affect the chemistry and growth of the solid-electrolyte interfaces and behavior at these interfaces, leading to slowed ion movement and poorer performance.
4. Under Severe Abuse: Flammability of the organic-based, liquid electrolytes is a significant concern when Li-ion cells are subjected to mechanical, thermal, or electrical abuse. Improving non-flammability and self-extinguishing properties can prevent thermal runaway of cells under abuse, leading to more widespread adoption.

Anticipated technology approaches include, but are not limited to the following:

- Fluorinated solvents and additives
- Ionic liquids
- High-concentration electrolytes
- Other non-traditional electrolytes

Requirements

Applications **must**:

1. Establish a baseline performance of the proposed systems.

2. Identify at least one of the above extreme conditions that will be a focus for improved performance within the project;
3. Describe a project aimed at either of the following in terms of improving performance:
   a. Demonstrate significant improvement over a baseline performance of their identified system towards one of the four extreme conditions of focus, described above. Projects should demonstrate at least an 80% retention in specific capacity for 1000 cycles under the condition when compared to performance within a traditional operating condition. In addition, projects should demonstrate this marked improvement in performance within their condition of focus (demonstrating a change of 10% or less in retention when compared to performance within a traditional operating condition) in at least two of the other three extreme conditions; or,
   b. Demonstrate significant improvement over a baseline performance of their identified system towards multiple extreme conditions of focus, described above. If improving multiple conditions, projects should, at the end of their term, demonstrate at least an 70% retention in specific capacity for 1000 cycles under both extreme conditions when compared to performance within a traditional operating condition. In this case, projects should show performance within the other categorized extreme conditions, but there is no requirement on maintaining performance;
4. Include the development and test of 2 Ah cells or larger to measure electrolyte performance. Projects will test their cells under the following conditions, regardless of the condition they are focusing on for improvement:

Extreme Condition of Focus:	**Required Testing:**
High Voltage Cells:	Measure specific capacity v. voltage up to at least 4.5 V or higher for at least 100 cycles at C/3 [required]
Wide Operating Temperature:	Measure specific capacity within a temperature range of -40°C to +40°C, or as high as +66°C, at C/3 [required]
Extreme Fast Charging	Measure specific capacity v. cycle number with charging cycles at least 4C or higher [required]
Under Severe Abuse	Measurements can include, but are not limited to, puncture or cut testing, and gassing studies under a wide operating temperature, under high voltage cycling, under extreme fast charging [recommended]

5. Include the following Cell Requirements:
    a. The electrolyte system of focus must be disclosed, along with activities that will be performed to improve electrolyte performance.
    b. The anode and cathode to be used in the project must be disclosed
    c. The anode and cathode materials used should not be altered during project experimentation (i.e. experiments should focus on adjusting the electrolyte and interfaces against the electrolyte, and not adjusting the electrodes the electrolyte is paired with).
    d. Projects are limited to next-generation Li-ion cells which use graphite-based anodes and NMC 622 or higher Ni-content cathodes, or comparable advanced, commercial cathode.
    e. If targeting higher voltage conditions, cells must use NMC 811 or higher Ni-content cathodes.
6. Establish a baseline performance of the proposed system
7. Include a discussion of the anticipated cost of their novel liquid electrolyte and how that compares to traditional liquid electrolytes utilized in Li-ion cells.

Teaming Arrangements

Collaborative teams combining knowledge and capabilities are encouraged. Teams comprising of one organization/ facility are acceptable if there is sufficient evidence given in the application that the facility has the required knowledge and capabilities to synthesize and characterize electrolyte, as well as build and test cells. Applications should demonstrate the team's ability to develop liquid electrolytes in house, fabricate cells, and perform extensive cell testing. Teams should have extensive experience in testing Li-ion cells, as well as designing and testing liquid electrolytes. Teams should have capabilities to build 2 Ah cells. DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under this area of interest:

- 12 final cells of a minimum capacity of 2 Ah and delivery to a to-be-designated DOE testing laboratory for performance testing. Test procedures will be agreed to between the applicant, the test lab, and DOE. (Cells must be delivered before the end of the project period of performance.)
- Baseline cells are not required as a deliverable, but baseline performance data should be demonstrated.

- Participation in the Annual Merit Review held in Washington D.C.
- Participation in an Annual Applied Battery Materials Research meeting at a to-be-determined Federal Funded Research and Development Center.
- Summary of accomplishments and project work report will be prepared for inclusion in the Vehicle Technologies Office annual programmatic progress report. Report will be due to October 31 of each year.

All cells shall be provided to the DOE for validation testing at a to-be-designated DOE National Laboratory. Non-Destructive Performance Validation testing will be conducted on the cells to validate performance. This testing will be conducted outside the scope of the proposed project and should not be included in the total estimated project costs included with the application. Participation by a DOE National Laboratory in test planning and execution will be addressed by a Non-Disclosure Agreement (NDA) between the National Laboratory and the Applicant. Test procedures will be provided by the Applicant and shall incorporate specifications and limits supplied by the manufacturer for the specific technology such as voltage and current limits, state of charge, charging, and temperature recommendations, number of test sequences, and/or other relevant test conditions as appropriate. The results of the DOE National Laboratory testing may be documented in a publicly releasable Summary Test Report (approved by both DOE and the Applicant prior to release) that validates performance of the deliverables relative to the end item performance targets as well as the technology deployment impact relative to DOE strategic goals. The Summary Test Report will be approved by the DOE (Vehicle Technologies Office) and the Applicant. Test cells or special test equipment supplied by the end item manufacturer for the purposes of the test will be returned at the conclusion of testing at no cost to the project.

Applications Discouraged

Applications focused on traditional, additive-based methods that allow for incremental improvement of the liquid electrolyte are discouraged. Also, applications that propose improvement in one extreme condition but severely hamper performance in all other extreme conditions are discouraged.

AOI 1b: Liquid Electrolytes for Li-S Cells ~~Introduction~~

Introduction

Current Li-ion batteries are based on oxide cathodes such as NMC. Not only are they the most expensive material in the battery, they offer limited capacity and contain cobalt and nickel, both considered to be critical material in the future. Sulfur represents the most promising cathode material in the near term. It is the 16th most abundant element on Earth and is highly affordable. In addition, the theoretical specific capacity of sulfur is 1,675 mAh/g compared to approximately 275 mAh/g for NMC oxide cathodes.

Objective

The purpose of this FOA topic is to develop novel electrolytes for Li-S batteries. One of the key barriers for the successful development of Li-S is to mitigate the shuttle mechanisms of polysulfide species during cycling. The formation of these polysulfides consumes lithium, sulfur and worst of all forms a passive layer (Li_2S) at the negative electrode resulting power degradation and short cycle life. While engineers and scientists have primarily focused on the design of composite sulfur cathodes to contain polysulfide species, studies have consistently shown that the electrolyte plays a key role in this mitigation effort. In addition, models and experimental data have confirmed that the short chain polysulfide species are more stable than the long chain ones (Li_2S_8, Li_2S_6).

At the minimum, the electrolyte will need to:

- Form a stable SEI at both negative and positive electrodes
- While there could be a trade-off in capacity, the integrated electrolyte and composite sulfur electrode should demonstrate a reversible specific capacity of more than 1,000 mAh/g.
- Have an ionic conductivity comparable to current lithium-ion electrolyte (>= 0.01 S/cm)

Electrolytes which selectively form stable short chain polysulfide species, including Li_2S_4, Li_2S_2, and Li_2S_3 are encouraged.

Requirements

Applications **must**:

1. Establish baseline performance of their system.
2. Utilize sulfur-based cathodes/catholytes. No restriction is placed on the anode;

3. Describe the anode and cathode to be used in the project. The anode and cathode materials used should not be altered during project experimentation (i.e. experiments should focus on adjusting the electrolyte and interfaces against the electrolyte, and not adjusting the electrodes the electrolyte is paired with);
4. Establish baseline performance of their system;
5. Disclose the electrolyte system of focus, along with anticipated studies that will be performed towards improving electrolyte performance
6. Identify the synthesis, testing, modeling, and diagnostics activities to be performed to understand the causes of the issues being addressed, methods and technologies that will be used to mitigate those issues; and
7. Implement the mitigation methods, technologies, and test their effectiveness in full cells of sizes greater than 200 mAh (preferably 1 to 2 Ah).

Teaming Arrangements

DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required for awards made under this area of interest:

- Baseline cells are not required as a deliverable, but baseline performance data should be demonstrated.
- Final cells are not required as a deliverable, but final testing data in full cells of sizes greater than 200 mAh (preferably 1 to 2 Ah) is required.
- Participation in the Annual Merit Review held in Washington DC
- Participation in an Annual Applied Battery Materials Research meeting at a to-be-determined Federally Funded Research and Development Center.
- Summary of accomplishments and project work report will be prepared for inclusion in the Vehicle Technologies Office annual programmatic progress report. Report will be due by October 31 of each year.

Applications Discouraged

None.

AOI 2: Development of State-of-the-art Lithium Sulfur and Lithium Air Battery Cells

Introduction

Lithium sulfur battery technology represents a very promising battery chemistry. It is the 16th most abundant element on Earth and is highly affordable. In addition, the theoretical specific capacity of sulfur is 1,675 mAh/g compared to approximately 275 mAh/g for current NMC oxide cathodes.

The lithium-air electrochemical couple is also impressive. In contrast with most other batteries that carry both anode and cathode inside a storage system, the open system lithium-air battery is unique in that the active cathode material (oxygen) is not stored in the battery. Instead, oxygen is absorbed from the environment and reduced by catalytic surfaces at the positive electrode. The theoretical specific energy of a lithium air battery based on reaction product of Li_2O and Li_2O_2 is 5,023 Wh/kg and 3,505 Wh/kg respectively. Newer concepts for using gaseous reactants, such as CO_2 that have a theoretical specific energy density of 1,876 Wh/kg, provide opportunities for further exploration.

Objective

The objective of this area of interest is to develop lithium sulfur or lithium air battery cells capable of meeting the VTO goals of 500 Wh/kg and $80/kWh and demonstrate improvements in cycle life, rate capability, safety and affordability.

Requirements

1. Identify the cell chemistry - including anode and cathode materials, electrolyte/separator, and the cell composition and construction that will be used to demonstrate success.
2. Demonstrate an understanding of all major issues impeding the progress of the technology, and clearly identify the particular barriers that are to be the target of the development effort.
3. Identify the synthesis, testing, modeling and diagnostics activities to be performed to understand the causes of the issues being addressed, and identify methods and technologies that will be used to mitigate those issues.
4. Implement the mitigation methods and technologies, and test their effectiveness in full cells of sizes greater than 200 mAh (preferably 1 Ah).

Teaming Arrangements
None

Special Deliverables
In addition to the deliverables above, VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C. and report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report.

Applications Discouraged
None.

AOI 3: High Power Density Inverters

Introduction

Electric drive systems are a key component in all electrified vehicle platforms ranging from hybrid to full battery electric vehicles and fuel cell electric vehicles, including both light-duty vehicles and heavy-duty vehicles. and potentially future EV designs make it crucial to have smaller size electric drives at lower costs. Highly integrated power modules with wide bandgap devices will allow higher power density traction inverters with higher efficiencies. Significant gains in EV range could be enabled by development of more efficient electric drives. VTO supports R&D to improve the power density of electric drives by 10X by 2025 compared with the 2015 numbers while reducing the cost by 50% and doubling the lifetime miles within the next 5 years.

Currently, a traction inverter is composed of multiple components put together separately in an enclosure. The use of discrete rather than integrated subcomponents pose major challenges to achieving consortium goals and result in electric drives that can only operate at lower temperatures, voltages, and speeds. Higher power density can be achieved by integrating many of these components together. Power modules, heat sinks, and capacitors occupy most of the volume. The gate drivers, sensors, and heat sinks can be integrated into the power modules to reduce the size of the inverter. Novel capacitor technologies with lower volumes or new inverter topologies that require less capacitor volume can be used to further increase the power density. Using artificial intelligence and machine learning (AI/ML) can further optimize designs and volumes of these inverters.

Achieving higher power density could be realized by addressing the following technology barriers:

- Components with drastically different temperature capabilities must now exist within a few millimeters of each other instead of tens or hundreds of millimeters apart.
- The coefficient of thermal expansion on these devices, which are in close proximity, will stress interconnects and material stack-ups to failure.
- Current carrying capability and magnetic properties of materials will need to be significantly improved.
- The need to build subcomponents directly into circuit boards, manage temperatures, and to increase voltage and speed operation simultaneously.

Objective

The objective of the area of interest is to research, develop, fabricate and test high power density traction inverters for use in light, medium, or heavy-duty vehicle applications capable of the following;

Parameter	Target [3]
Cost [1]	≤ $2.7/kW
Power Density [2]	≥ 100kW/liter
Operating Voltage	≥ 650V
Lifetime	≥ 300,000 miles

Notes:
(1) Calculate cost based on 2025 equivalent dollars. The cost is not required to include any cases or shielding, or external connectors/connections.
(2) Calculate volume based on overall outer bounding dimensions. For example, a simple bounding box (or simple shape) volume for power electronics. Volume is not required to include any cases or shielding, or external connectors/connections
(3) U.S. DRIVE Partnership Electrical and Electronics Team (EETT) Technical Team Roadmap Targets for 2025

Potential areas of innovation include, but are not limited to:

- Technologies that implement emerging materials and devices
- Wide Band Gap (WBG) semiconductors
- High energy density capacitors
- Thermal management innovations
- Technologies that enable recycling of critical materials and use of recycled materials

Requirements

Applications **must**:

1. Identify a current baseline electric traction inverter design for comparison purposes.
   a. Clearly specify the state of the art (SOA), baseline, and proposed advancements and innovations to be accomplished.
   b. Describe how the proposed R&D will lead to specific improvements in comparison to the baseline system and address the technical targets, with particular emphasis and details on cost reduction;
2. Describe the plan for validating the system technical targets through final system testing and characterization in a dyno setup.

a. Provide detailed plan to document and confirm technology validation and reports/data to be provided;

3. Describe how the proposed technology addresses typical and/or application-specific vehicle conditions and limitations such as cooling, voltages, temperatures, and speeds;
4. Describe potential for scalability and/or modularity of proposed technology and how it could be developed for light, medium, or heavy electric vehicle applications;
5. Include the following within the application U.S. Manufacturing Plan (USMP) at a minimum:
   a. Description of applicable process steps, supporting suppliers and/or materials, and equipment appropriate for high volume manufacturing of the proposed technologies for vehicle applications at low cost and high volumes.
   b. Project team manufacturing capabilities in the United States and describe how the proposed technologies could be integrated into existing or expanded manufacturing processes;

Teaming Arrangements

Project teams that include participation by vehicle original equipment manufacturer (OEM) and Electric Traction Inverter manufacturers in the United States are highly encouraged. DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required:

- High Power Density Inverter relevant to Electric Vehicle Applications for subsequent testing by the applicant
- Test plan to validate final inverter performance to technical targets;
- Listing of estimated manufacturing equipment and equipment cost required to produce the final inverter design; and
- Modular or indentured bill of materials for the final inverter design.
- Final Validation Test Report

In addition to the deliverables above, VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C., report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report, and present as required/requested to DOE VTO, partnership technical teams, and EDT Consortium meetings (plan for one presentation at each forum).

Applications Discouraged

Applications that duplicate ongoing or previous efforts, see VTO EDT 2019 Annual Report for ongoing research.

Applications that focus on development of an electric motor and/or electric drive system.

For reference:
US DRIVE Partnership EETT Roadmap
https://www.energy.gov/sites/prod/files/2017/11/f39/EETT%20Roadmap%2010-27-17.pdf

VTO EDT 2019 Annual Report
https://www.energy.gov/sites/prod/files/2020/06/f76/VTO_2019_APR_ELECTRIFICATION_FINAL_compliant_.pdf

AOI 4: Integrated Simulation of Combustion and Aftertreatment - Optimizing for Near-Zero Emissions (ISCA-ONE)

Introduction

Light- and heavy-duty vehicles running on internal combustion (IC) engines are facing numerous challenges from regulation as well as competitive vehicle technologies to reduce emissions while further improving fuel efficiency and durability. EPA's tier 3 standards, in comparison to tier 2, will reduce light-duty vehicle nitrogen oxides (NOx) emissions by up to 80% and particulate matter (PM) emissions by 70% while increasing the useful life of the emissions control system by 25% in 2025.[5] In the meantime, price of platinum group metals (platinum, palladium, Rhodium), critical components of engine aftertreatment systems (three-way catalytic converters, NOx traps, diesel oxidation catalyst etc.) have substantially increased in the last five years, therefore, putting further pressure on auto industry to reducing the content of platinum group metals while improving the performance of the aftertreatment systems.[6]

Further integration of engine combustion and aftertreatment systems through simulated modeling would enable the auto industry to realistically assess how far they could reduce emissions from their lineups while preserving or improving engine efficiency. However, targeted research is needed to facilitate development of simulation tools that can allow virtual calibration and optimization of engine combustion and exhaust aftertreatment systems for further efficiency gain, emissions reduction, and thrifting of platinum group metals. These simulation tools will need to be built from accurate component models and be able to capture spatial and temporal distributions in flow, composition, and temperature during key drive cycle transients. Specific focus is needed on the prediction of system behavior during cold-starts and low load operations, as a high proportion air pollutants are emitted from the tail pipe during these events.

Objective

The objective of this area of interest is to research, develop, and validate transient simulation tools that enable virtual coupling of engine combustion with aftertreatment systems so that industry can use them for further optimizing light- or heavy-duty aftertreatment systems for near-zero exhaust emission while maintaining or improving engine efficiency. The integrated tool should combine state-of-the-art simulations to predict emission formation in-cylinder, the evolution of chemical species and from the exhaust valve to aftertreatment

[5] https://dieselnet.com/standards/us/ld_t3.php

[6] http://www.platinum.matthey.com/prices/price-charts

system, and the relevant catalytic reactions within the aftertreatment system. Where applicable, research should utilize high-performance computing, balancing increased accuracy of simulations with reduced simulation turnaround time.

Anticipated technology approaches include but not limited to:

- Experimentally validated models of aftertreatment devices able to make connection with various combustion strategies
- Experimentally validated simulation tools that will identify catalysts for optimum emissions reduction
- Experimentally validated simulated tools that model how exhaust gases permeate through catalysts, their flow chemistry as well as catalyst filtration efficiency
- Models that demonstrate how the catalysts are changing their performance over extended period and help develop an aging test protocol

Requirements

Applications **must:**

1. Clearly define the system they plan to simulate (ex. stoichiometric engine with three-way catalyst or diesel engine with particulate filter, oxidation catalyst, and selective catalytic reduction system),
2. Identify the state-of-the-art for simulating in-cylinder emissions formation, aftertreatment performance, and the trade-offs between speed and accuracy of the different models,
3. Describe the proposed simulation tool and how the proposed tool would address these trade-offs
4. Identify metrics and measures to be used to track project progress, and
5. Include a plan to validate performance of the simulation tool with experimental data collected on regulatory test cycles and how the simulation tool will facilitate integration of combustion and exhaust aftertreatment systems.

Final deliverable should include end-to-end high fidelity simulation tool for combustion and exhaust emissions with modeled benefit.

Teaming Arrangements

Applicants are encouraged to include auto industry and/or Tier 1 suppliers. DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

The awarded teams must detail how the simulation tool compares with the state-of-the-art tools available to manufacturers and demonstrate their advantages over the existing ones. Simulation tools developed under this program, including new software or user defined functions called by commercial software, must be made widely available.

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C. and report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report.

Applications Discouraged

None.

AOI 5: Demonstration of Lightweight Multi-Material Glider System

Introduction

VTO's overall light weight vehicle structure performance and cost goal is to reduce vehicle glider weight by 25% (560 lbs) at less than a $5/lb-saved cost penalty by 2025, relative to a model year 2015 baseline. Achieving this goal would represent an additional 3-4 mpg of fuel economy for midsize sedans with internal combustion engines or increased range for electric vehicles. Previous and ongoing projects supported by VTO are on track to achieve a 400 lb weight reduction. These research efforts have focused on component weight reduction for doors, seats, bumpers, body-in-white, subframes, steering knuckles, brake rotors, wheels, battery box, cross bar, and oil pans [https://www.energy.gov/eere/vehicles/reports-and-publications]. The applications sought under this area of interest represent opportunities to further reduce glider weight by an additional 160 lbs and enable VTO to fully achieve the 2025 weight reduction goal.

The most effective way to reduce the overall weight of a vehicle is to tailor the material selection to each component's needs. However, joining dissimilar materials to create a multi-material structure creates significant challenges in assembly, coatings, controlling distortion through paint bake, and prediction of crash performance. Early stage research at the National Laboratories has increased fundamental knowledge in many of these areas through laboratory scale development. Prior EERE efforts [7] have demonstrated a 23% total vehicle weight savings without cost requirements and identified several technical challenges to the widespread production of lightweight multi-material vehicles.

Objective

The objective of this area of interest is to demonstrate production of a large-scale multi-material passenger vehicle sub-system that weighs 160 lb less than its 2015 or later baseline at less than a $5/lb-saved cost penalty. The passenger vehicles of interest for this FOA include class C-D cars and SUVs with unibody construction.

Requirements

Applications ***must***:

1. Identify a specific sub-assembly of a vehicle glider that will weigh at least 160 lbs less than its 2015 or later baseline. For the purposes of this FOA, multi-material means an assembly consisting of components made of two

[7] https://www.energy.gov/eere/success-stories/articles/eere-success-story-multi-material-lightweight-vehicle-helps-bring

or more of the following materials: steel, aluminum, magnesium, or polymer composite;
2. Demonstrate joining of dissimilar materials at high volume, production-relevant take times;
3. Include a successful corrosion mitigation strategy that meets cost targets;
4. Include development and demonstration of a method for sorting production scrap by alloy/grade;
5. Include a fully accounted cost analysis of the assembled lightweight design as a Go/No-Go prior to beginning the production phase;
6. Include a plan to demonstrate production of the lightweight structure using processes compatible with high volume production (>200,000 ppy); and
7. Include plans to test that the produced lightweight design meets safety, durability, fatigue, noise and vibration performance requirements established by OEM.

Approaches are anticipated to include, but are not limited to:

- Predictive modeling of deflection after paint-bake due to coefficient of thermal expansion differences.
- Cost effective coatings for corrosion control that can be applied to all materials in the design after assembly and prior to painting.
- Automated joining processes at high volume production relevant takt times.
- Cost effective, high volume methods of sorting multi-material production scrap and shredded end of life vehicles for recycling.
- Real-time control of joining processes to ensure quality of dissimilar material joints.
- Improved steel coatings for corrosion mitigation, adhesive compatibility, and welding.
- Advanced manufacturing methods and low cost tooling for lightweight components.

Teaming Arrangements

At least one automotive original equipment manufacturer (OEM) or Tier 1 supplier is **required** to provide automotive performance and manufacturing requirements. For the purposes of this area of interest, an OEM is defined as a commercial manufacturer that sells at least 500 vehicles annually. DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C. and report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report.

Applications Discouraged

Inclusion of any of the following sub-assemblies for demonstration is discouraged:

- Door
- Seat
- Sub-frame
- Hood
- Deck lid
- Brake rotors
- Steering knuckles
- Wheels
- Battery box
- Powertrain components (engine, transmission, fuel system, etc.)
- Sub-assemblies or BIW of large SUVs (body on frame), pick-up trucks, off-road vehicles, motorcycles, three-wheeled vehicles, neighborhood electric vehicles, low-speed vehicles, medium-duty vehicles, heavy-duty vehicles and non-conventional passenger vehicles

AOI 6: Low-cost Infrastructure-based Enablers for Cooperative Driving Automation

Introduction

Existing roadways and infrastructure are designed for human drivers and primarily rely on sight and sound to navigate. Connected and automated vehicles (CAVs) are not limited to sight and sound and can receive information in far more ways than human drivers. By providing information to the vehicle through connectivity and / or additional sensors, there is the potential to reduce the on-board compute burden and / or improve operational efficiency while providing redundancy in complex sensing environments, such as in urban areas or in poor weather. Cooperative driving automation (CDA) enables CAVs to communicate between vehicles, infrastructure devices, and road users such as pedestrians and cyclists.

Studies have shown that offloading perception from a level 4 autonomous vehicle to infrastructure can decrease the on-vehicle compute load from several thousand watts to a few hundred watts. They have also shown that broadcasting information to vehicles via signage or roadside infrastructure 40 meters in advance has the potential to improve operational efficiency by 10%. Increasing the effectiveness of the communication and sensing can expand the operational design domain of automated vehicle technologies, thereby increasing the potential impact that these technologies will have.

State and local Departments of Transportation (DOTs) maintain local roadways and infrastructure and make related purchasing decisions. These organizations are responsible for planning infrastructure improvements and making infrastructure investments to effectively serve their communities. Connected and automated vehicle are emerging technologies and planning and investment decisions can benefit from information regarding how different infrastructure solutions can enable them to operate more effectively. It is important that technology innovations align with cost and other considerations of purchasing and investment decisions.

Objective

This area of interest seeks to develop and demonstrate technologies that lead to low-cost infrastructure upgrades to reduce on-board compute load and/or improve operational efficiency of CAVs through CDA. This can be accomplished through infrastructure-only upgrades or novel applications of on-vehicle technology paired with infrastructure technology. Proposed innovations must be

implementable by local or State DOTs at minimal additional cost to normal transportation infrastructure maintenance and upgrades.

Innovations can be implemented through connectivity, sensing, or novel interactions between sensors and infrastructure technologies. Applications that only include on-vehicle sensing technologies (such as LiDAR, radar, and/or cameras) will not be considered. Innovations that utilize on-vehicle sensing technologies must be paired with an infrastructure-based technology to improve performance and efficiency.

Potential areas of innovation include, but are not limited to:

- Coatings and road surface markings
- Below ground infrastructure
- Static information signage (curve ahead, grade change, etc.)
- Real-time roadside communication infrastructure

Requirements

Applications **must**:

1. Describe the technology or innovation to be developed and technical barriers to be overcome for successful implementation;
2. Quantify the expected energy, mobility, and/or affordability benefits that would result from the deployment of the technology or system;
3. Include analysis showing the cost-effectiveness of the proposed innovation and how it aligns with municipal budgets and purchasing decisions;
4. Describe how data generated by the project will quantify the energy gains that result from the proposed technology;
5. Include at least two phases: technology development and validation with a technology demonstration. Small-scale / laboratory demonstration is acceptable;
6. Characterize communication latency and transmission range, as applicable; and
7. Participate in DOE's Annual Merit Review held in Washington DC.

Teaming Arrangements

Applicant teams must include active participation by city- or state-level stakeholders such as metropolitan planning organizations, departments of transportation, and others with the ability to implement the proposed infrastructure-based innovation. DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, recipients are required to provide data produced in the project validation phase to the SMART Mobility National Lab Consortium (https://www.energy.gov/eere/vehicles/energy-efficient-mobility-systems) through the Livewire Data Platform (https://livewire.energy.gov) in a timely manner. Data that project teams do not wish to be made public will be protected through a Non-Disclosure Agreement with the relevant laboratories in the Consortium.

In addition to the deliverables above VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C. and report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report.

Applications Discouraged

None.

AOI 7: Implementation of Energy Efficient Mobility Systems Technologies into Real-World System Applications

Introduction

The Energy Efficient Mobility Systems (EEMS) program conducts research at the traveler, vehicle and system level. It is focused on developing better understanding of new mobility technologies, particularly on automated, connected, electric, and shared (ACES) vehicle technology and how these ACES technologies interact with the larger transportation system to be able to improve the overall transportation system. EEMS research has focused on developing comprehensive, multi-fidelity, end-to-end integrated modeling and capabilities that uses complex agent-based simulations to understand how different aspects of the transportation system interact with each other and together under different future scenarios and what impacts these have on the transportation system. The results of this modeling and simulation capability have most recently been published through the SMART 1.0 capstone reports.[8] EEMS research has also focused on using artificial intelligence at both the vehicle level (to improve performance of CAVs) and also at the transportation network level (to model regional areas using high performance computing). EEMS research is also focused on developing tools and methodologies to validate and implement the results and insights gained from beyond modeling and simulation to controlled laboratory test beds.

The Technology Integration (TI) program has conducted successful pilot-scale deployments of alternative fuel and advanced technology vehicles with its Clean Cities partners. These pilot deployments have involved fleets, local governments, and other Clean Cities stakeholders who have explored the performance of these technologies in real-world applications and helping VTO research programs understand the benefits and challenges of these technologies.

This topic seeks to bridge the previous modeling and simulation-based systems research that EEMS has funded with the real-world implementation that the TI program has funded to conduct mobility research and deploy these results in pilot level studies in physical settings. In the context of this AOI, "pilot" refers to the first use of a technology in a specific physical location.

Through these integrated research and deployment activities, the vehicle and transportation communities can gain useful feedback to understand how new mobility technologies translate into actual hardware and system level

[8] https://www.energy.gov/eere/vehicles/downloads/eems-smart-mobility-capstone-reports-and-webinar-series

performance. This feedback will be also be essential in helping Clean Cities coalitions and cities and states understand how new mobility technologies can be implemented to help meet their local goals for improving transportation efficiency.

Objective

The objective of this area of interest is to conduct research demonstration pilots of novel and innovative energy efficient mobility technologies or practices in real-world transportation systems as "living labs." Research and Demonstration pilots under this area of interest should assess the impacts of these technologies on energy efficiency, time, cost, and accessibility to transportation resources. These real-world results will be fed back to EEMS researchers and to the Clean Cities/Technology Integration network to inform future activities.

The technologies within scope for this AOI will be limited to:

- Connectivity and automation at both the vehicle and infrastructure level (V2V, V2I, I2V)
- transit accessibility improvements (such as first mile/last mile)
- freight system optimization
- Transportation-as-a-service.

Project strategies may include a demonstration of hardware or a combination of hardware demonstration and system simulation and may include multiple technologies as part of a systems approach. This could include projects such as (but not limited to):

- Large scale demonstration of connected vehicles and associated enabling infrastructure
- Pilot study of multi-modal (on-demand shuttles, transit) options to improve access
- Design and pilot testing of automated last-mile delivery services
- Demonstration of automated bus/truck capabilities to improve driver experience, improve safety, and reduce energy consumption

In all cases, applicants must explain the scope of the demonstration, the potential avenues for scale-up of the demo, and the benefits that would result from the scale-up of the project beyond the demo.

Requirements

Applications **must:**

1. Clearly describe the technology (or technologies) to be implemented, the rationale for selecting these technologies, and any barriers to be overcome for successful implementation;

2. Clearly describe the geographic and transportation system scope of the proposed project (i.e., is it a downtown area, a highway corridor, a freight facility or facilities? What vehicle types will be included in the project?);
3. Clearly identify metrics of the proposed project, including baseline performance and end-of-project targets. Applicants are highly encouraged to consider metrics such as improvements to mobility energy productivity (MEP), vehicle miles travelled, productive hours travelled, freight load capacity, vehicle occupancy, vehicle energy efficiency (energy/mile driven), average trip speed, congestion, travel efficiency, network efficiency, and other similar and salient metrics;
4. Quantify the expected energy, mobility, and/or affordability benefits that would result from the deployment of the technology to be developed, supported by analysis, modeling, or simulation results as appropriate;
5. Describe how the project team will share the data on expected energy/mobility/affordability improvements with DOE and its National Laboratories;
6. Describe how data generated by the project will quantify the energy and mobility gains that result from the proposed technology, and how the project team will share this data with DOE and its National Laboratories;
7. Describe the project outreach plan to communicate results, including lessons learned, best practices, and case studies, to educate the broader transportation community (particularly the Clean Cities coordinators and stakeholders); and
8. Participate in the Annual Merit Review held in Washington, DC.

Teaming Arrangements

- Applicants are strongly encouraged to include active participation by at least one Clean Cities coalition with clearly documented roles, responsibilities, and/or active participation by other locally-based stakeholders such as metropolitan planning organizations, departments of transportation, and others with an interest in overall transportation system efficiency. These organizations are to be part of the team to be able to implement the R&D solutions developed in the project
- Applicants are encouraged to include partnerships with past and current EEMS research organizations with direct research experience and tools that are relevant to these pilot studies
- DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Other Considerations

- Applicants are strongly encouraged to incorporate project activities that address the needs of underserved communities/regions (socially or economically disadvantaged).
- Applicants are encouraged to make use of available EEMS resources such as modeling and simulation tools wherever appropriate.
- Applicants are also encouraged to make appropriate use of previous EEMS research results such as those found in the SMART 1.0 capstone reports.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, VTO will require recipients to provide all testing and validation data produced in the project validation phase to the SMART Mobility National Lab Consortium (https://www.energy.gov/eere/vehicles/energy-efficient-mobility-systems) through the Livewire Data Platform (https://livewire.energy.gov) in a timely manner. Data that the project teams do not wish to be made public will be protected through a Non-Disclosure Agreement with the relevant laboratories in the Consortium.

In addition VTO will require recipients to participate in the EERE Annual Merit Review (AMR) in Washington, D.C. and report on annual project accomplishments for inclusion in the VTO Annual Accomplishments Report.

Applications Discouraged

None.

AOI 8: Transportation and Energy Analysis

Introduction

The Analysis Program provides a cross-cutting, overarching, and convening role within VTO in its support for and application of energy, environmental, and economic models and tools. These tools serve to estimate benefits and identify and evaluate gaps, opportunities, and challenges for VTO-supported advanced vehicle technologies. Conventionally, VTO Analysis has relied on national laboratory expertise and methods for model development and application; however, given recent and ongoing developments in electrification beyond light-duty vehicles, the Analysis Program recognizes the timely opportunity to solicit the development of new models and tools as a complement or improvement to conventional methods.

Objective

The objectives of this area of interest is to use real-world data (or representative synthetic data) to develop and/or apply either new analytical models and tools or a novel approach to or using existing model(s) to estimate energy use and associated environmental and cost impacts (compared to incumbent vehicle technologies). Illustrative application(s) of that new or existing model/tool should identify novel transportation technology opportunities and insights, especially in terms of potential energy, environmental, and cost impacts.

Topics of interest include the following:

- The economic value of managed charging (for light and/or medium and heavy vehicles)--both one-way ("V1X", e.g. delaying charging for lower costs, etc.) and bidirectional (e.g., vehicle-to-grid, or "V2G")--with an explicit comparison to other potential grid services;
- Geographically resolved estimation of market projections for medium- and heavy-vehicle electrification (including both individual fleet perspectives and broader perspectives combining multiple fleets) over time to inform infrastructure (charging and grid integration) planning;
- Benefit-cost and/or other economic analysis of advanced technologies and systems for managing medium and heavy vehicle charging;
- Cost-optimization or other heuristic approaches to cost-minimizing (or cost-reducing) strategies for grid "scale-up" and investment to support charging for growing numbers of light, medium, and heavy vehicles;
- Any combination of the above; and
- Other timely, priority economic analysis of medium and heavy vehicle electrification.

Teaming Arrangements

DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Special Deliverables

In addition to the deliverables required in the Federal Assistance Reporting Requirements Checklist, the following deliverables are required:

- Participation in the Annual Merit Review held in Washington DC
- Summary of accomplishments and project work report will be prepared for inclusion in the Vehicle Technologies Office annual programmatic progress report.

Applications Discouraged

None.

All work under EERE funding agreements must be performed in the United States. See Section IV.I.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):

- **All AOIs**
  - Applications that fall outside the technical parameters specified in Section I.A. and I.B. of the FOA.
  - Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).

- **AOI 1a**
  - Applications with a solid state electrolyte.
- **AOI 1b**
  - Applications with a solid state electrolyte.
- **AOI 2**
  - Applications that primarily focus on issues regarding Li metal anodes and/or solid-state electrolytes.
- **AOI 6**
  - Applications that only consider on-vehicle LiDAR, RADAR, and/or cameras, with no infrastructure-based innovation.
  - Applications that only demonstrate results in simulation.
- **AOI 7**

- Applications that do not include a plan to provide all sharable data to a designated DOE National Laboratory.
- Applications that propose to perform only modeling and simulation of a transportation system solution without physical implementation and validation.
- Applications that propose a simple demonstration of existing technologies that do not contribute new data or understanding to the research community

D. Authorizing Statutes

The programmatic authorizing statute is 42 U.S.C. § 16191 "Energy Efficiency" Section 911 of EPACT 2005, as amended.

Awards made under this announcement will fall under the purview of 2 Code of Federal Regulations (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 $60,200,000 of federal funding available for new awards under this FOA, subject to the availability of appropriated funds. EERE anticipates making approximately 20 to 32 awards under this FOA. EERE may issue one, multiple, or no awards. Individual awards may vary between $300,000 and $5,750,000.

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

Area of Interest Number	Area of Interest 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)
1a	Next-generation Liquid Electrolytes for Li-ion Cells under Extreme Conditions	2-3	$1,666,667	$2,500,000	$5,000,000	39
1b	Liquid Electrolytes for Li-S cells	2-3	$1,666,667	$2,500,000	$5,000,000	39
2	Development of State-of-the-art Lithium Sulfur and Lithium Air Battery Cells	4-5	$1,000,000	$1,250,000	$5,000,000	39
3	High Power Density Inverters	2-4	$2,500,000	$5,000,000	$10,000,000	39
4	Integrated Simulation of Combustion and Aftertreatment - Optimizing for Near-Zero Emissions (ISCA-ONE)	1-2	$2,500,000	$5,000,000	$5,000,000	27-39
5	Demonstration of Lightweight Multi-Material Glider System	2-3	$3,833,333	$5,750,000	$11,500,000	39
6	Low-cost Infrastructure-based Enablers for	1-3	$1,500,000	$4,500,000	$4,500,000	39

	Cooperative Driving Automation					
7	Implementation of Energy Efficient Mobility Systems Technologies into Real-World System Applications	3-5	$2,600,000	$4,333,333	$13,000,000	39
8	Transportation and Energy Analysis	3-4	$300,000	$400,000	$1,200,000	27-39

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

ii. Period of Performance

EERE anticipates making awards up to 39 months in length, comprised of one or more budget periods.

Budget Period	Budget Period Length
1	15 months
2	12 months
3	12 months

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

iii. New Applications Only

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

B. EERE Funding Agreements

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

i. Cooperative Agreements

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

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

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

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

FFRDCs will be funded through the prime recipient as a member of the project team.

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.

The National Energy Technology Laboratory is ineligible to participate as a prime applicant or as a team member/sub-recipient on any application because of its role in developing the requirements for this announcement.

A. Eligible Applicants

i. Restricted Eligibility

The National Energy Technology Laboratory is ineligible to participate as a prime applicant or as a team member/sub-recipient on any application because of its role in developing the requirements for this announcement. The National Science Foundation (NSF) is ineligible to apply to AOI 4 due to its role in developing the requirements for that topic. The Combat Capabilities Development Command Ground Vehicles System Center (CCDC-GVSC, formerly known as U.S. Army Tank Automotive Research, Development and Engineering Center [TARDEC]) is ineligible to apply to this FOA due to its role in developing the requirements for this FOA.

ii. Individuals

U.S. citizens and lawful permanent residents are eligible to apply for funding as a prime recipient or subrecipient.

iii. Domestic Entities

For-profit entities, educational institutions, and nonprofits that are incorporated (or otherwise formed) under the laws of a particular state or territory of the United States and have a physical location for business operations in the United States are eligible to apply for funding as a prime recipient or subrecipient. 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.

State, local, and tribal government entities are eligible to apply for funding as a prime recipient or subrecipient.

Area of Interest 1a, 1b, 3, 4, 5, 6, 7, and 8: DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

Area of Interest 2: DOE/NNSA FFRDCs are not eligible to apply for funding as a either a prime recipient or subrecipient.

For all Areas of Interest, non-DOE/NNSA FFRDCs are eligible to apply for funding as a subrecipient, but are not eligible to apply as a prime recipient.

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

iv. Foreign Entities

Other than as provided in the "Individuals" or "Domestic Entities" sections above, all prime recipients receiving funding under this FOA must be incorporated (or otherwise formed) under the laws of a State or territory of the United States and have a physical location for business operations in the United States. If a foreign entity applies for funding as a prime recipient, it must designate in the Full Application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a State or territory of the United States to be the prime recipient. The Full Application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

A foreign entity may receive funding as a subrecipient.

v. Incorporated Consortia

Incorporated consortia, which may include domestic and/or foreign entities, are eligible to apply for funding as a prime recipient or subrecipient. For consortia incorporated (or otherwise formed) under the laws of a state or territory of the United States, please refer to "Domestic Entities" above

Each incorporated consortium must have an internal governance structure and a written set of internal rules. Upon request, the consortium must provide a written description of its internal governance structure and its internal rules to the EERE Contracting Officer.

vi. Unincorporated Consortia

Unincorporated Consortia, which may include domestic and foreign entities, must designate one member of the consortium to serve as the prime recipient/consortium representative. The prime recipient/consortium

representative must be incorporated (or otherwise formed) under the laws of a state or territory of the United States. The eligibility of the consortium will be determined by the eligibility of the prime recipient/consortium representative under Section III.A. of the FOA.

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

- Management structure;
- Method of making payments to consortium members;
- Means of ensuring and overseeing members' efforts on the project;
- Provisions for members' cost sharing contributions; and
- Provisions for ownership and rights in intellectual property developed previously or under the agreement.

B. Cost Sharing

See 2 CFR 200.306 and 2 CFR 910.130 for the applicable cost sharing requirements.

Area of Interest Number	Area of Interest Title	Cost Share Requirement
1a	Next-generation Liquid Electrolytes for Li-ion Cells under Extreme Conditions	20%
1b	Liquid Electrolytes for Li-S cells	20%
2	Development of State-of-the-art Lithium Sulfur and Lithium Air Battery Cells ~~Battery Incubator/Open Topic~~	20%
3	High Power Density Inverters	20%
4	Integrated Simulation of Combustion and Aftertreatment - Optimizing for Near-Zero Emissions (ISCA-ONE)	20%
5	Demonstration of Lightweight Multi-Material Glider System	50%
6	Low-cost Infrastructure-based Enablers for Cooperative Driving Automation	20%
7	Implementation of Energy Efficient Mobility Systems Technologies into Real-World System Applications	50%
8	Transportation and Energy Analysis	10%

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

i. Legal Responsibility

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

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

ii. Cost Share Allocation

Each project team is free to determine how best to allocate the cost share requirement among the team members. The amount contributed by individual project team members may vary, as long as the cost share requirement for the project as a whole is met.

iii. Cost Share Types and Allowability

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

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

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

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

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

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

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

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

Cost share contributions must be specified in the project budget, verifiable from the prime recipient's records, and necessary and reasonable for proper and efficient accomplishment of the project. As all sources of cost share are considered part of total project cost, the cost share dollars will be scrutinized under the same federal regulations as federal dollars to the project. Every cost share contribution must be reviewed and approved in advance by the Contracting Officer and incorporated into the project budget before the expenditures are incurred.

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

iv. Cost Share Contributions by FFRDCs

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

v. Cost Share Verification

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

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

vi. Cost Share Payment

EERE requires prime recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the prime recipient's cost share for each billing period must always reflect the overall cost share ratio negotiated by the parties (i.e., the total amount of cost sharing on each invoice when considered cumulatively with previous invoices must reflect, at a minimum, the cost sharing percentage negotiated.

In limited circumstances, and where it is in the government's interest, the EERE Contracting Officer may allow the prime recipient to meet its cost share requirements on a less frequent basis, such as by budget period. Regardless of the interval requested, the prime recipient must be up-to-date on cost share at each interval.

C. Compliance Criteria

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

i. Compliance Criteria

1. *Concept Papers*
   Concept Papers are deemed compliant if:
   - The Concept Paper complies with the content and form requirements in Section IV.C. of the FOA; and
   - The applicant successfully uploaded all required documents and clicked the "Submit" button in ~~EPIC~~ EERE Exchange by the deadline stated in this FOA.

2. *Full Applications*
   Full Applications are deemed compliant if:
   - The applicant submitted a compliant Concept Paper;

- The Full Application complies with the content and form requirements in Section IV.D. of the FOA; and
- The applicant successfully uploaded all required documents and clicked the "Submit" button in ~~EPIC~~ EERE Exchange by the deadline stated in the FOA.

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 and non-DOE/NNSA Federally Funded Research and Development Centers Included as a Subrecipient

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

1. *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.

2. *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.

3. *Value/Funding*
   The value of, and funding for, the FFRDC/NL portion of the work will be included in the award to a successful applicant. DOE/NNSA will not fund a DOE/NNSA FFRDC/NL through the DOE field work authorization process and other FFRDC/NLs through an interagency agreement with the sponsoring

agency. FFRDCs/NLs will be treated as subawards for applicants. Therefore, applicants should prepare the budgets utilizing rates appropriate for such an arrangement. For subawards to DOE FFRDCs, the recipient shall use the Department's strategic partnership projects program and the terms and conditions established for that program.

4. *Cost Share*
   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.

5. *Responsibility*
   The prime recipient will be the responsible authority regarding the settlement and satisfaction of all contractual and administrative issues including, but not limited to disputes and claims arising out of any agreement between the prime recipient and the FFRDC contractor.

6. *Limit on FFRDC Effort*

   The FFRDC effort, in aggregate, shall not exceed 25% of the total estimated cost of the project, including the applicant's and the FFRDC's portions of the effort.

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 provided that an eligible Concept Paper was submitted for each Full Application.

G. Questions Regarding Eligibility

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

IV. Application and Submission Information

A. Application Process

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

Areas of Interest	Phase 1: Concept Paper	Phase 2: Full Application
Areas of Interest 1a, 1b, 2, 3, 4, 5, 6, 7, and 8	Yes	Yes

At each phase, EERE performs an initial eligibility review of the applicant submissions to determine whether they meet the eligibility requirements of Section III of the FOA. EERE will not review or consider submissions that do not meet the eligibility requirements of Section III. All submissions must conform to the following form and content requirements, including maximum page lengths (described below) and must be submitted via ~~EPIC~~ EERE Exchange at https://eere-exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~, unless specifically stated otherwise. **EERE will not review or consider submissions submitted through means other than ~~EPIC~~ EERE Exchange, submissions submitted after the applicable deadline, or incomplete submissions**. EERE will not extend deadlines for applicants who fail to submit required information and documents due to server/connection congestion.

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

The Concept Paper and Full Application must conform to the following requirements:

- Each must be submitted in Adobe PDF format unless stated otherwise;
- Each must be written in English;
- All pages must be formatted to fit on 8.5 x 11 inch paper with margins not less than one inch on every side. Use Calibri typeface, a black font color, and a font size of 12 point or larger (except in figures or tables, which may be 10 point font). A symbol font may be used to insert Greek letters or special characters, but the font size requirement still applies. References must be included as

footnotes or endnotes in a font size of 10 or larger. Footnotes and endnotes are counted toward the maximum page requirement;

- The Control Number must be prominently displayed on the upper right corner of the header of every page. Page numbers must be included in the footer of every page; and
- Each submission must not exceed the specified maximum page limit, including cover page, charts, graphs, maps, and photographs when printed using the formatting requirements set forth above and single spaced. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages.

Applicants are responsible for meeting each submission deadline. **Applicants are strongly encouraged to submit their Concept Papers and Full Applications at least 48 hours in advance of the submission deadline**. Under normal conditions (i.e., at least 48 hours in advance of the submission deadline), applicants should allow at least 1 hour to submit a Concept Paper or Full Application. Once the Concept Paper or Full Application is submitted in ~~EPIC~~ 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 or Full Application before the applicable deadline.

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

i. Additional Information on ~~EPIC~~ EERE Exchange

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

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

B. Application Forms

The application instructions are available on ~~EPIC~~ EERE Exchange. The application forms are available on ~~EPIC~~ and Grants.gov. To access the instructions, go to https://eere-exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~ and select the appropriate funding opportunity number.

Note: The maximum file size that can be uploaded to the ~~EPIC~~ EERE Exchange website is 10 ~~50~~MB. Files in excess of 10 ~~50~~MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds 10 ~~50~~MB but is still within the maximum page limit specified in the FOA, it must be broken into parts and denoted to that effect. For example:
TechnicalVolume_Part_1
TechnicalVolume_Part_2

C. Content and Form of the Concept Paper

To be eligible to submit a Full Application, applicants must submit a Concept Paper by the specified due date and time.

i. Concept Paper Content Requirements

EERE will not review or consider ineligible Concept Papers (see Section III of the FOA).

Each Concept Paper must be limited to a single concept or technology. Unrelated concepts and technologies should not be consolidated into a single Concept Paper.

The Concept Paper must conform to the following content requirements:

Area of Interest 1a, 1b, 2, 3, 4, 5, 6, 7, and 8

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Area of Interest being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Technology/Project Description	3 pages maximum	Applicants are required to describe succinctly: • The proposed technology, including its basic operating principles and how it is unique and innovative;

		• The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state-of-the-art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application; • The potential impact that the proposed project would have on the relevant field and application; • The key technical risks/issues associated with the proposed technology development plan; and • The impact that EERE funding would have on the proposed project. 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 worked together with its teaming partners on prior projects or programs; and • Whether the applicant has adequate access to equipment and facilities necessary to accomplish the effort and/or clearly explain how it intends to obtain access to the necessary equipment and facilities. • Applicants may provide graphs, charts, or other data to supplement their Technology Description.

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

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

While the content and form of the Concept Paper does not require proposing a cost share amount ~~or proposed project schedule~~ during the concept paper submission phase, the EERE Exchange ~~EPIC~~ system will require entering proposed project costs ~~and project budget period schedule~~ as a step in the submission process. Any proposed costs ~~or schedules~~ at the Concept Paper stage of the application process can be updated or amended at the time of full application submission.

D. Content and Form of the Full Application

Applicants must submit a Full Application by the specified due date and time to be considered for funding under this FOA. Applicants must complete the following application forms found on the ~~EPIC~~ EERE Exchange website at https://eere-exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~ in accordance with the instructions.

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

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

i. Full Application Content Requirements

EERE will not review or consider ineligible Full Applications (see Section III. of the FOA).

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

AOIs 1a, 1b, 2, 3, 4, 5, and 6 :

Component	File Format	Page Limit	File Name
Technical Volume	PDF	30	ControlNumber_LeadOrganization_TechnicalVolume
Resumes	PDF	2 per resume	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	2 per letter	ControlNumber_LeadOrganization_LOCs
Statement of Project Objectives	MS Word	10	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	N/A	ControlNumber_LeadOrganization_App424
Budget Justification Workbook	~~N/A~~ MS Excel	N/A	ControlNumber_LeadOrganization_Budget_Justification
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS PowerPoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	~~N/A~~ MS Excel	N/A	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
~~DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)~~	~~PDF~~	~~N/A~~	
Authorization from cognizant Contracting Officer for FFRDC	PDF	N/A	ControlNumber_LeadOrganization_FFRDCAuth
SF-LLL Disclosure of Lobbying Activities	PDF	N/A	ControlNumber_LeadOrganization_SF-LLL
Foreign Work	PDF	N/A	ControlNumber_LeadOrganization_Waiver
U.S. Manufacturing Plan	PDF	N/A	ControlNumber_LeadOrganization_USMP
Data Management Plan	MS Word	N/A	ControlNumber_LeadOrganization_DMP

AOIs 7 and 8:

Component	File Format	Page Limit	Filename
Technical Volume	PDF	30	ControlNumber_LeadOrganization_TechnicalVolume
Resumes	PDF	2 per resume	ControlNumber_LeadOrganization_Resumes
Letters of Commitment	PDF	2 per letter	ControlNumber_LeadOrganization_LOCs

Statement of Project Objectives	MS Word	10	ControlNumber_LeadOrganization_SOPO
SF-424	PDF	N/A	ControlNumber_LeadOrganization_App424
Budget Justification Workbook	~~N/A~~ MS Excel	N/A	ControlNumber_LeadOrganization_Budget_Justification
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS PowerPoint	1	ControlNumber_LeadOrganization_Slide
Subrecipient Budget Justification	~~N/A~~ MS Excel	N/A	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
~~DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)~~	~~PDF~~	~~N/A~~	
Authorization from cognizant Contracting Officer for FFRDC	PDF	N/A	ControlNumber_LeadOrganization_FFRDCAuth
SF-LLL Disclosure of Lobbying Activities	PDF	N/A	ControlNumber_LeadOrganization_SF-LLL
Foreign Work	PDF	N/A	ControlNumber_LeadOrganization_Waiver
Data Management Plan	MS Word	N/A	ControlNumber_LeadOrganization_DMP

Note: The maximum file size that can be uploaded to the ~~EPIC~~ EERE Exchange website is ~~50~~ 10MB. Files in excess of ~~50~~ 10MB cannot be uploaded, and hence cannot be submitted for review. If a file exceeds ~~50~~ 10MB but is still within the maximum page limit specified in the FOA it must be broken into parts and denoted to that effect. For example:

TechnicalVolume_Part_1
TechnicalVolume_Part_2

EERE will not accept late submissions that resulted from technical difficulties due to uploading files that exceed ~~50~~ 10MB.

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

ii. Technical Volume

The Technical Volume must be submitted in PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths

indicated below, EERE will review only the authorized number of pages and disregard any additional pages. This volume must address the Merit Review Criteria as discussed in Section V.A.ii. of the FOA. Save the Technical Volume in a single PDF.

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 30 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria (see Section V.A.ii of the FOA) when preparing the Technical Volume.

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

SECTION	DESCRIPTION
Cover Page	The cover page should include the project title, the specific FOA Areas of Interest being addressed, both the technical and business points of contact, names of all team member organizations, 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 their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The applicant should explicitly identify the targeted improvements to the baseline technology and the critical success factors in achieving that goal. • DOE Impact: The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or

	anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (Approximately 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: • 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 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: The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. A Go/No-Go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. At a minimum, each project must have at least one project-wide Go/No-Go decision point for each budget period (12 to 18-month period) of the project. See Section VI.B.xiii. The applicant should also provide the specific technical 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.

	• Project Management: The applicant should discuss the team's proposed management plan, including the following:
	  ○ The overall approach to and organization for managing the work
	  ○ The roles of each project team member
	  ○ Any critical handoffs/interdependencies among project team members
	  ○ The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices
	  ○ The approach to project risk management
	  ○ A description of how project changes will be handled
	  ○ If applicable, the approach to Quality Assurance/Control
	  ○ How communications will be maintained among project team members
	• Market Transformation Plan: The applicant should provide a market transformation plan, including the following:
	  ○ 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, U.S. Manufacturing Plan (for applicable AOIs), and product distribution.

Technical Qualifications and Resources (Approximately 20% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the project team's unique qualifications and expertise, including those of key subrecipients. • Describe the project team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. • This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives. • Describe the time commitment of the key team members to support the project.

	• Describe the technical services to be provided by DOE/NNSA FFRDCs, if applicable.
	• For multi-organizational or multi-investigator projects, describe succinctly:
	  ○ The roles and the work to be performed by each PI and Key Participant;
	  ○ Business agreements between the applicant and each PI and Key Participant;
	  ○ How the various efforts will be integrated and managed;
	  ○ Process for making decisions on scientific/technical direction;
	  ○ Publication arrangements;
	  ○ Intellectual Property issues; and
	  ○ Communication plans

iii. Resumes

Applicants are required to submit resumes (not to exceed 2 pages per resume) for key participating team members. Save the resumes in a single PDF.

iv. Letters of Commitment

Submit letters of commitment from all subrecipient and third party cost share providers. If applicable, also include any letters of commitment from partners/end users (2-page maximum per letter). Save the letters of commitment in a single PDF.

v. Statement of Project Objectives (SOPO)

Applicants are required to complete a SOPO. A SOPO template is available on ~~EPIC~~ EERE Exchange at https://eere-Exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~. ~~Applicants can choose to complete the SOPO using the EERE template in the EPIC system, or it can be completed off-line and uploaded to the EPIC system.~~

The SOPO, including the Milestone Table, must not exceed 10 pages. The SOPO must not exceed the page limit 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 SOPO in a single MS Word file.

vi. SF-424: Application for Federal Assistance

Complete all required fields in the ~~EPIC~~ EERE Exchange system in accordance with the instructions on the form. The list of certifications and assurances in Field 21 can be found at http://energy.gov/management/office-management/operational-management/financial-assistance/financial-assistance-forms, under Certifications and Assurances. Note: The dates and dollar amounts on the SF-424 are for the complete project period and not just the first project year, first phase or other subset of the project period.

vii. Budget Justification Workbook

Applicants are required to complete the Budget Justification Workbook. This form is available on ~~EPIC~~ EERE Exchange at https://eere-Exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~.

Prime recipients must complete each tab of the Budget Justification Workbook for the project as a whole, including all work to be performed by the prime recipient and its subrecipients and contractors.

Applicants should include costs associated with 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.

~~Applicants will have the opportunity to complete the Budget Justification Workbook directly in the EPIC system, or can choose to upload the Budget Justification. If the budget justification will be uploaded, the~~ The applicant should save the Budget Justification Workbook in a single Microsoft Excel file.

viii. Summary/Abstract for Public Release

Applicants are required to submit a one-page summary/abstract of their project. The project summary/abstract must contain a summary of the proposed activity suitable for dissemination to the public. It should be a self-contained document that identifies the name of the applicant, the project director/principal investigator(s), the project title, the objectives of the project, a description of the project, including methods to be employed, the potential impact of the project (e.g., benefits, outcomes), and major participants (for collaborative projects). This document must not include any proprietary or sensitive business information as DOE may make it available to the public after selections are made. The project summary must not exceed 1 page when printed using

standard 8.5 x 11 paper with 1" margins (top, bottom, left, and right) with font not smaller than 12 point. Save the Summary for Public Release in a single PDF.

ix. Summary Slide

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

The Summary Slide template requires the following information:

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

x. Subrecipient Budget Justification (if applicable)

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

~~Applicants will have the opportunity complete the subrecipient Budget Justification Workbook directly in the EPIC system, or can choose to upload it. If the subrecipient budget justification will be uploaded, the~~ The applicant should save the Budget Justification Workbook in a single Microsoft Excel file.

~~xi. Field Work Proposal for DOE/NNSA FFRDC~~

~~If a DOE/NNSA FFRDC contractor is to perform a portion of the work, the applicant must provide a DOE WP in accordance with the requirements in DOE Order 412.1A, Work Authorization System. Save the WP in a single PDF.~~

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

The federal agency sponsoring the FFRDC must authorize in writing the use of the FFRDC on the proposed project and this authorization must be submitted

with the application. The use of a FFRDC must be consistent with the contractor's authority under its award. Save the Authorization in a single PDF.

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

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

Prime recipients and subrecipients are required to complete and submit SF-LLL "Disclosure of Lobbying Activities" 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.

xiv. Waiver Requests: Foreign Entities and Foreign Work (if applicable)

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

As set forth in Section IV.I.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the prime recipient should make every effort to purchase supplies and equipment within the United States. Appendix C lists the necessary information that must be included in a foreign work waiver request.

Save the Waiver in a single PDF.

xv. U.S. Manufacturing Commitments

Areas of Interest 1a, 1b, 2, 3, 4, 5, and 6:

Pursuant to the DOE Determination of Exceptional Circumstances (DEC) dated September 9, 2013, each applicant is required to submit a U.S. Manufacturing Plan as part of its application. The U.S. Manufacturing Plan represents the applicant's measurable commitment to support U.S. manufacturing as a result of its award.

Each U.S. Manufacturing Plan must include a commitment 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 applicant can show to the satisfaction of DOE that it is not commercially feasible to do so (referred to hereinafter as "the U.S. Competitiveness Provision"). The applicant further agrees to make the U.S. Competitiveness Provision binding on any subawardee and any assignee or licensee or any entity otherwise acquiring rights to any subject invention, including subsequent assignees or licensees. A subject invention is any invention conceived of or first actually reduced to practice under an award.

Due to the lower technology readiness levels of this FOA, DOE does not expect the U.S. Manufacturing Plans to be tied to a specific product or technology. However, in lieu of the U.S. Competitiveness Provision, an applicant may propose a U.S. Manufacturing Plan with more specific commitments that would be beneficial to the U.S. economy and competitiveness. For example, an applicant may commit specific products to be manufactured in the U.S., commit to a specific investment in a new or existing U.S. manufacturing facility, keep certain activities based in the U.S. or support a certain number of jobs in the U.S. related to the technology. An applicant which is likely to license the technology to others, especially universities for which licensing may be the exclusive means of commercialization the technology, the U.S. Manufacturing Plan may indicate the applicant's plan and commitment to use a specific licensing strategy that would likely support U.S. manufacturing.

If DOE determines, at its sole discretion, that the more specific commitments would provide a sufficient benefit to the U.S. economy and industrial competitiveness, the specific commitments will be part of the terms and conditions of the award. For all other awards, the U.S. Competitiveness Provision shall be incorporated as part of the terms and conditions of the award as the U.S. Manufacturing Plan for that award.

The U.S. Competitiveness Provision is also a requirement for the Class Patent Waiver that applies to domestic large business under this FOA (see Section VIII.K. Title to Subject Inventions).

Save the U.S. Manufacturing Plan in a single PDF.

Areas of Interest 7 and 8:
A USMP is not required.

xvi. Data Management Plan (DMP)

Applicants are required to submit a DMP with their Full Application.

An applicant may select one of the template Data Management Plans (DMP) listed below. Alternatively, instead of selecting one of the template DMPs below, an applicant may submit another DMP provided that the DMP, at a minimum, (1) describes how data sharing and preservation will enable validation of the results from the proposed work, how the results could be validated if data are not shared or preserved and (2) has a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publications. DOE Public Access Plan dated July 24, 2014 provides additional guidance and information on DMPs.

Option 1 (when protected data is allowed): For the deliverables under the award, the recipient does not plan on making the underlying research data supporting the findings in the deliverables publicly-available for up to five (5) years after the data were first produced because such data will be considered protected under the award. The results from the DOE deliverables can be validated by DOE who will have access, upon request, to the research data. Other than providing deliverables as specified in the award, the recipient does not intend to publish the results from the project. However, in an instance where a publication includes results of the project, the underlying research data will be made available according to the policies of the publishing media. Where no such policy exists, the recipient must indicate on the publication a means for requesting and digitally obtaining the underlying research data. This includes the research data necessary to validate any results, conclusions, charts, figures, images in the publications.

Option 2: For any publication that includes results of the project, the underlying research data will be made available according to the policies of the publishing media. Where no such policy exists, the recipient must indicate on the publication a means for requesting and digitally obtaining the underlying research data. This includes the research data necessary to validate any results, conclusions, charts, figures, images in the publications.

Save the DMP in a single MS Word file.

E. Post Selection Information Requests

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

- Indirect cost information;
- Other budget information;
- Updated Commitment Letters from Third Parties Contributing to Cost Share, if applicable;
- Name and phone number of the Designated Responsible Employee for complying with national policies prohibiting discrimination (See 10 CFR 1040.5);
- Representation of Limited Rights Data and Restricted Software, if applicable;
- Environmental Questionnaire; and
- Foreign National Involvement.

F. Dun and Bradstreet Universal Numbering System (DUNS) Number and System for Award Management (SAM)

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

G. Submission Dates and Times

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

H. Intergovernmental Review

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

I. Funding Restrictions

i. Allowable Costs

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

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

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

ii. Pre-Award Costs

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

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

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

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

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

   EERE does not guarantee or assume any obligation to reimburse pre-award costs incurred prior to receiving written authorization from the Contracting Officer. If the applicant elects to undertake activities that DOE determines may have an adverse effect on the environment or limit the choice of

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

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

1. Requirement

All work performed under EERE awards must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment; however, the prime recipient should make every effort to purchase supplies and equipment within the United States. The prime recipient must flow down this requirement to its subrecipients.

2. Failure to Comply

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

3. Waiver

There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside the United States. To seek a foreign work waiver, the applicant must submit a written waiver request to EERE. Appendix C lists the necessary information that must be included in a request for a foreign work waiver.

The applicant must demonstrate to the satisfaction of EERE that a waiver would further the purposes of the FOA and is in the economic interests of

the United States. EERE may require additional information before considering a waiver request. Save the waiver request(s) in a single PDF. The applicant does not have the right to appeal EERE's decision concerning a waiver request.

iv. Construction

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

v. Foreign Travel

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

vi. Equipment and Supplies

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

Property disposition will be required at the end of a project if the current fair market value of property exceeds $5,000. For-profit entity disposition requirements are set forth at 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316.

vii. Domestic Preference – Infrastructure Projects

As appropriate and to the extent consistent with law, Applicants shall ensure that, to the greatest extent practicable, iron and aluminum as well as steel, cement, and other manufactured products (items and construction materials composed in whole or in part of non-ferrous metals such as aluminum; plastics and polymer-based products such as polyvinyl chloride pipe; aggregates such as concrete; glass, including optical fiber; and lumber) used in the proposed project shall be produced in the United States. This requirement shall flow down to all sub-awards including all contracts, subcontracts and purchase orders for work performed under the proposed project.

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/r-r-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

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

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

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

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.

V. Application Review Information

A. Technical Review Criteria

i. Concept Papers

Concept Papers are evaluated based on consideration of the following factors all of which are of equal weight.

Areas of Interest 1a, 1b, 2, 3, 4, 5, 6, and 7:

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

This criterion involves consideration of the following factors:

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

Area of Interest 8:

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

This criterion involves consideration of the following factors:

- The proposed project is responsive to the objectives as stated in the FOA/Area of Interest;
- The proposed project is clearly described, unique, and innovative;
- The proposed approach/project will significantly accelerate the widespread use of the identified technologies or fuels;
- The probability that the proposed project will accomplish its objectives;
- The proposed partnerships are appropriate; and
- The applicant has the qualifications, experience, capabilities and other resources necessary to complete the proposed project.

ii. Full Applications

Applications will be evaluated against the merit review criteria shown below.

Area of Interest 1a, 1b, 2, 3, 4, 5, and 6:

Criterion 1: Technical Merit, Innovation, and Impact (45%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the application demonstrates knowledge of the current state-of-the-art (SOA) or baseline technology and how the proposed project will move the state-of-the-art;
- Extent to which the proposed project will likely achieve prescribed goals, targets, or requirements as described in the area of interest; and
- Extent to which the proposed project is technically sound, viable, and is supported by relevant data, calculations, technical assumptions, design rationale, alternatives, discussion of prior work, and references to literature.

Criterion 2: Project Plan (40%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the approach comprehensively and logically addresses research, development, validation, technology integration, risks, and risk mitigation strategies as well as provides appropriate tasks and detailed task descriptions;
- Extent to which the project schedule includes all required tasks, reasonable task durations, logical predecessor and successor task ordering, and a defined critical path;
- Extent to which the baseline performance is defined, performance metrics quantify interim performance progress, appropriately scheduled SMART milestones demonstrate project advancement based upon significant project outcomes, and appropriately scheduled SMART Go/No Go Decision Points represent decisions regarding project continuation; and
- Extent to which the Technology Transfer Plan/Manufacturing Plan demonstrates knowledge of the target market(s), distribution channels, required licensing, and competitors as well as the risks and risk mitigation strategies associated with each.

Criterion 3: Project Team and Resources (15%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the qualifications, relevant experience, and time commitment of the individuals on the proposed project team are aligned and integrated for successful completion of the proposed project;
- Extent to which existing equipment and facilities, along with proposed acquisition of equipment, support successful completion of the proposed project; and
- Extent and appropriateness of resource commitment to the proposed project by project partners or other key participants validated by letters of commitment.

Area of Interest 7:

Criterion 1: Technical Merit, Innovation, and Impact (40%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the application demonstrates knowledge of the current state-of-the-art (SOA) or baseline technology and how the proposed project will move the state-of-the-art;
- Extent to which the proposed project will likely achieve prescribed goals, targets, or requirements as described in the area of interest; and
- Extent to which the proposed project is technically sound, viable, and is supported by relevant data, calculations, technical assumptions, design rationale, alternatives, discussion of prior work, and references to literature.

Criterion 2: Project Plan (40%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the approach comprehensively and logically addresses research, development, validation, technology integration, risks, and risk mitigation strategies as well as provides appropriate tasks and detailed task descriptions;

- Extent to which the project schedule includes all required tasks, reasonable task durations, logical predecessor and successor task ordering, and a defined critical path; and
- Extent to which the baseline performance is defined, performance metrics quantify interim performance progress, appropriately scheduled SMART milestones demonstrate project advancement based upon significant project outcomes, and appropriately scheduled SMART Go/No Go Decision Points represent decisions regarding project continuation.

Criterion 3: Project Team and Resources (20%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the qualifications, relevant experience, and time commitment of the individuals on the proposed project team are aligned and integrated for successful completion of the proposed project;
- Extent to which existing equipment and facilities, along with proposed acquisition of equipment, support successful completion of the proposed project; and
- Extent and appropriateness of resource commitment to the proposed project by project partners or other key participants validated by letters of commitment.

Area of Interest 8:

Criterion 1: Project Merit, Innovation, and Impact (40%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the proposed methods for collecting, transmitting, storing, validating and analyzing data are clearly described, feasible, and aligned with the area of interest objectives;
- Reasonableness of the approach to sharing models, tools, and analytical applications/insights and the extent to which summary reports and operational data sets will be made publicly available; and
- Comprehensiveness of the proposed models, tools, and analytical applications/insights and its consistency with the requirements of the AOI.

Criterion 2: Project Plan (30%)

This criterion involves consideration of the following factors, all of which are equal weight:

- Extent to which the project plan and schedule include all required tasks, reasonable task durations, logical predecessor and successor task ordering, and a defined critical path;
- Extent to which the baseline performance is defined, performance metrics quantify interim performance progress, appropriately scheduled SMART milestones demonstrate project advancement based upon significant project outcomes, and appropriately scheduled SMART Go/No Go Decision Points represent decisions regarding project continuation;
- Extent to which the project plan effectively addresses the management of Personally Identifiable Information (PII); and
- Extent to which the approach comprehensively and logically addresses research, development, validation, technology integration, risks, and risk mitigation strategies as well as provides appropriate tasks and detailed task descriptions.
- ~~Extent to which the project schedule includes all required tasks, reasonable task durations, logical predecessor and successor task ordering, and a defined critical path; and~~
- ~~Extent to which the baseline performance is defined, performance metrics quantify interim performance progress, appropriately scheduled SMART milestones demonstrate project advancement based upon significant project outcomes, and appropriately scheduled SMART Go/No Go Decision Points represent decisions regarding project continuation.~~

Criterion 3: Project Team and Resources (30%)
This criterion involves consideration of the following factors, all of which are equal weight:

- Extent of team member qualifications, relevant expertise, resource commitment, and time commitment to address all aspects of the proposed work with a high probability of success;
- Reasonableness of the allocation of project resources to ensure the successful completion of the proposed work; and
- Extent and appropriateness of resource commitment to the proposed project by project partners or other key participants validated by letters of commitment.

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 April 14, 2017, 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:

- Whether the proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject FOA;
- Whether 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;
- Whether the proposed project is likely to lead to increased employment and manufacturing in the United States;
- Whether the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty; and
- Whether the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications).
- Whether the proposed project collectively represents diverse types and sizes of applicant organizations;
- Whether the proposed project will occur in a Qualified Opportunity Zone or otherwise advance the goals of Qualified Opportunity Zones. The goals include spurring economic development and job creation in distressed communities throughout the United States[9]; and

[9] Opportunity Zones were added to the Internal Revenue Code by section 13823 of the Tax Cuts and Jobs Act of 2017, codified at 26 U.S.C. 1400Z-1. The list of designated Qualified Opportunity Zones can be found in IRS Notices 2018-48 (PDF) and 2019-42 (PDF). Further, a visual map of the census tracts designated as Qualified

- Whether the proposed project exhibits team member diversity, with participants including but not limited to those from Minority Serving Institutions (MSIs), including Historically Black Colleges and Universities (HBCUs)/Other Minority Institutions (OMIs),[10] or members within Qualified Opportunity Zones.

D. Evaluation and Selection Process

i. Overview

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

ii. Pre-Selection 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, and will be limited to information already provided in the application documentation. 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.

Opportunity Zones may also be found at Opportunity Zones Resources. Also see, frequently asked questions about Qualified Opportunity Zones.

[10] Minority Serving Institutions (MSIs), including HBCUs/OMIs 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 https://www2.ed.gov/about/offices/list/ocr/edlite-minorityinst.html.

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.

iii. Recipient Integrity and Performance Matters

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

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

DOE will consider any written comments by the applicant, in addition to the other information in the designated integrity and performance system, in making a judgment about the applicant's integrity, business ethics, and record of performance under federal awards when completing the review of risk posed by applicants as described in 2 C.F.R. § 200.205.

iv. Selection

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

E. Anticipated Notice of Selection and Award Negotiation Dates

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

VI. Award Administration Information

A. Award Notices

i. Ineligible Submissions

Ineligible Concept Papers and Full Applications will not be further reviewed or considered for award. The Contracting Officer will send a notification letter by email to the technical and administrative points of contact designated by the applicant in ~~EPIC~~ 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 ~~EPIC~~ EERE Exchange.

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

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

iii. Full Application Notifications

EERE will notify applicants of its determination via a notification letter by email to the technical and administrative points of contact designated by the applicant in ~~EPIC~~ EERE Exchange. The notification letter will inform the applicant whether or not its Full Application was selected for award negotiations.

iv. Successful Applicants

Receipt of a notification letter selecting a Full Application for award negotiations does not authorize the applicant to commence performance of the project. If an application is selected for award negotiations, it is not a commitment by EERE to

issue an award. Applicants do not receive an award until award negotiations are complete and the Contracting Officer executes the funding agreement, accessible by the prime recipient in FedConnect.

The award negotiation process will take approximately 60 days. Applicants must designate a primary and a backup point-of-contact in ~~EPIC~~ 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.I.ii. of the FOA for guidance on pre-award costs.

v. Alternate Selection Determinations

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

vi. Unsuccessful Applicants

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

B. Administrative and National Policy Requirements

i. Registration Requirements

There are several one-time actions before submitting an application in response to this FOA, and it is vital that applicants address these items as soon as possible. Some may take several weeks, and failure to complete them could interfere with an applicant's ability to apply to this FOA, or to meet the negotiation deadlines and receive an award if the application is selected. These requirements are as follows:

1. **EERE Exchange** **~~EPIC~~**

Register and create an account on ~~EPIC~~ EERE Exchange at https://eere-Exchange.energy.gov/ ~~https://epicweb.ee.doe.gov~~.
This account will then allow the user to register for any open EERE FOAs that are currently in ~~EPIC~~ EERE Exchange. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission. Applicants should also designate backup points of contact so they may be easily contacted if deemed necessary. **This step is required to apply to this FOA.**

The ~~EPIC~~ EERE 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. **DUNS Number**
   Obtain a DUNS number (including the plus 4 extension, if applicable) at http://fedgov.dnb.com/webform.

3. **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.

4. **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.

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

6. **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 ~~EPIC~~ 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 Access - Unclassified Foreign Visits and Assignments Program

All applicants selected for an award under this FOA are required to provide information to the Department of Energy (DOE) in order to satisfy requirements for foreign nationals' access to DOE sites, information, technologies, equipment, programs, or personnel. A "foreign national" is defined as any person who is not a U.S. citizen by birth or naturalization.

If a selected applicant anticipates involving foreign nationals in the performance of its Award, the selected applicant must provide specific information about each foreign national to DOE for review and consideration. The selected applicant must provide this information for any foreign national who will participate in the performance of the Award for the selected applicant or any subrecipient. The information must also be provided for any foreign national who will provide a service under a contract and who will be exposed to Official Use Only (OUO) or business sensitive information, or information or technology developed under the Award that may be included under any category of national or state security.

The Secretary of Energy or the Secretary's assigned approval authority must approve foreign national participation before any foreign national may gain access to DOE sites, information, technologies, equipment, programs, or personnel or begin performance of any work under the Award.

iv. Subaward and Executive Reporting

Additional administrative requirements necessary for DOE grants and cooperative agreements to comply with the Federal Funding and Transparency Act of 2006 (FFATA) are contained in 2 CFR Part 170. Prime recipients must register with the new FFATA Subaward Reporting System database and report the required data on their first tier subrecipients. Prime recipients must report the executive compensation for their own executives as part of their registration profile in SAM.

v. National Policy Requirements

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

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

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

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

vii. Applicant Representations and Certifications

1. Lobbying Restrictions

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

2. Corporate Felony Conviction and Federal Tax Liability Representations

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

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

b. It is **not** a corporation that has any unpaid federal tax liability that has been assessed, for which all judicial and administrative remedies have been exhausted or have lapsed, and that is not being paid in a timely manner pursuant to an agreement with the authority responsible for collecting the tax liability.

For purposes of these representations the following definitions apply:

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

3. Nondisclosure and Confidentiality Agreements Representations
In submitting an application in response to this FOA the applicant represents that:

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

viii. Statement of Federal Stewardship

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

ix. Statement of Substantial Involvement

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

1. EERE shares responsibility with the recipient for the management, control, direction, and performance of the project.

2. EERE may intervene in the conduct or performance of work under this award for programmatic reasons. Intervention includes the interruption or modification of the conduct or performance of project activities.

3. EERE may redirect or discontinue funding the project based on the outcome of EERE's evaluation of the project at the Go/No-Go decision point(s).

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

x. Subject Invention Utilization Reporting

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

xi. Intellectual Property Provisions

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

xii. Reporting

Reporting requirements are identified on the Federal Assistance Reporting Checklist, attached to the award agreement. This helpful EERE checklist can be accessed at https://www.energy.gov/eere/funding/eere-funding-application-and-management-forms. See Attachment 2 Federal Assistance Reporting Checklist, after clicking on "Model Cooperative Agreement" under the Award Package section.

xiii. Go/No-Go Review

Each project selected under this FOA will be subject to a periodic project evaluation referred to as a Go/No-Go Review. At the Go/No-Go decision points, EERE will evaluate project performance, project schedule adherence, meeting milestone objectives, compliance with reporting requirements, and overall contribution to the EERE program goals and objectives. Federal funding beyond the Go/No-Go decision point (continuation funding) is contingent upon (1) availability of federal funds appropriated by Congress for the purpose of this

program; (2) the availability of future-year budget authority; (3) recipient's technical progress compared to the Milestone Summary Table stated in Attachment 1 of the award; (4) recipient's submittal of required reports; (5) recipient's compliance with the terms and conditions of the award; (6) EERE's Go/No-Go decision; (7) the recipient's submission of a continuation application; and (8) written approval of the continuation application by the Contracting Officer.

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

The Go/No-Go decision (including a DOE determination that continuation is in the best interests of the EERE program goals and objectives) is distinct from a non-compliance determination. In the event a recipient fails to comply with the requirements of an award, EERE may take appropriate action, including but not limited to, redirecting, suspending or terminating the award.

xiv. Conference Spending

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

xv. Uniform Commercial Code (UCC) Financing Statements

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

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

VII. Questions/Agency Contacts

Upon the issuance of a FOA, EERE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the FOA except through the established question and answer process as described below. Specifically, questions regarding the content of this FOA must be submitted ~~in EPIC at https://epicweb.ee.doe.gov~~ to DE-FOA-0002420@netl.doe.gov. ~~To submit an announcement-specific question, applicants must first select the specific FOA Number.~~ Questions must be submitted not later than 3 business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this FOA will be posted on ~~EPIC at: https://epicweb.ee.doe.gov~~ EERE Exchange at: https://eere-exchange.energy.gov. **Please note that you must first select this specific FOA Number in order to view the questions and answers specific to this FOA**. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer has already been posted on the website. If the question involves sensitive application information, please email it to DE-FOA-0002420@netl.doe.gov. The response will be sent by return email.

Questions related to the registration process and use of the ~~EPIC~~ EERE Exchange website should be submitted to: EERE-ExchangeSupport@hq.doe.gov ~~eere-epichelpdesk@ee.doe.gov~~.

VIII. Other Information

A. FOA Modifications

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

B. Government Right to Reject or Negotiate

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

C. Commitment of Public Funds

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

D. Treatment of Application Information

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

If an application includes trade secrets or information that is commercial or financial, or information that is confidential or privileged, it is furnished to the Government in confidence with the understanding that the information shall be used or disclosed only for evaluation of the application. Such information will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act. Without assuming any liability for inadvertent disclosure, EERE will seek to limit disclosure of such information to its employees and to outside reviewers when necessary for merit review of the application or as

otherwise authorized by law. This restriction does not limit the Government's right to use the information if it is obtained from another source.

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

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

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

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

E. Evaluation and Administration by Non-Federal Personnel

In conducting the merit review evaluation, the Go/No-Go Reviews and Peer Reviews, the government may seek the advice of qualified non-federal personnel as reviewers. The government may also use non-federal personnel to conduct routine, nondiscretionary administrative activities, including EERE contractors. The applicant, by submitting its application, consents to the use of non-federal reviewers/administrators. Non-federal reviewers must sign conflict of interest (COI) 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 Concept Papers and 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. In order to avail itself of the class waiver, a domestic large business must agree that any products embodying or produced through the use of a subject invention first created or reduced to practice under this program will be substantially manufactured in the United States, unless DOE agrees that the commitments proposed in the U.S. Manufacturing Plan are sufficient.

- Advance and Identified Waivers: Applicants 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; and

- Applicants to AOIs 1a - 6 are required to submit a U.S. Manufacturing Plan as part of their application. If selected, the U.S. Manufacturing Plan shall be incorporated into the award terms and conditions for domestic small businesses and nonprofit organizations. DOE has determined that exceptional circumstances exist that warrants the modification of the standard patent rights clause for small businesses and non-profit awardees under Bayh-Dole to the extent necessary to implement and enforce the U.S. Manufacturing Plan. Any Bayh-Dole entity (domestic small business or nonprofit organization) affected by this DEC has the right to appeal it.

K. Government Rights in Subject Inventions

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

1. Government Use License

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

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

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

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

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

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

L. Rights in Technical Data

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

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

Area of Interest 1a, 1b, 2, 3, 4, 5, and 6: Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory

authority, certain categories of data generated under EERE awards may be protected from public disclosure for up to five years after the data is generated ("Protected Data"). For awards permitting Protected Data, the protected data must be marked as set forth in the awards 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.

Area of Interest 7 and 8: Government Rights in Technical Data Produced Under Awards: The U.S. government retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. One exception to the foregoing is that 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 U.S. government regulates the transfer of information, commodities, technology, and software considered to be strategically important to the U.S. 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". To ensure compliance with Export Controls, it is the prime recipient's responsibility to determine when its project activities trigger Export Controls and to ensure compliance.

Export Controls may apply to individual projects, depending on the nature of the tasks. When Export Controls apply, the recipient must take the appropriate steps to obtain any required governmental licenses, monitor and control access to restricted information, and safeguard all controlled materials. Under no circumstances may foreign entities (organizations, companies or persons) receive

access to export controlled information unless proper export procedures have been satisfied and such access is authorized pursuant to law or regulation.

Applicants are advised that some of the results of the research conducted under this FOA are expected to be restricted for proprietary reasons and not published or shared broadly within the scientific community.

O. 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-07-16 dated May 22, 2007, found at: https://www.whitehouse.gov/sites/whitehouse.gov/files/omb/memoranda/2007/m07-16.pdf

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).

P. 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 C.F.R. § 910.501 and Subpart F.

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

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

Recipients and subrecipients are prohibited from obligating or expending federal funds 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 Public Law 115-232, section 889, covered telecommunications equipment is telecommunications equipment produced by Huawei Technologies Company or ZTE Corporation (or any subsidiary or affiliate of such entities).

a. For the purpose of public safety, security of government facilities, physical security surveillance of critical infrastructure, and other national security purposes, video surveillance and telecommunications equipment produced by Hytera Communications Corporation, Hangzhou Hikvision Digital Technology Company, or Dahua Technology Company (or any subsidiary or affiliate of such entities).

b. Telecommunications or video surveillance services provided by such entities or using such equipment.

c. Telecommunications or video surveillance equipment or services produced or provided by an entity that the Secretary of Defense, in consultation with the Director of the National Intelligence or the Director of the Federal Bureau of Investigation, reasonably believes to be an entity owned or controlled by, or otherwise connected to, the government of a covered foreign country.

Certain prohibited equipment, systems, or services, including equipment, systems, or services produced or provided by entities identified in Public Law 115-232, section 889, are recorded in the System for Award Management exclusion list.

R. Foreign Government-Sponsored Talent Recruitment Program Prohibition (October 2020)

Recipients of DOE financial assistance awards and project participants are prohibited from participating in certain foreign-government sponsored talent recruitment programs. The purpose of this prohibition is to ensure the protection of U.S. competitive and national security interests and DOE program objectives;

prevent potential conflicts of interest; and limit unauthorized transfers of scientific and technical information.

Selected applicants and Recipients of financial assistance awards under this FOA may be required to submit disclosures and/or certifications to ensure compliance with the prohibition; individual certifications and/or disclosures may be required for the selected applicant, Recipient, and certain project participants (at the recipient, subrecipient, and contractor levels). Further, to exercise due diligence, Recipients of a financial assistance award under this FOA may be required to submit updated disclosures and/or certifications during the life of the award to ensure that neither they nor certain project participants (at the recipient, subrecipient, and contractor levels) are participating in certain foreign government-sponsored talent recruitment programs.

S. Implementation of Executive Order 13798, Promoting Free Speech and Religious Liberty (November 2020)

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

~~T. Implementation of Exective Order 13950, Combating Race and Sex Stereotyping~~

~~In submitting an application in response to this FOA, the applicant represents that it will not use Federal funds, including funds to meet cost share requirements, to promote the concepts that (a) one race or sex is inherently superior to another race or sex; (b) an individual, by virtue of his or her race or sex, is inherently racist, sexist, or oppressive, whether consciously or unconsciously; (c) an individual should be discriminated against or receive adverse treatment solely or partly because of his or her race or sex; (d) members of one race or sex cannot and should not attempt to treat others without respect to race or sex; (e) an individual's moral character is necessarily determined by his or her race or sex; (f) an individual, by virtue of his or her race or sex, bears responsibility for actions committed in the past by other members of the same race or sex; (g) any individual should feel discomfort, guilt, anguish, or any other form of psychological distress on account of his or her race or sex; or (h) meritocracy or traits such as a hard work ethic are racist or sexist, or were created by a particular race to oppress another race.~~

APPENDIX A – COST SHARE INFORMATION

Cost Sharing or Cost Matching

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

How Cost Sharing Is Calculated

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

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

- Formula: Total Project Cost ($) minus federal share ($) = Non-federal share ($)
  Example: $1,250,000 minus $1,000,000 = $250,000

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

What Qualifies For Cost Sharing

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

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

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

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

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

General Cost Sharing Rules on a DOE Award

1. Cash Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s), for costs incurred and paid for during the project. This includes when an organization pays for personnel, supplies, equipment for their own company with organizational resources. If the item or service is reimbursed for, it is cash cost share. All cost share items must be necessary to the performance of the project.

2. In-Kind Cost Share – encompasses all contributions to the project made by the recipient or subrecipient(s) that do not involve a payment or reimbursement and represent donated items or services. In-Kind cost share items include volunteer personnel hours, donated existing equipment, donated existing supplies. The cash value and calculations thereof for all In-Kind cost share items must be justified and explained in the Cost Share section of the project Budget Justification. All cost share items must be necessary to the performance of the project. If questions exist, consult your DOE contact before filling out the In-Kind cost share section of the Budget Justification.

3. Funds from other federal sources MAY NOT be counted as cost share. This prohibition includes FFRDC subrecipients. Non-federal sources include any source not originally derived from federal funds. Cost sharing commitment letters from subrecipients must be provided with the original application.

4. Fee or profit, including foregone fee or profit, are not allowable as project costs (including cost share) under any resulting award. The project may only incur those costs

that are allowable and allocable to the project (including cost share) as determined in accordance with the applicable cost principles prescribed in FAR Part 31 for For-Profit entities and 2 CFR Part 200 Subpart E - Cost Principles for all other non-federal entities.

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

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

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

(1) They are verifiable from the recipient's records.

(2) They are not included as contributions for any other federally-assisted project or program.

(3) They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives.

(4) They are allowable under the cost principles applicable to the type of entity incurring the cost as follows:

a. For-profit organizations. Allowability of costs incurred by for-profit organizations and those nonprofit organizations listed in Attachment C to OMB Circular A–122 is determined in accordance with the for-profit cost principles in 48 CFR Part 31 in the FAR, except that patent prosecution costs are not allowable unless specifically authorized in the award document. (v) Commercial Organizations. FAR Subpart 31.2—Contracts with Commercial Organizations; and

b. Other types of organizations. For all other non-federal entities, allowability of costs is determined in accordance with 2 CFR Part 200 Subpart E.

(5) They are not paid by the federal government under another award unless authorized by federal statute to be used for cost sharing or matching.

(6) They are provided for in the approved budget.

(B) Valuing and documenting contributions

(1) Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which mean that amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as cost sharing or matching, that full value must be the lesser or the following:

a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or

b. The current fair market value. If there is sufficient justification, the Contracting Officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The Contracting Officer may accept the use of any reasonable basis for determining the fair market value of the property.

(2) Valuing services of others' employees. If an employer other than the recipient furnishes the services of an employee, those services are valued at the employee's regular rate of pay, provided these services are for the same skill level for which the employee is normally paid.

(3) Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as cost sharing or matching if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

(4) Valuing property donated by third parties.

a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the cost sharing or matching share must be reasonable and must not exceed the fair market value of the property at the time of the donation.

b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the

performance of the award or fully depreciated by the end of the award, provided that the Contracting Officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:

i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately-owned building in the same locality.

ii. The value of loaned equipment must not exceed its fair rental value.

(5) Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:

a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.

b. The basis for determining the valuation for personal services and property must be documented.

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

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

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

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

Each task must be calculated individually as follows:

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

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

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

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

The calculation may then be completed as follows:

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

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

APPENDIX C – WAIVER REQUESTS AND APPROVAL PROCESSES: PERFORMANCE OF WORK IN THE UNITED STATES (FOREIGN WORK WAIVER)

As set forth in Section IV.I.iii., all work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a waiver is not required for foreign purchases of these items. However, the prime recipient should make every effort to purchase supplies and equipment within the United States. There may be limited circumstances where it is in the interest of the project to perform a portion of the work outside 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 EERE 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 to waive the *Performance of Work in the United States* requirement must include the following:

- The rationale for performing the work outside the U.S. ("foreign work");
- A description of the work proposed to be performed outside the U.S.;
- An explanation as to how the foreign work is essential to the project;
- A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the US economy;
- The associated benefits to be realized and the contribution to the project from the foreign work;
- How the foreign work will benefit U.S. research, development and manufacturing, including contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
- How the foreign work will promote domestic American manufacturing of products and/or services;
- A description of the likelihood of Intellectual Property (IP) being created from the foreign work and the treatment of any such IP;
- The total estimated cost (DOE and recipient cost share) of the proposed foreign work;
- The countries in which the foreign work is proposed to be performed; and
- The name of the entity that would perform the foreign work.

EERE may require additional information before considering the waiver request.

The applicant does not have the right to appeal EERE's decision concerning a waiver request.

APPENDIX D – GLOSSARY

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

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

i. A report on the Recipient's progress towards meeting the objectives of the project, including any significant findings, conclusions, or developments, and an estimate of any unobligated balances remaining at the end of the budget period. If the remaining unobligated balance is estimated to exceed 20 percent of the funds available for the budget period, explain why the excess funds have not been obligated and how they will be used in the next budget period.

ii. A detailed budget and supporting justification if there are changes to the negotiated budget, or a budget for the upcoming budget period was not approved at the time of award.

iii. A description of any planned changes from the negotiated Statement of Project Objectives and/or Milestone Summary Table.

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

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

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

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

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

Subrecipient – A non-federal entity that receives a subaward from a pass-through entity to carry out part of a federal program; but does not include an individual that is a beneficiary of such program. A subrecipient may also be a recipient of other federal awards directly from a federal awarding agency. Also, a DOE/NNSA and non-DOE/NNSA FFRDC may be proposed as a subrecipient on another entity's application. See Section III.E.i.

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

COI	Conflict of Interest
DEC	Determination of Exceptional Circumstances
DMP	Data Management Plan
DOE	Department of Energy
DOI	Digital Object Identifier
EERE	Energy Efficiency and Renewable Energy
FAR	Federal Acquisition Regulation
FFATA	Federal Funding and Transparency Act of 2006
FOA	Funding Opportunity Announcement
FOIA	Freedom of Information Act
FFRDC	Federally Funded Research and Development Center
GAAP	Generally Accepted Accounting Principles
IPMP	Intellectual Property Management Plan
M&O	Management and Operating
MPIN	Marketing Partner ID Number
MYPP	Multi-Year Program Plan
NDA	Non-Disclosure Acknowledgement
NEPA	National Environmental Policy Act
NNSA	National Nuclear Security Agency
OMB	Office of Management and Budget
OSTI	Office of Scientific and Technical Information
PII	Personal Identifiable Information
R&D	Research and Development
RFI	Request for Information
RFP	Request for Proposal
SAM	System for Award Management
SOPO	Statement of Project Objectives
SPOC	Single Point of Contact
TIA	Technology Investment Agreement
TRL	Technology Readiness Level
UCC	Uniform Commercial Code
WBS	Work Breakdown Structure
WP	Work Proposal