Financial Assistance
Notice of Funding Opportunity
Part 1

U.S. Department of Energy (DOE)
Office of Energy Efficiency and Renewable Energy (EERE)
Fiscal Year 2025 Vehicle Technology Office Program Wide
Notice of Funding Opportunity Number: DE-FOA-0003514

Concept Paper Due: April 1, 2025
Application Due: June 18, 2025

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Before You Begin

Navigating the Notice of Funding Opportunity

The OMB Memorandum M-24-11 directs federal agencies to reduce the burden on applicants in the Notice of Funding Opportunity (NOFO) process and limit the length of the NOFO information requests. With Fiscal Year (FY) 2025 NOFOs, DOE has separated the NOFO into two parts.

The NOFO Part 1 describes the specific DOE programmatic goals and evaluation criteria, eligibility, and other components that are specific to each funding opportunity. The NOFO Part 2 includes the fixed DOE requirements that generally do not change from NOFO to NOFO, including standard information for the application phase, expectations for award negotiations, and post-award requirements. Applicants must review both the NOFO Part 1 and the NOFO Part 2 prior to applying. To facilitate navigation, you will find links throughout this document to additional information found in Part 2.

There are several required one-time actions applicants must take before applying to this NOFO. Some of these actions may take several weeks, so it is vital applicants build in enough time to complete them. Failure to complete these actions could interfere with application or negotiation deadlines or the ability to receive an award if selected. If you have previously completed the necessary registrations, make sure your registration is active and up to date. All registrations are free. Please refer to NOFO Part 2, *Get Registered,* for additional information.

This announcement is published in conjunction with NOFO Part 2 Version 1.

I. Basic Information

A. Key Facts

Issuing Agency	Department of Energy, Vehicle Technologies Office
Funding Opportunity Title	Fiscal Year 2025 Vehicle Technologies Office Program Wide Funding Opportunity
Announcement Type	Initial
Funding Opportunity Number	DE-FOA-0003514
Funding Instrument	Cooperative Agreements
Assistance Listing Number	81.086
Funding Opportunity Description	The research, development, demonstration, and deployment (RDD&D) activities to be funded under this NOFO will improve transportation by driving the innovation that can lead to the accelerated deployment of advanced technologies while also significantly improving U.S. competitiveness. This will lead to benefits including increased safety and reliability of batteries, more convenient travel options, decreased cost of driving, increased vehicle and system efficiency, and a more secure supply chain. Specifically, this NOFO is seeking innovative solutions for on-road and off-road vehicles in the areas of improved battery technology for both light- and heavy-duty applications, smart charging infrastructure, sustainable farming, workforce development, and demonstration and deployment of these new technologies.
Program Goals & Objective(s)	This NOFO seeks applications to address improved battery technology for both light- and heavy-duty applications, smart charging infrastructure, sustainable farming, workforce development, and demonstration and deployment of these new innovative technologies. The research and development work performed under this program will lead to economic and environmental benefits including extended battery reliability, improved battery packaging, decreased cost of driving, increased vehicle and system efficiency, and a competent workforce serving the

KEY DATES

Notice of Funding Opportunity Issue Date:
January 17, 2025

Concept Paper Deadline:
April 1, 2025

Application Deadline:
June 18, 2025

Anticipated Selection Notification Date:
November 5, 2025

Anticipated Award Date:
February 13, 2026

	transportation sector. Detailed technical descriptions of the specific Topic Areas are provided in the sections that follow.
Topic Areas	• Topic Area 1: Technologies for Enhanced Lithium-ion Cell Safety • Topic Area 2a: Low-Cost Production of Lithium • Topic Area 2b: Lithium Metal Surface Protection • Topic Area 3a: Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks • Topic Area 3b: Standardized Battery Module Design for Heavy-Duty Electric Trucks • Topic Area 4: Thermal Technologies for Zero Emission Vehicles • Topic Area 5: Optimized Grid Planning for Electric Vehicles Using Advanced Metering Infrastructure • Topic Area 6: CROP - Co-located Renewable-Fuel and Off-road Vehicle Pilots • Topic Area 7: Vehicle Life Cycle Analysis Baseline • Topic Area 8: Quality Improvements of Battery Busbar Joining • Topic Area 9: Electric Vehicle Workforce Development • Topic Area 10: Vehicle Technology Integration – Open Topic
Eligible Applicants	Domestic Entities: 1. Institutes of higher education; 2. For-profit entities; 3. Non-profit entities; 4. State and local government entities and Indian tribes; and 5. Consortia of entities as described above in 1 through 4. DOE Federally Funded Research & Development Center's (FFRDC's) and non-DOE FFRDCs and Federal Research Agencies are eligible to apply for funding as a subrecipient but are not eligible to apply as a prime recipient. Refer to eligibility section.
eXCHANGE URL and Helpdesk	https://eere-exchange.energy.gov ExchangeSupport@hq.doe.gov

1. Funding Details

Multiple Topic Areas

Approximate total available funding including all topic areas: $88,000,000

Topic Area 1: Technologies for Enhanced Lithium-ion Cell Safety

- Approximate total available funding: $12,000,000
- Approximate number of awards: 3-5
- Approximate dollar amount of individual awards: $2M-$4M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 2a: Low-Cost Production of Lithium

- Approximate total available funding: $7,000,000
- Approximate number of awards: 2-3
- Approximate dollar amount of individual awards: $2M-$4M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 2b: Lithium Metal Surface Protection

- Approximate total available funding: $8,000,000
- Approximate number of awards: 2-3
- Approximate dollar amount of individual awards: $3M-$6M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 3a: Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks

- Approximate total available funding: $12,000,000
- Approximate number of awards: up to 4
- Approximate dollar amount of individual awards: Up to $3M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 3b: Standardized Battery Module Design for Heavy-Duty Electric Trucks

- Approximate total available funding: $8,000,000
- Approximate number of awards: up to 2
- Approximate dollar amount of individual awards: Up to $4M
- Minimum cost share required: 50% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 4: Thermal Technologies for Zero Emission Vehicles

- Approximate total available funding: $4,000,000
- Approximate number of awards: 1-2
- Approximate dollar amount of individual awards: $2M-$4M
- Minimum cost share required: 20% of the total project costs for the first two years; 50% of the total project costs in the final year for the demonstration
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 5: Optimized Grid Planning for Electric Vehicles Using Advanced Metering Infrastructure

- Approximate total available funding: $2,000,000
- Approximate number of awards: 1-2
- Approximate dollar amount of individual awards: $1M-$2M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: 24 to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 6: CROP – Co-located Renewable Fuel and Off-road Vehicle Pilots

- Approximate total available funding: $6,000,000
- Approximate number of awards: 3-4
- Approximate dollar amount of individual awards: $1.5M-$2M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: 12 to 18 months
- Anticipated length of budget periods: 12 months

Topic Area 7: Vehicle Life Cycle Analysis Baseline

- Approximate total available funding: $3,000,000
- Approximate number of awards: 2
- Approximate dollar amount of individual awards: $1M-$3M
- Minimum cost share required: 20% of the total project costs
- Approximate award project period: up to 24 months
- Anticipated length of budget periods: 12 months

Topic Area 8: Quality Improvements of Battery Busbar Joining

- Approximate total available funding: $6,000,000
- Approximate number of awards: 2-4
- Approximate dollar amount of individual awards: $1.5M-$3M
- Minimum cost share required: 20% of the total project costs for the R&D phase; 50% of the total project costs for the demonstration phase
- Approximate award project period: 12 to 36 months
- Anticipated length of budget periods: 12 months

Topic Area 9: Electric Vehicle Workforce Development

- Approximate total available funding: $10,000,000
- Approximate number of awards: 4-6
- Approximate dollar amount of individual awards: $1.6M-$2.5M
- Minimum cost share required: 0% cost share required
- Approximate award project period: 24 to 36 months
- Anticipated length of budget periods: 1-comprehensive budget period

Topic Area 10: Vehicle Technology Integration – Open Topic

- Approximate total available funding: $10,000,000
- Approximate number of awards: 5-10
- Approximate dollar amount of individual awards: $1M-$2M
- Minimum cost share required: 50% of the total project costs
- Approximate award project period: up to 36 months
- Anticipated length of budget periods: 1-comprehensive budget period

2. Period of Performance

For Topic Areas 1-8: DOE anticipates making awards, comprised of multiple budget periods. If applicable, project continuation will be contingent upon DOE's Go/No-Go decision. For a complete list and more information on the Go/No-Go review, see the NOFO Part 2, *Award Administration Information*. Funding for all budget periods, including the initial budget period, is not guaranteed.

For Topic Areas 9-10: DOE anticipates making awards comprised of one budget period. Project continuation will be contingent upon several elements, including satisfactory performance and DOE's Go/No-Go decision. For a complete list and more information on the Go/No-Go review, see the NOFO Part 2, *Award Administration Information*.

B. Executive Summary

The Office of Energy Efficiency and Renewable Energy (EERE) is issuing on behalf of the Vehicle Technologies Office (VTO), a Notice of Funding Opportunity (NOFO) entitled "Fiscal Year 2025 Vehicle Technologies Office Program Wide Funding Opportunity Announcement."

This NOFO supports a bold approach to increase American economic competitiveness, upgrade, and modernize infrastructure, and build a clean energy economy to the benefit of all Americans through improved battery technology for both light- and heavy-duty applications, smart charging infrastructure, sustainable farming, workforce development, and demonstration and deployment of these new technologies. The Department of Energy is committed to pushing the frontiers of science and engineering, catalyzing domestic jobs through research, development, demonstration, and deployment (RDD&D), and ensuring affordable and low emission energy is available to all communities in America.

The RDD&D activities to be funded under this NOFO will support innovation to reduce the energy and cost needed to move goods and people across the US, providing more options for consumers and businesses that can lead to the accelerated deployment of advanced technologies while also significantly improving US competitiveness. This will lead to benefits including increased safety and

reliability of batteries, more convenient travel options, decreased cost of driving, increased vehicle and system efficiency, and a more secure supply chain. Specifically, this NOFO is seeking innovative solutions for on- and off-road vehicles in the areas of improved battery technology for both light- and heavy-duty applications, smart charging infrastructure, sustainable farming, workforce development, and demonstration and deployment of these new technologies.

C. Agency Contact Information

Office of Vehicle Technologies
U.S. Department of Energy
1000 Independence Ave SW
Washington, D.C. 20585

NOFO Contact Information
For questions relating to this specific NOFO, please send emails to DE-FOA-0003514@NETL.DOE.GOV.

Please be clear and concise when asking a question under the NOFO and be as specific as possible to which Topic Area you are asking the question. If it is not clear, DOE will be required to ask for additional information and clarity on the question to provide an accurate response, which will take additional time.

DISCLAIMER: Applicants are discouraged from submitting information considered proprietary unless it is deemed essential for proper evaluation of the application. If the application contains information that the applicant organization considers to be trade secrets, information that is commercial or financial, or information that is privileged or confidential, the pages containing that information must be identified as specified in the application instructions. When such information is included in the application, it will be withheld from public disclosure to the extent permitted by law, including the Freedom of Information Act, with the understanding that the information will be used or disclosed only for evaluation of the application. The information contained in the application will be protected by DOE from unauthorized disclosure, consistent with the need for merit review of applications of financial assistance awards to assure the integrity of the competitive process and the accuracy and completeness of the information. If a federal financial assistance award is made as a result of or in connection with an application, the federal government has the right to use or disclose the information to the extent authorized by law. This restriction does not limit the federal government's right to use the information if it is obtained without restriction from another source.

II. Eligibility

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 and ineligible for any award. DOE will not make eligibility determinations for potential applicants prior to the date on which applications to this NOFO must be submitted. The decision whether to apply in response to this NOFO lies solely with the applicant. The information included here is specific to eligibility requirements for this NOFO. For eligibility requirements applicable to all NOFOs, please consult the NOFO Part 2, *Eligibility*.

A. Eligible Applicants

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.

3. Domestic Entities

Domestic entities are eligible to apply as recipients or subrecipients. The following types of domestic entities are eligible to participate as a recipient or subrecipient of this NOFO:

- Institutions of higher education;
- For-profit organization;
- Nonprofit organization;
- State and local governmental entities;
- Indian Tribes, as defined in section 4 of the Indian Self-Determination and Education Assistance Act, 25 U.S.C. § 5304[1]; and
- Consortia of entities as described in the bullets above.

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

4. Foreign Entity Participation

In general, foreign entities are not eligible to apply as either a recipient or subrecipient. In limited circumstances, DOE may approve a waiver to allow a foreign entity to participate as a recipient or subrecipient.

[1] "**Indian Tribe**," for the purposes of this NOFO and as defined in in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. § 5304), means any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act (85 Stat. 688) [43 U.S.C. § 1601, et seq.], which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians. Federally Recognized Indian Tribes are also considered disadvantaged communities for the purposes of Justice40 requirements in this NOFO per https://www.whitehouse.gov/wp-content/uploads/2023/01/M-23-09_Signed_CEQ_CPO.pdf.

A foreign entity may submit an application to this NOFO, but the application must be accompanied by an explicit written waiver request. Likewise, if the applicant seeks to include a foreign entity as a subrecipient, the applicant must submit a separate explicit written waiver request in the application for each proposed foreign subrecipient. Please see NOFO Part 2, *Application Content Requirements* for the requirements for submission of a foreign entity waiver request. The applicant does not have the right to appeal DOE's decision concerning a waiver request.

Recipients must only be legally formed in the United States and have a physical location for business operations in the United States.

Entities that are organized, chartered, or incorporated (or otherwise formed) under the laws of the United States or 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 recipient or subrecipient.

Foreign Entity Participation
A foreign entity is eligible to apply for funding as a recipient if it designates in the application a subsidiary or affiliate incorporated (or otherwise formed) under the laws of a state or territory of the United States to be the recipient. The application must state the nature of the corporate relationship between the foreign entity and domestic subsidiary or affiliate.

Foreign entities may request a waiver of the requirement to designate a subsidiary in the United States as the recipient in the application (i.e., a foreign entity may request that it be the recipient). To do so, the applicant must submit an explicit written waiver request in the application.

NOFO Part 2, *Application Content Requirements* lists the information that must be included in a request to waive this requirement. The applicant does not have the right to appeal DOE's decision concerning a waiver request.

Participant Limitations
Participation of the following entities are limited as follows.

- DOE FFRDCs[2] are eligible to apply for funding as a subrecipient but are not eligible to apply as a recipient.
- Non-DOE FFRDCs are eligible to participate as a subrecipient but are not eligible to apply as a recipient.
- Federal agencies and instrumentalities (other than DOE) are eligible to participate as a subrecipient but are typically not eligible to apply as a recipient.
- National Energy Technology Laboratory (NETL) is not eligible for award under this announcement and may not be proposed as a subrecipient on another entity's application. An application that includes NETL as a recipient or subrecipient will be considered non-responsive.

Performance of Work in the United States
All work for the awards under this NOFO must be performed in the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the application. Absent an

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

approved waiver, such costs will not be allowable under the award. The NOFO Part 2, *Application Content Requirements* lists the requirements for submission of a foreign work waiver request.

Ineligible Participants

- The following entities are ineligible for participation in this NOFO as a recipient, subrecipient, or subcontractor.
- In accordance with 2 CFR 200.214, entities banned from doing business with the U.S. government such as entities debarred, suspended, or otherwise excluded from or ineligible for participating in federal programs.
- Entities identified on Department of the Treasury Office of Foreign Assets Control Treasury's Sanctions Program Specially Designated Nationals list are prohibited from doing business with the United States government and are not eligible. See OFAC - Sanctions List Service (treas.gov).
- 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.

Entity of Concern Prohibition

Entities of Concern are prohibited from participating in projects selected under this NOFO (see NOFO Part 2, *Eligibility, Other Eligibility Information, Entity of Concern Prohibition* section for details and definitions).

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

An entity may submit more than one concept paper and associated application to this NOFO if each describes a unique, scientifically distinct project concept and an eligible concept paper was submitted for each Full Application.

C. Cost Sharing

Applicants are expected to follow through on estimated cost share commitments proposed in their applications if selected for award negotiations. Please refer to the NOFO Part 2, *Eligibility* for more information on Cost Sharing.

1. Cost Share Requirements

Cost Share 20%
The cost share must be at least 20% of the total project costs[3] for research and development.[4]

Cost Share 50%
The cost share must be at least 50% of the total project costs[5] for demonstration projects.[6]

Cost Share 20% - R&D Phase and 50% - Demonstration Phase
The cost share must be at least 20% of the total project cost during the R&D phase and at least 50% of total project costs for the Demonstration Phase.

Cost Sharing Not Required
Cost sharing is not required for education projects under this NOFO.

Tribes and Tribal Nations
Tribes and Tribal Nation applicants are required to provide only a minimum 10% cost share pursuant to EERE's blanket cost share reduction, applicable to NOFOs issued after October 3, 2024, entitled by Determination to Reduce Non-Federal Cost Share Requirements for Tribes and Tribal Nations Applying for Funding from the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy.

Please reference the table below for cost shares associated with each Topic Area.

Topic Area Number	Topic Area Name	Required Cost Share[7] (%)
1	Technologies for Enhanced Lithium-ion Cell Safety	20% R&D
2a	Low-Cost Production of Lithium	20% R&D
2b	Lithium Metal Surface Protection	20% R&D
3a	Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks	20% R&D
3b	Standardized Battery Module Design for Heavy-Duty Electric Trucks	50% Demonstration
4	Thermal Technologies for Zero-Emission Vehicles (ZEVs)	20% - R&D Phase 50% - Demonstration Phase

[3] Total project costs are the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.
[4] Energy Policy Act of 2005, Pub. L. 109-58, sec. 988. Also see 2 CFR 200.306 and 2 CFR 910.130 for additional cost sharing requirements.
[5] Total project costs are the sum of the government share, including FFRDC costs if applicable, and the recipient share of project costs.
[6] Energy Policy Act of 2005, Pub. L. 109-58, sec. 988. Also see 2 CFR 200.306 and 2 CFR 910.130 for additional cost sharing requirements.
[7] For estimating purposes, use the percentage selected in Section II.A.5 below. Do not factor in any cost share above the minimum unless it is required for applicants to this NOFO.

5	Optimized Grid Planning for Electric Vehicles (EVs) Using Advanced Metering Infrastructure	20% R&D
6	CROP - Co-located Renewable-Fuel and Off-road Vehicle Pilots	20% R&D
7	Vehicle Life Cycle Analysis Baseline	20% R&D
8	Quality Improvements of Battery Busbar Joining	20% - R&D Phase 50% - Demonstration Phase
9	Electric Vehicle Workforce Development	0% Education
10	Vehicle Technology Integration – Open Topic	50% Demonstration

D. Federal Funded Research and Development Centers (FFRDCs) Eligibility Criteria

1. DOE and Non-DOE FFRDCs Eligibility Criteria as a Subrecipient

As long as they have no conflict, DOE and non-DOE FFRDCs may be proposed as a subrecipient on another entity's application subject to the following guidelines:

Authorization for non-DOE 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.

Authorization for DOE 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.

Funding, Cost Share, and Subaward with FFRDCs

The value of and funding for the FFRDC portion of the work will not normally be included in the award. DOE FFRDCs participating as a subrecipient on a project will be funded directly through the DOE Work Authorization process in accordance with DOE O 412.1A. Non-DOE FFRDCs participating as a subrecipient will be funded through an interagency agreement with the sponsoring agency.

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

All DOE FFRDCs are required to enter into a Cooperative Research and Development Agreement[8] (CRADA) or, if the role of the DOE FFRDC is limited to technical assistance and intellectual property is not anticipated to be generated from the DOE FFRDC's work, a Technical Assistance Agreement (TAA), with at least the recipient. A fully executed CRADA or TAA must be in place or be compliant with a Master Scope of Work process prior to the FFRDC starting work directly allocable to the FA award.

A CRADA is used to ensure accountability for project work and provide the appropriate management of intellectual property (IP), e.g., data protection and background IP. A Data Management Plan is not suited for this purpose.

Responsibility

The 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 recipient and the FFRDC.

Limit on FFRDC Effort

The FFRDC effort, in aggregate, shall not exceed the total project cost threshold identified in the table below.[9]

Topic Area Number	Topic Area Name	Aggregate Project Cost Threshold for FFRDC (%)
1	Technologies for Enhanced Lithium-ion Cell Safety	25%
2a	Low-Cost Production of Lithium	25%
2b	Lithium Metal Surface Protection	25%
3a	Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks	25%
3b	Standardized Battery Module Design for Heavy-Duty Electric Trucks	25%
4	Thermal Technologies for Zero-Emission Vehicles	25%
5	Optimized Grid Planning for Electric Vehicles (EVs) Using Advanced Metering Infrastructure	25%
6	CROP - Co-located Renewable-Fuel and Off-road Vehicle Pilots	20%
7	Vehicle Life Cycle Analysis Baseline	25%
8	Quality Improvements of Battery Busbar Joining	20%
9	Electric Vehicle Workforce Development	20%

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

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

10	Vehicle Technology Integration – Open Topic	25%

III. Program Description

A. Program Purpose

This NOFO improves transportation sector innovation competitiveness and reduces pollution from the transportation sector. Transportation is critical to the nation's economy, carrying people and freight as well as providing access to jobs, education, and healthcare. The transportation sector accounts for approximately 30% of total U.S. energy needs and is the largest source of greenhouse gas (GHG) emissions in the energy sector. The average U.S. household spends over 15% of its total family expenditures on transportation, making it the most expensive spending category after housing. Low-income people spend more on transportation, as high as 30% of their household income.
Providing better and cleaner transportation options that are affordable for all Americans is the core objective of the Vehicle Technologies Office (VTO). The RDD&D activities to be funded under this NOFO will support the government-wide approach to improving transportation by driving innovation that can lead to the deployment of clean energy technologies, which are critical for national competitiveness and reducing pollution. Specifically, this funding opportunity is seeking innovative solutions for on-road and off-road vehicles to improve battery technology, develop and accelerate charging infrastructure, and demonstrate innovative technologies.

As part of the whole-of-government approach to advance equity across the Federal Government, we create opportunities for the improvement of communities that have been historically underserved, which benefits everyone. As part of this approach, these anticipated funding opportunities will encourage the participation of underserved communities and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented in STEM on their project teams.

B. Program Goals and Objectives

This NOFO seeks applications to address improved battery technology for both light- and heavy-duty applications, smart charging infrastructure, sustainable farming, workforce development, and demonstration and deployment of these and other new innovative technologies. The research and development work performed under this program will lead to economic and environmental benefits including extended battery reliability, improved battery packaging, decreased cost of driving, increased vehicle and system efficiency, and a competent workforce serving transportation sector. Detailed technical descriptions of the specific Topic Areas are provided in the sections that follow.

C. Expected Performance Goals

Performance goals and targets will be determined by the applicant in alignment with target requirements or quantitative metrics of interest outlined in this NOFO on a per-topic basis. Baseline data will be provided by the applicant to serve as a reference point for project progress. Data collection to occur by monitoring completion of project milestones relevant to the specified performance goals and targets.

D. Teaming Partner List

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

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

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

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

E. Topic Areas

Topic Area Number	Topic Title
1	Technologies for Enhanced Lithium-ion Cell Safety
2a	Low-Cost Production of Lithium
2b	Lithium Metal Surface Protection
3a	Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks
3b	Standardized Battery Module Design for Heavy-Duty Electric Trucks
4	Thermal Technologies for Zero-Emission Vehicles
5	Optimized Grid Planning for Electric Vehicles Using Advanced Metering Infrastructure
6	CROP - Co-located Renewable-Fuel and Off-road Vehicle Pilots
7	Vehicle Life Cycle Analysis Baseline
8	Quality Improvements of Battery Busbar Joining
9	Electric Vehicle Workforce Development
10	Vehicle Technology Integration – Open Topic

Topic Area 1: Technologies for Enhanced Lithium-ion Cell Safety

Introduction

As more and more electric vehicles (EVs) enter the roadways, concerns over vehicle safety remain a top priority. While EVs report fewer fire incidents per mile driven compared to internal combustion engine (ICE) vehicles, challenges in containing and putting out these fires pose a major challenge. One of the primary factors leading to EV fires is the risk of thermal runaway in EV batteries. Thermal runaway

events pose a challenge due to several factors including: lack of training for emergency responders, repair shops, and storage facilities for battery related fires; risk of idle EVs catching fire during storage/charging inside of homes and parking structures; and significant financial burden to battery and EV manufacturers related to recalls caused by battery fires. Therefore, to increase EV safety perception and derisk the EV transition, enhanced battery safety is a top priority for advanced battery chemistry and cell designs.

This topic area addresses the development of technologies to improve the abuse tolerance of Li-ion cells used in plug-in electric vehicles, specifically cells with graphite anodes and mass-produced cathodes.

Objective
Technologies of interest should offer improvements on abuse tolerance parameters at the cell level, such as, but not limited to: total heat release, rate of heat release, reduction in cell-to-cell propagation and/or the flammability of ejected cell materials. Successful applications will improve the abuse tolerance of individual cells, ultimately reducing the likelihood of cascading effects of EV fires.

The cells used to demonstrate improved abuse tolerance should be at least 5Ah and should have energy densities and performances appropriate to plug-in electric vehicle requirements.

The technology will have to meet life performance equivalent to commercial cells. Moreover, the proposed technology must have the potential to achieve cell performance and abuse testing results identified in the table below:

Performance Targets for Next-Generation Li-Ion Batteries

Beginning of Life Characteristics at 30°C	Cell Level
Useable Specific Energy @ C/3	250Wh/kg
Overcharge Testing	European Council for Automotive R&D (EUCAR) 2
Overheat Testing	EUCAR 2
External Short Circuit Testing	No event
Cost	<$80/kWh*

*$100/kWh at the pack level

Anticipated technology approaches include, but are not limited to:

- Nonactive components of the cell
- Cathode materials. Commercially relevant cathode materials, Technology Readiness Level (TRL) 5 and above. A TRL of 5 is defined as a technology at laboratory scale, similar system validation in relevant environment
- Active material coatings
- Electrode coatings

- Electrolytes. Electrolyte ionic conductivity must be similar to conventional carbonate-based electrolyte conductivity at 30°C
- Cell mechanical design
- Any combination of the above

General Requirements

Applications must:

- Include plans to demonstrate baseline cells abuse tolerance results and life performance results.
- Include plans to demonstrate improvements of abuse tolerance parameters using abuse tests such as the following:
    - Overheat
    - Accelerating Rate Calorimetry (ARC)
    - Fractional Thermal Runaway Calorimeter (FTRC)
    - Overcharge
    - External Short Circuit
    - Nail Penetration
- Identify the cell components' composition/construction of the entire cell including, mechanical design (if innovative), active and non-active components with a focus on the developed technology.
- Describe the materials and component optimization pathway that achieves cell abuse performance requirements.
- Demonstrate an understanding of the major issues and barriers impeding the use of the proposed cell design, and how the particular barrier(s) will be overcome during the proposed project.
- Identify performance targets that represent the highest risk for achievement during the project and the strategies to mitigate these risks.
- Model cell to cell propagation in a battery pack.
- Describe the testing and diagnostics to be performed to understand performance and life issues for the targeted technology:
    - Indicate if data is from half-cells or paired with a graphite material.
    - Full cell data is preferred, however in the event only half-cell data is available coulombic efficiency must be included.
    - Include the electrode loading (mAh/cm2), electrolyte amount and N/P ratio of all cell performance data.
    - Indicate what temperature the experiments were performed at as well as the upper and lower voltage used for cycling the cell.
    - Include detailed procedures for abuse testing.
- Include plans to annually participate in the VTO Annual Merit Review in Washington, DC and an annual U.S. DRIVE Electrochemical Energy Storage Technical Team Meeting in Southfield, MI.
- For both the Project Progress Cells (PPCs) and Project Completion Cells (PCCs), the cells delivered to DOE will be tested according to the protocol provided below:

Cell Testing Protocol

Number of Cells	Test Type	Test Protocol
3	Cycle Life	C/3 cycle life at 30°C
3	Calendar Life	100% SOC at 45°C

3	Overcharge*	Overcharge Testing at 30°C
3	Overheat**	Overheat Testing
3	External Short Circuit***	External Short Circuit Testing at 30°C

*The Overcharge protocol will be specified by the applicant in consultation with DOE.
** The Overheat protocol will be specified by the applicant in consultation with DOE.
*** The External Short Circuit protocol will be specified by the applicant in consultation with DOE.

USABC testing is recommended. Please use the following link to review USABC testing procedures: https://uscar.org/usabc/. If the developer has their own established testing procedures a discussion can happen between DOE and Awardee upon negotiations.

Teaming Arrangements
None specified.

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 topic:

- Eighteen (18) PPCs of ≥5 Ah delivered to a to-be-designated DOE testing laboratory for performance testing at midpoint of the project length. Anode material is limited to graphite.
- Eighteen (18) PCCs of ≥5 Ah delivered to a to-be-designated DOE testing laboratory for performance testing at the end of the project. Anode material is limited to graphite.
- Report and associated data resulting from at least thirty (30) days of PPC retained cell testing following test protocols approved by the DOE. This data will be shared with the testing lab.
- Include plans to obtain at least 30 days of cycle life and calendar life test data from the retained cells prior to shipment of the deliverable cells to DOE.
- Report and associated data resulting from at least thirty (30) days of PCC retained cell testing following test protocols approved by the DOE. This data will be shared with the testing lab.

Note: All final cell deliverables must be equal or greater than 5Ah; larger than 5Ah cells are preferred but not required. It is acceptable to deliver cells that do not meet performance targets, as long as the cell components (electrodes with similar active material content, porosity, thickness, loading, etc. and separator thickness) in the delivered cells, when scaled to automotive size (40Ah or greater) are capable of meeting the targets: i.e., an applicant will not be penalized for packaging inefficiencies of small cells, but needs to deliver cells with automotive relevant electrodes, separators, and electrolyte volume. If the deliverable cells do not meet performance targets, a model validating the proposed scaling factors will also be required for interim, and final cells.

All deliverable cells shall be provided to DOE for validation testing at a 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 Statement of Project Objectives (SOPO) for the cooperative agreement and therefore should not be addressed in the SOPO nor included in the total estimated project costs associated with the application. Test procedures for the delivered cells will be agreed to between the Applicant, the test lab, and the government. Participation by a DOE National Laboratory in test planning and execution will be addressed by a Nondisclosure Agreement (NDA) between the national laboratory and the end item manufacturer. 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, 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, and delivered to, DOE (Vehicle Technologies Office) and end item manufacturer. 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 Applicant or the project.

Applications Not of Interest
Applications that propose:

- electrolyte with lower ionic conductivity than conventional carbonate-based electrolytes (5mS/cm) at 30°C
- an anode material other than graphite
- a sodium-ion chemistry
- oxide- and sulphide-based electrolytes

Topic Area 2a: Low-Cost Production of Lithium

Introduction
As lithium-metal-based batteries continue to evolve, there are concerns about the supply and cost of lithium metal. The United States depends heavily on lithium imports since there are no domestic production facilities currently operating. Imported lithium ingots are typically extruded into thick foil (>40 micron) to manufacture anodes for lithium batteries. For applications that require much thinner lithium foil, lithium can be vapor deposited directly on the current collector or on a plastic substrate for later use.

Currently, lithium is produced by the electrolysis of a lithium chloride and potassium chloride (LiCl + KCl) eutectic mixture at temperatures between 420°C and 550°C. Not only is this process highly energy-intensive due to the high-temperature requirements for the molten salts, but it also has a low production yield due to the low coulombic efficiency of the chemical reaction ($2LiCl \Leftrightarrow 2Li + Cl_2$). In addition, the reaction releases toxic chlorine gas, which requires treatment to address environmental concerns. The lithium produced through this method is of technical grade (98% purity) and must undergo further refining to achieve battery-grade purity (99.9%), adding to overall production costs.

Objective
This topic seeks innovative approaches for producing battery-grade lithium at a lower cost, with reduced energy consumption, improved production yield, and minimal environmental impact compared to the current process. These new methods should harness U.S. lithium resources to bolster supply chain resilience for next-generation batteries that rely on metallic lithium as the anode material. Projects should clearly describe the R&D innovations in the proposed application, including the process cost, energy use, purity, and final lithium cost.

General Requirements
Compared to the current process (described in the introduction), the new process should demonstrate:

- A lower cost (at least 25% savings),

- An improved coulombic efficiency (>70%),
- A lower operating temperature (< 500°C), and
- The product should be free from other metal impurities, surface should be free of any oxide layer and salt precipitation, with no cracks in the ingot, and no visually observable contamination.

Teaming Arrangements
None specified.

Special Deliverables
A working lab-scale prototype that demonstrates lithium production (100 grams per batch) and meets the requirements listed above.

Applications Not of Interest
Applications that propose direct lithium extraction (that extracts lithium salt from brine on an adsorbed material) are not of interest and will not be reviewed.

Topic Area 2b: Lithium Metal Surface Protection

Introduction
Scientists have long sought to harness the benefits of a lithium metal anode. With its high theoretical capacity and low redox potential, lithium metal is highly suitable for pairing with next-generation, high-capacity cathode materials, such as sulfur or air. However, challenges with uncontrolled dendritic lithium growth, low coulombic efficiency during lithium deposition and stripping, and the formation of "dead" lithium have limited the cycle life and raised safety concerns in rechargeable lithium batteries. Recent studies have highlighted the importance of lithium foil surface treatment in addressing these problems and confirmed that surface modifications could significantly improve the performance of lithium metal electrode. If successful, engineering a protected lithium surface with a well-designed passivation layer could:

- Enable safe handling during battery assembly and transportation,
- Enhance lithium stripping and plating dynamics, thereby extending cycle life, and
- Relieve the need for externally applied cell stack pressure.

Objective
This topic seeks to develop novel materials that can form a beneficial passivation layer on the surface of the lithium foil for use in rechargeable lithium batteries containing liquid or solid-state electrolytes. The materials must exhibit excellent stability against lithium, a high ionic conductivity and low electronic conductivity, and compatibility with a high-speed, high-volume roll-to-roll manufacturing process. The applied film should be ultra-thin (nanoscale order), uniformly thick, and exhibit strong adhesion to both lithium and solid-state electrolytes.

Requirements

- Perform testing on symmetrical cells to validate the performance of the passivation layer. (See Appendix A on “Standard Polymer Electrolyte Formulation for Studying the Stability of Lithium Metal Anodes.”)
- Repeat the test with a current density of 0.5 mA/cm^2.

Teaming Arrangements
Applications are restricted to U.S. based companies, and the project team may include Universities and National Labs.

Special Deliverables

- Comprehensive Data Report: Provide a detailed report substantiating that the newly developed protection layer extends the viable storage lifetime of the lithium foil by a factor of five compared to unprotected (bare) lithium when stored in a dry room environment. The report should include all relevant data, methodologies, and analysis to support those findings.
- Symmetrical Cells: Deliver six two-electrode cells designed with lithium as both the counter (approximately 15 microns of lithium) and working (approximately 5 microns of lithium) electrodes, utilizing a polymer electrolyte (as specified in Appendix A). These cells should be sent to a designated DOE laboratory for testing to confirm the significantly improved Coulombic efficiency over cells with unprotected lithium.
- Full-Cell Samples: Supply six full-cells (≥2 Ah capacity) incorporating the newly developed protected lithium, paired with an NMC622 cathode and a liquid electrolyte (1.54M LiFSI in DME/TTE 1:6.44 by weight). These cells must be delivered to a designated DOE laboratory for independent testing and evaluation. The cells will be tested at C/3 charge and discharge rates under ambient conditions and should demonstrate the ability to complete 600 cycles with less than 20% capacity loss (applied external stack pressure if needed should be less than 75 psi).

Applications Not of Interest
Applications that propose R&D for solid-state electrolytes are not of interest and will not be reviewed.

Topic Area 3 – Optimized Li-Ion Battery Solutions for Heavy-Duty Electric Vehicles
Medium- and heavy-duty vehicles (MHDVs) make up 5% of the on-road fleet but consume over 51 billion gallons gasoline equivalent (GGE) annually and contribute 21% of transportation emissions[10],[11] Heavy-duty Class 8 trucks account for 67% of fuel use in the MHDV sector[12], averaging >10,700 GGE annually[13], representing a significant fraction of operation cost and total cost of ownership. Electrification of heavy-duty trucks would eliminate nitrogen oxides and particulate matter emissions, a significant public health benefit, and substantially reduce carbon emissions from the on-road transportation sector.
The subtopics below aim to stimulate U.S.-made innovations that accelerate a domestic battery industry that can support lower cost options for long haul U.S. Trucks.

Among MHDVs, Class 8 long-haul trucks are uniquely challenging due to energy density requirements implied by significant onboard capacity to handle disparate routes with full cargo loads (i.e., no offset of cargo due to mass, volume of batteries, 500-mi range). Although this topic targets ultra-high-cycle life

[10] The U.S. National Blueprint for Transportation Decarbonization (2022) p. 61-63. https://www.energy.gov/sites/default/files/2023-01/the-us-national-blueprint-for-transportation-decarbonization.pdf
[11] "Energy Use by Transportation Mode and Fuel Type." Alternative Fuels Data Center. (https://afdc.energy.gov/data/10661)
[12] 21st Century Truck Partnership Electrification Technical Sector Team Roadmap (2023) https://www.energy.gov/sites/default/files/2023-12/21CTP-ETT-Roadmap_Final_Sep2023_compliant_corrected_08Dec23.pdf
[13] "Average Annual Fuel Use by Vehicle Type." Alternative Fuels Data Center. (https://afdc.energy.gov/data/10308)

and modular batteries for the especially challenging Class 8 long-haul truck vocation, the benefits in performance and cost will extend to many other MHDV applications. Cost reduction through improved battery cell and pack design is particularly important for competitiveness in the MHDV sector due to the low production volume relative to other battery end uses. Optimizing chemistry and modularity for MHDV applications for cross-sector use helps alleviate the economies of scale challenge.

Subtopic Area 3a: Ultra-Long-Cycle Life Li-Ion Batteries for Heavy-Duty Electric Trucks

Introduction

The challenge of battery design to meet or exceed the million-mile lifetime expected over the useful life of most Class 8 trucks[14] requires further innovation in lithium-ion batteries to increase cycle life without significant trade-offs on energy density. Lithium-ion batteries (e.g., but not exclusively, graphite anode, liquid electrolyte and cathode such as lithium iron phosphate [LFP] or nickel-manganese-cobalt oxides [NMC]) are currently manufactured at relevant scales for significant deployment of BETs, and thus are the battery primed to make the greatest impact over the next decade or more. Innovations increasing lithium-ion batteries cycle life without substantial loss in energy density are highly advantageous for near-term BETs.

Objective

This subtopic seeks lithium-ion battery chemistry innovations and design solutions that are readily adapted to multilayer pouch cells or cylindrical or prismatic cells to demonstrate cycle life.

Table: Performance Targets for MHDV Cell Deliverables

Initial cell capacity	≥3 Ah (cylindrical only), ≥10 Ah (pouch or prismatic)
Cell energy density	≥120 Wh/kg
Cell cycle life	≥4,000 cycles with 80% initial energy and power
Cell calendar life	≥10 years
Cell applied pressure	≤1 MPa
Temperature	Ambient (25 °C)

Consideration will be given for improved energy density that can also meet the cycle life requirement; however, any innovative cathode chemistry must have been rigorously tested through at least 500 cycles and the data included in the proposal.

General Requirements

Applications must:

- Identify the cell components' composition/construction focused on the innovations to significantly improve cycle life. Describe and justify the choice of active materials, electrolyte composition, etc. compared to current state of the art lithium-ion cell performance.
- Identify major issues impeding the proposed cell chemistry and the specific barriers to be overcome during the research effort to reach the deliverable targets for energy density and cycle life.
- Describe how the proposed effort is different than past and current research efforts.

[14] 21st Century Truck Partnership Electrification Technical Sector Team Roadmap (2023) https://www.energy.gov/sites/default/files/2023-12/21CTP-ETT-Roadmap_Final_Sep2023_compliant_corrected_08Dec23.pdf

- Include supporting theoretical predictions and/or relevant experimental data supporting performance claims.
    - Cell/material baseline performance should be included to justify prediction of at least 1,000 cycle life, including demonstration of 500 cycles on any novel cathode chemistry.
    - Include the electrode loading (mAh/cm^2) and composition (weight %), and electrolyte composition of all cell performance data.
    - Indicate what temperature the experiments were performed at as well as the upper and lower voltage and applied pressure used for cycling the cell.
- Identify performance targets that represent the highest risk for achievement during the project and the strategies to mitigate these risks.
- Describe the testing and diagnostics planned to characterize, investigate, and mitigate issues.

Teaming Arrangements
None specified.

Special Deliverables
- Interim deliverable: Go/no-go decision point based on full cell (at least 2 Ah capacity) test results demonstrating progress towards final targets. Must include at least three cells and report cell characteristics (chemistry, format, energy density, etc.) and testing parameters.
- Final deliverable: Five cells at least 3 Ah for cylindrical, 10 Ah for prismatic/pouch for third-party testing will be tested by accelerated test protocols developed by the 21st Century Truck Partnership.
- At least one month of testing data for all deliverable cell builds will be carried out by the Applicant following test protocols approved by the DOE. This data will be shared with DOE and the testing lab prior to deliverable shipment to the testing laboratory.

Note: 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 Not of Interest
- Batteries for Hybrid Electric Vehicles (HEVs) and/or Plug-in Hybrid Electric Vehicles (PHEVs) PHEVs

- Non-lithium-ion batteries
- Innovations outside cell chemistry and design, e.g., to the battery management system, thermal management, on-board monitoring, or other capabilities beyond the battery cell itself

Topic Area 3 – Optimized Li-Ion Battery Solutions for Heavy-Duty Electric Vehicles

Medium- and heavy-duty vehicles (MHDVs) make up 5% of the on-road fleet but consume over 51 billion gallons gasoline equivalent (GGE) annually and contribute 21% of transportation emissions [1,2]. Heavy-duty Class 8 trucks account for 67% of fuel use in the MHDV sector [3], averaging >10,700 GGE annually [4], representing a significant fraction of operation cost and total cost of ownership. Electrification of heavy-duty trucks would eliminate nitrogen oxides and particulate matter emissions, a significant public health benefit, and substantially reduce carbon emissions from the on-road transportation sector. The subtopics below aim to stimulate U.S.-made innovations that accelerate a domestic battery industry that can support lower cost options for long haul U.S. trucks.

Among MHDVs, Class 8 long-haul trucks are uniquely challenging due to energy density requirements implied by significant onboard capacity to handle disparate routes with full cargo loads (i.e., no offset of cargo due to mass, volume of batteries, 500-mi range). Although this topic targets ultra-high-cycle life and modular batteries for the especially challenging Class 8 long-haul truck vocation, the benefits in performance and cost will extend to many other MHDV applications. Cost reduction through improved battery cell and pack design is particularly important for competitiveness in the MHDV sector due to the low production volume relative to other battery end uses. Optimizing chemistry and modularity for MHDV applications for cross-sector use helps alleviate the economies of scale challenge.

Subtopic Area 3b: Standardized Battery Module Design for Heavy-Duty Electric Trucks

Introduction

For Li-ion-based Battery Electric Trucks (BETs) to achieve cost parity faster and unlock larger fractions of HD truck routes, energy density must be increased, and costs must be reduced. Class 8 BETs capable of traveling 500 miles on a single charge require a 1 MWh onboard capacity[15]. This battery pack must also fit within the weight and volume restrictions without offsetting cargo, emphasizing the importance of maximizing battery packing efficiency while maintaining robust safety and ruggedness, and minimizing the weight and volume of support systems, including thermal management. Reduced battery cost is a key enabler for decarbonization of this fleet through electrification[16], and the use of a standard battery solution across multiple platforms can alleviate the challenge of economy of scale that MHDVs face compared to LDVs due to lower production volume.

Objective

This subtopic seeks innovative standardized modules or scaled packs (for cell-to-pack design) suitable for Class 8 long-haul trucks. The pack should be based on commercial-relevant Li-ion battery cells (i.e., no

[15] 21st Century Truck Partnership Electrification Technical Sector Team Roadmap (2023). https://www.energy.gov/sites/default/files/2023-12/21CTP-ETT-Roadmap_Final_Sep2023_compliant_corrected_08Dec23.pdf

[16] "Energy Use by Transportation Mode and Fuel Type." Alternative Fuels Data Center. (https://afdc.energy.gov/data/10661)

chemistry/cell development in this topic), target at least a 60% cell-to-pack weight and volume ratio, minimum projected life of 2,000 cycles and 10-year calendar life, and be rugged, resilient, and safe.

Requirements
Module design should include specification of components, cell testing, modeling of thermal management and pack performance and lifetime, and culminate in a ≥10-kWh module or scaled pack deliverable. Increased consideration will be given for solutions that can be scaled across platforms (e.g., scaled modules or packs for multiple medium- and heavy-duty vehicle models).

Applications must:

- Specify intended module components, including cells, packaging materials, and thermal management system design. Include modeling of module/pack performance and lifetime based on cell testing and thermal management. Describe and justify the choice of these cells and components as compared to the state of the art.
- Consider and justify trade-offs between expected charge rate, thermal management, pack energy density, and battery cycle life.
- Justify choice of cells, materials, and operations that satisfies needs for long-haul trucks in terms of performance, ruggedness to vibration and other hazards, and safety to crash and cell thermal events compared to relevant industry criteria.
- Identify major issues impeding the proposed module design and the specific barriers to be overcome during the research effort to reach the deliverable targets for energy density, cycle life, and safety.
- Describe how the proposed effort is different than past and current research efforts.
- Include supporting theoretical predictions and/or relevant experimental data supporting performance claims, including baseline cell performance specifications for chosen chemistry at relevant conditions and representative duty cycles.
- Identify performance targets that represent the highest risk for achievement during the project and the strategies to mitigate these risks.
- Describe the testing and diagnostics planned to characterize, investigate, and mitigate issues.

Teaming Arrangements
Teams should be industry-led.

Special Deliverables

Interim deliverable: Go/no-go decision point based on full specification of module including performance modeling including thermal management, lifetime modeling, simulated duty cycle performance.

Final deliverable: Module or scaled pack, ≥10 kWh. At least one month of testing data for all deliverable module builds will be carried out by the Applicant following test protocols approved by the DOE. This data will be shared with DOE and the testing lab prior to deliverable shipment to the testing laboratory.

Note: All modules 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 Not of Interest

- Batteries for HEVs, PHEVs
- Non-lithium-ion batteries

Topic Area 4: Thermal Technologies for Zero-Emission Vehicles

Background

Medium and heavy-duty zero-emission vehicles (ZEV) must operate in all climate conditions which may require thermal regulation for the driver, passengers, cargo, and key powertrain components such as batteries, inverters, and motors. In very cold and very hot temperature conditions, the vehicle expends significant energy on thermal regulation. This energy cost often comes at the expense of range and potentially a reduction in daily utilization. This topic addresses thermal needs for batteries, powertrain components, as well as vehicle occupants.

Objective

The objective of this topic area is to research, develop, and demonstrate innovative technologies capable of significantly decreasing the on-board energy use of vehicle thermal systems, including but not limited to heating, ventilation, and air conditioning (HVAC) systems, for medium- and heavy-duty on-highway zero-emission vehicles. Proposed technologies could include, but are not limited to, phase change materials, heat pumps, electric compressors, advanced controls, novel thermal system designs, energy capture, high-efficiency components, load reduction technologies, load thermal management, and novel applications of existing technologies. Awarded projects must demonstrate resulting improvements in overall vehicle energy efficiency on duty/drive cycles appropriate for the chosen vehicle type(s) and environmental conditions and appropriate for the proposed technology improvements.

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

- Novel technologies which co-optimize vehicle thermal system management and demonstrate reductions in vehicle energy use
- Novel integration of advanced components
- Thermal system management innovations
- Innovative use of advanced materials to improve or benefit a vehicle thermal system

General Requirements

Applications ***must***:

- Identify the approach for vehicle thermal management improvement and the proposed advancements to the state of the art through development of a novel prototype and/or novel method of integration and system optimization.
- Identify how the research will lead to a demonstration of a minimum 20% reduction in the energy use of the thermal management system over a drive cycle typical to the proposed application/vocation in the appropriate operating conditions.
- Identify the baseline system, specifications, and the associated cost, mass, volume, and efficiency over a standardized or typical drive cycle.
- Describe the existing challenges that necessitate the proposed thermal system technology, using specific metrics such as energy used, range, or impacts to usability.
- Describe the improvements to the thermal system packaging, capabilities, performance, and lifetime/reliability and potential for reductions in lifetime total cost of operation (TCO).
- Describe how the resulting energy use/range and TCO improvements could potentially enable expanded vehicle usage and reduced downtime, and result in more mainstream adoption of MHD ZEVs in the class/vocation proposed.
- Describe the plan to demonstrate a measurable reduction of the overall vehicle energy use over a drive cycle typical to the proposed vehicle application/vocation and appropriate operating conditions. The extent of feasible and demonstrable vehicle operational energy savings is a factor for selection.
- Provide schematics and diagrams of the proposed thermal system topology and key system specifications, including but not limited to proposed component specifications, power, voltage, thermodynamic efficiency, and integration methods that enable novel thermal system design.
- Identify the planned vehicle application, typical usage/duty cycle of the vehicle, the thermal system requirements, and the potential impact of the technology to the market.
- Identify and describe the flexibility and scalability of the integrated system design to different vehicle applications (vehicle classes and vocations).
- Describe the proposed R&D to be performed and describe the advancements of the technology designed to overcome current challenges.
- Describe the benefits of the technology on class/vocation-specific ZEV adoption and the market penetration of the technology.
- Identify the potential technological and market risks and a plan to mitigate these risks.
- Describe the proposed demonstration vehicle(s) to be used and the plan for validation of the system in real world environments.
- Describe the approach to comply with applicable vehicle and safety standards.
- Identify all team members and their role in the project.

Teaming Arrangements

Teams are encouraged to include:

- A vehicle Original Equipment Manufacturer (OEM)
- Thermal system technology developer/manufacturer
- Tier 1 supplier.

Special Deliverables

None specified.

Applications Not of Interest
The following types of applications will be deemed nonresponsive and will not be reviewed or considered:

- Applications that propose commercially available products, unless integrated into a vehicle system in a novel manner.
- Applications with proposed solutions that utilize non-electric energy sources (e.g. fuel-fired heaters).
- Applications with technical solutions focused on cargo handling thermal controls.

Topic Area 5: Optimized Grid Planning for Electric Vehicles Using Advanced Metering Infrastructure

Background
The number of Electric Vehicle (EV) charging installation projects has risen year-over-year, making it increasingly difficult for utilities to process load-service requests and interconnection agreement applications at a rate that keeps pace with construction timelines. Concurrently, advancements in Smart Charge Management (SCM) technology have introduced opportunities for EVs to provide a wide range of grid services, such as load shifting, demand response, voltage regulation, frequency regulation, and other functions. Utilities across the US have introduced and deployed Advanced Metering Infrastructure (AMI) to optimize grid planning and develop a responsive smart grid. However, most utilities currently do not have the tools to integrate with their backend system to make use of the advanced capabilities of AMI to both support the EV charging energization process, and efficiently optimize EV load management post-energization.

Objective
The objective of this topic area is to research, develop, and validate novel and innovative tools leveraging Advanced Metering Infrastructure (AMI) and smart metering as a sensory network to improve the EV charging infrastructure energization process, accelerate EV charging infrastructure deployment, and provide an efficient and secure EV load management platform. Projects in this topic area should look to use advanced metering hardware and backend software to leverage the wide range of front-of-the-meter granular electricity usage data, as well as provide a bi-directional communication stream between the service provider and the connection node smart meter to optimize load profiles and support vehicle-grid integration (VGI). Projects awarded must show how the proposed technology will utilize deployed AMI to accelerate EV charging infrastructure deployment timelines and improve grid transparency and resiliency. Awardees must also detail how the resulting improvements to infrastructure will provide quantitative and qualitative impacts for both EV charging infrastructure and the utility distribution grid.

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

- Co-optimization of advanced metering infrastructure (AMI) with smart charge management (SCM) systems.
- Automation of real-time hosting capacity map analysis
- Distributed Energy Resource Management System (DERMS) integration
- Innovative Customer-facing and utility-facing distribution grid hosting capacity tools
- Innovative cybersecure control and monitoring architectures

General Requirements
Applications ***must***:

- Identify the baseline system, specifications, and the associated cost.
- Describe the proposed technology, the R&D to be performed, and describe the advancements of the technology to overcome current challenges.
- Describe the research workplan and validation strategy to demonstrate feasibility of the proposed technology.
- Describe how the tool(s) will be implemented to provide stakeholders with the ability to identify and assess grid conditions and/or support energy aggregation.
- Describe the planned tool application and use cases, and the potential impact of the technology to the market.
- Describe how the proposed technology or tool will be integrated with utility's existing software.
- Describe how the proposed technology will provide improvements to EV charging infrastructure, grid service capabilities, smart energy management, grid resiliency, and reductions in system cost through deferment of grid upgrades.
- Provide details of the proposed AMI sensory network (number of smart meters, communication protocol, feeder details, etc.) and data stream workflow.
- Identify and describe the replicability and scalability of the system design and architecture to account for variations in utility service territory size and AMI deployment.
- If the application is addressing EV charging infrastructure deployment, describe the benefits of the technology on electric vehicle supply equipment (EVSE) energization timelines and the market penetration of the technology.
- If the application is addressing smart charge management and/or distributed energy resource management, describe the benefits of the technology on utility load energy management and the market penetration of the technology.
- Identify the potential technological and market risks and a plan to mitigate these risks.
- Describe the proposed demonstration metering infrastructure and software to be used.
- Describe the proposed validation plan of the full-scale system with a distribution service territory in a real-world environment.
- Describe the supporting distribution grid specifications and smart metering requirements (voltage, current, etc.) for the technology.
- Identify all team members and their role in the project.

Teaming Arrangements

Applying teams **must** include:

- One or more electric utilities (investor-owned utility, municipality, and/or electric cooperative)

Teams are encouraged to include:

- One or more energy management or distribution management software developers
- State public utilities commissions (PUCs)
- Advanced metering infrastructure product OEMs
- Charging network operators
- DOE national laboratories

Special Deliverables

None specified.

Applications Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered:

- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Applications proposing only the installation of smart metering infrastructure.

Topic Area 6: CROP - Co-located Renewable-Fuel and Off-road Vehicle Pilots

Introduction

Farms and agricultural communities rely on a wide range of off-road vehicles to till, plant, irrigate, harvest and transport crops. These vehicles have unique requirements for durability, power/torque density, and daily run times. Today, these requirements are typically met by using compression-ignition engines running on diesel fuel and fluid-power systems (hydraulics) for the work and/or drive circuits. Some vehicles (such as agricultural tractors) also provide power to implements via an engine/transmission power take off unit. Daily operations vary greatly across the fleet and depend heavily on the machine's purpose. In total, off-road vehicles consume more than 21 billion gallons of fuel and are a significant portion of a farm's operating budget. The use of diesel contributes to poor air quality, including nitrogen oxides and fine particulate matter, as well as CO_2 emissions.

Farms also possess a unique advantage as producers of fuel feedstocks, such as agricultural waste and animal manure, as well as ideal siting for local clean electricity production. This topic area seeks to catalyze research beyond individual pieces of equipment to include the ecosystems in which they operate. Farms and agricultural communities offer an opportunity to both create fuel feedstocks (through crops, land use, waste management, etc.) and consume those fuels for vehicle operation.

Objective

Through a two-phased approach, demonstrate locally produced, renewable fuels for agricultural use. The initial phase focuses on feasibility, engineering design and lab-scale testing; as funds are available in the future, a second phase will build and test the complete design. The projects selected will reduce costs, advance novel powertrains in a real-world environment, and decrease emissions. Phase 1 is the focus of this current Notice of Funding Opportunity (NOFO), while Phase 2 is intended to be released in a future, separate NOFO.

Requirements

Applicants are required to select pathways from the following list (applicants may combine as necessary), but in general applicants should strive to demonstrate products or co-products as fuel or energy stocks for typical agricultural vehicle tasks:

- Ethanol/biodiesel/methanol/renewable natural gas/sustainable aviation fuel production from crops grown on the farm or wastes produced on the farm which provide local, renewable fuels
- Local solar/wind/hydro/geothermal clean electric production that is used for the farm, not exclusively sold to grid
- Clean hydrogen or ammonia production for fuel that is used on the farm; fertilizer co-production may be part of the vehicle demonstration
- Bio intermediates or bio crudes production to reduce total transportation costs with final production offsite, so long as a product is used on the farm
- Agroforestry if the forest crops are used for energy production in the cycle

- Bio-char or pyrolysis products which provide fuel feed stocks for vehicle use; carbon sequestration farming practices may be part of the vehicle demonstration
- Community shared resources for the above so long as the end products are used within the community and primarily for farming needs (e.g. cooperatives or collectives)

All applicants must describe in their applications their plans for communicating how the proposed project could make positive advancements towards economic, environmental, and social sustainability goals in their community. Applicants may want to consider the use of publicly available tools such as EJScreen, GREET, CalEnviroScreen, COMET Farm, or FASOM-GHG to help address these and other sustainability indicators. Additionally, applicants must plan for the fuel stock to be demonstrated in a vehicle in some representative farming application or task.

Recipients are allowed a limited (up to 50% of the budget) amount of experimental work. The intent of this experimental work is to generate the data needed to refine the engineering design and/or data needed for permitting or air quality analysis. The experimental work can either take place on-site or be done remotely, provided that the production streams being used are sourced from the recipient community. **Model streams are not permitted**. The use of real streams will increase the likelihood of technical success by ensuring the process is sufficiently robust to the contaminants, impurities, and other factors causing variability.

At a minimum, applicants must describe how the proposed project solution or process addresses the following indicators. Applicants are not required to have baseline levels for each of these required indicators at the time of the application, but the Feasibility Development components of the projects must include the following required indicators during the duration of the projects, if awarded. Applications should include baseline values for as many of these indicators as possible at the time of application.

Required Economic Indicators:

- Total energy produced and consumed within the stream
- Any byproducts or excess energy which is part of the process
- Total cost of energy consumed if it were produced from conventional sources (e.g. 100 gals of biodiesel is offsetting 100 gals of diesel at $4.25/gal)

Required Environmental Indicators:

- Criteria emissions (NOx, PM, VOC, HC, etc.)
- Greenhouse gas emissions (CO_2, at a minimum)
- Tonnage of waste sent to landfill (if applicable)
- Malodorous compounds (sulfur species and ammonia, at a minimum)
- Compliance with current or pending disposal regulations (if applicable)
- Water quality

Required Social Indicators:

- Project siting (especially proximity of infrastructure to farming communities)
- Degree of farming community ownership/engagement in the project
- Localized health impacts (e.g., respiratory impacts)

In addition to these required indicators, applicants may self-select other appropriate economic, environmental, and social indicators that are relevant to their farming community. Examples include but are not limited to those listed below:

Economic Indicators:

- Impacts on total costs of farm operations
- Sales of newly produced energy
- Impacts on relevant rates for municipal services charged to communities

Environmental Indicators:

- Localized water quality or runoff (nitrate/nitrite or phosphorus as examples)
- Localized air quality (volatile organic compounds as examples)
- Soil contamination or reduced compaction
- Impact on fluorinated species
- Particulate emissions
- Heavy duty vehicle traffic
- Accidental waste discharges

Social Indicators:

- Localized energy and economic resilience
- Local workforce impacts
- Community-wide recycling rates
- Community aesthetics
- Local property values

Phase 1: Design Phase Requirements (this topic area):

- Quantification of the business-as-usual (baseline) environmental and economic sustainability indicators (e.g., emissions, disposal costs, waste sent to landfill, etc.) from the current practices (as listed above)
- Completion of a feasibility study and/or basic engineering design for a system/process that can quantify the impacts of increasing resource and energy circularity and the impacts on economic and environmental sustainability indicators. This must also include information on the transportation use case(s) for the energy produced or consumed offsite
- Life Cycle Analysis (LCA) showing that the selected pathway(s) meet or exceed the 50% emissions reduction requirement and describe how the proposed project presents a significant LCA improvement over baseline technologies
    - Applicants may use any standardized approach to calculating life cycle emissions e.g. Argonne National Laboratory GREET model[17] or provide schemes developed through the CORSIA methodology[18] for calculating life cycle emissions
- Small-scale testing as necessary to support the engineering design package
- Laboratory-scale demonstration of vehicle operation on chosen pathway
    - Applicants may use commercially available fuels/feedstocks as needed
- Front-End Loaded – 3 (FEL-3) Basic Engineering Design Package (details below in Special Deliverables section)

[17] https://greet.es.anl.gov/
[18] https://www.icao.int/environmental-protection/CORSIA/Pages/CORSIA-Eligible-Fuels.aspx

- Initiation of siting analysis and final design

Phase 2: Potential Future, Construction/Demonstration Phase Requirements (to be issued in a separate, future, Notice of Funding Opportunity).

- Finalized design plans and siting analysis
- Pilot-scale demonstration of selected stream for fuel production
- Farming application demonstration with locally produced, renewable fuel powered vehicle
- Sufficient contingency funding

Phasing process

Given the high cost and complexity of pilot scale projects, recipients will undergo a phased approach where the initial phase focuses on design and (as funds are available) a second phase focuses on construction and full-scale demonstration.

Phase 1: Phase 1 will consist of a 12–18-month design work and experimental validation phase to verify prior scale data and readiness to proceed. Up to $2,000,000 of federal funds will be made available for each project. A minimum of 20% cost share is required.

Phase 2: Only projects which have completed Phase 1 may be eligible to apply for potential future, Phase 2 funding, subject to the availability of future year federal appropriations. Selected recipients will be permitted to proceed into the 24–36-month design/construction/operation phase (Phase 2). Phase 2 activities are expected to be limited to a maximum of $5,000,000 in federal share and recipients will be required to provide a minimum of 20-50% non-federal cost share for all Phase 2 activities.

Teaming Arrangements

Given the breadth of work required in both Phase 1 and 2, a diverse team partnered with OEMS, Universities, National Laboratories, and component suppliers is strongly encouraged.

Special Deliverables

Phase 1:

By the completion of this phase of the project, recipients must have completed a Front-End Loaded – 3 (FEL-3) Basic Engineering Design Package that includes, but is not limited to, the following:

- -5%/+15% cost estimate accuracy
- Process design basis
- Refined mass and energy balances
- Equipment specifications and lists
- Pre-design process hazard analysis
- Utility flow diagrams
- Instrument specifications and lists
- General arrangement drawings
- Detailed piping and instrumentation diagrams
- Electrical single line diagrams
- Site plans and plot plans
- Detailed project schedule

Recipients will also be required to initiate a detailed siting analysis that considers a variety of factors, including localized air quality (VOCs, particulate matter, and NOx, at a minimum), net impact on traffic, noise, odors, and other sustainability indicators identified through the prior feasibility analysis. The

siting analysis should also engage community and neighborhood associations to identify other areas of concern associated with the project.

Phase 2: (As Funds Are Available in a separate, future NOFO):
Recipients should expect to demonstrate their financial and technical readiness to proceed into Phase 2. This includes demonstrating the ability to provide all required cost share and contingency reserve (25%) prior to beginning construction of the project. Throughout the award life cycle, DOE will review and monitor the financial capability of the Recipient and other key organizations within the project team, such as partnering companies/parent organizations or other cost share providers. DOE may also conduct pre-award accounting system audits, financial capability reviews, or reviews of financial or compliance audits. By completing Phase 1, recipients are expected to have most of the technical documentation necessary for a future Phase 2 application.

Applications Not of Interest

- Applications which focus on carbon sequestration through crop rotation or land-use activities are discouraged if there is no renewable pathway used to derive fuel.
- Applications proposing the development of model streams.
- Applications which do not produce and consume the fuel or energy stock for farming activities are likewise discouraged.

Topic Area 7: Vehicle Life Cycle Analysis Baseline

Introduction
Life cycle analysis (LCA) is a valuable tool used to understand the overall impact of a product on the environment, energy usage, and critical resource utilization, allowing better decisions to be made on sustainability, strategic planning, and supply chain optimization. Argonne National Laboratory released the GREET (Greenhouse Gases, Regulated Emissions, and Energy use in Technologies) tool in 1995, and it has been continuously updated to provide a consistent Lifecycle Analysis (LCA) platform with reliable, widely accepted methods/protocols. GREET fully evaluates energy and emission impacts of advanced and new transportation fuels, the fuel cycle from well to wheel and the vehicle cycle through material recovery and vehicle disposal. It allows researchers and analysts to evaluate various vehicle and fuel combinations on a full fuel-cycle/vehicle-cycle basis.

In order to benchmark current lifecycle performance of vehicles and plan for future research activities, analysis of representative vehicles is needed. The EPA has identified 4 powertrain configurations that are likely to dominate in the near future, Internal Combustion Engine vehicles, Battery Electric vehicles, Plug-in Electric Hybrid vehicles, and hybrid vehicles. Two platforms have already been chosen as baseline vehicles: model year 2022 (MY2022) Ford Mach-E and Chevrolet Suburban. LCA for the baseline vehicles and two additional vehicles are needed to establish baseline performance. The LCA for all vehicles should be compatible with the R&D GREET model.

Objective
The objective of this topic area is to conduct LCA including energy usage, critical materials requirements, sustainability, and Greenhouse Gas (GHG) Emissions on up to four vehicles. The LCA must include two baseline vehicles: MY2022 Ford Mach-E and Chevrolet Suburban. Two additional vehicles selected by applicants should also be 2022 models. A passenger car or small SUV utilizing either a plug-in electric hybrid drivetrain or the strong hybrid drivetrain is preferred for these additional baseline vehicles. A cost analysis must also be included. The LCAs should include break downs to sub-assemblies as identified in

the R&D GREET model, including body structure, powertrain, transmission, chassis, traction motor, generator, electronic controller, and onboard energy storage.

General Requirements
Applications must:

- Include a plan to conduct LCA on MY2022 Ford Mach-E and Chevrolet Suburban.
- Include a minimum of one additional 2022 model production light-duty vehicle.
- Include a plan to conduct complete cradle-to-grave analysis, including material production, recycled content, critical materials usage, manufacturing processes, lifetime in use fuel/energy consumption, and end-of-life disposition.
- Describe planned data sources for vehicle material composition.
- Describe a plan to report on in-depth methodologies, assumptions, and underlying data resources.
- Include a plan to conduct a sensitivity analysis consisting of material sourcing, manufacturing methods, energy sourcing, recycling pathways, and potential cost implications.
- Include a plan to coordinate with the DOE to ensure results are in sufficient detail and format for inclusion in Argonne National Laboratory's R&D GREET Life Cycle Analysis Model.
- Include a technical cost analysis sufficient to provide a baseline for use in future cost benefit analysis of emerging technologies.

Teaming Arrangements
Applicant teams **must** include team members proficient in conducting complex LCA, and either an OEM or Tier 1 supplier to provide material production manufacturing process data, critical materials content, recycled content, and embedded energy in material and component production. For the purposes of this topic area, an OEM is defined as a commercial manufacturer that sells at least 500 vehicles annually.

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.
- Projects selected under this Topic Area must provide LCA results in a format compatible with the R&D GREET model. Awardees must work on an ongoing basis with the DOE to ensure the format is compatible.

Applications Not of Interest
Applications which do not meet the General Requirements.

Topic Area 8: Quality Improvements of Battery Busbar Joining

Introduction
A modern electric vehicle battery pack consists of a large number of individual battery cells that are structurally held and electrically interconnected. Typical large format cells use copper for the anode foil (current collector) and aluminum for the cathode foil. A 'foil-to-tab' weld is needed to gather all the current collector plates (electrode foils) inside the cell and join them to a tab. These tabs serve as the primary connection points between the battery cell and external circuits. Manufacturing the required 'foil-to-tab' joints represents several challenges, including joining of multiple and thin highly

conductive/reflective materials of varying thicknesses, potential damage (thermal, mechanical, or vibrational) during joining, a high joint durability requirement, and so on. As there are numerous foil-to-tab joining methods currently implemented, the focus will be on Resistive Spot Welding, Laser Beam Welding and Ultrasonic Metal welding as the three listed joining technologies are what are currently employed to produce the three main battery cell types currently employed in all Electric and Plug in Electric Hybrid vehicles: Cylindrical, Pouch and Prismatic Cells.

Objective

The topic area will focus on joining methods implemented for 'foil-to-tab' manufacturing for use in electric vehicles and the ability to monitor joining performance in real time. The quality of foil-to-tabs manufacturing has seen an improvement over the years, including minimizing the heat-affected zone and achieving precision welding, challenges have also arisen in the case of joining dissimilar materials within battery cells themselves leading to issues ranging from the low absorptivity of non-ferrous materials such as Copper (Cu) and Aluminum (Al) when welded using lasers, to the formation of brittle intermetallic connections. These challenges increase the probability of a joint being defective in terms of low electrical conductivity and/or pure mechanical strength and the inability to monitor such defects in real time comes at a financial cost for battery cell manufacturers.

The development of scientific quality guidelines for implementing 'foil-to-tab' real time monitoring and feedback loop during manufacturing in medium to high volume production is of critical importance. In addition, the ability to develop non-destructive evaluation methods to monitor joint quality in real time is also a key objective.

General Requirements

Applications must:

- Identify in real time, weld type and key parameters associated with implemented joining method (applicants ***must*** focus on at-least one joining technology).
    - Ultrasonic Metal Welding (UMW): Oscillation amplitude, welding force and transferred welding energy. As for material parameters besides the materials chemical-, mechanical-, and physical properties, the geometry of the upper welding part bears great significance
    - Laser Beam Welding (LBW): Laser power, welding speed and pulse rate
    - Resistance Spot Welding (RSW): Welding time, welding current and electrode force
- Identify and actively monitor in real time 'foil-to-tab' joint quality to include bond density, post weld thickness, weld nugget size, and Thermo-mechanically affected zone.
- Identify and monitor in real time, joint depth up to 0.1mm.
- Identify the defect formation mechanism during foil-to-tab welding and attributes associated defected joint.
- Develop an In Line Quality Monitoring and close feedback loop methodology to employed joining technology with the ability to adjust identified joining technology parameters during tab-to-foil manufacturing.
- Identify deployment strategy in current battery cell manufacturing.
- Describe the plan to demonstrate In Line Quality Monitoring and close feedback loop during the manufacturing of battery cells utilizing one or all the three joining methods (RSW, UMW, LBW).
- Describe the existing challenges that necessitate the use of the proposed real time image analysis tool/method for the selected joining method.

- Describe the improvements to be made to cell manufacturing, battery system packaging and assembly, performance, and lifetime/reliability and potential for reductions in lifetime total cost due to the implementation of real time joint quality monitoring.
- Identify the potential technological and market risks and a plan to mitigate these risks.

Teaming Arrangements
Applying teams **must** include National Lab partnership(s).

Applications are strongly encouraged to form teams with Industry (Battery manufacturing) and Vehicle Manufacturers.

Special Deliverables
A working lab-scale prototype that demonstrates the ability to actively monitor joint quality, a proper closed loop feedback strategy, and a system that meets the requirements listed above.

Applications Not of Interest
None specified.

Topic Area 9: Electric Vehicle Workforce Development

Introduction
Battery electric vehicle and infrastructure technologies have become more commonplace in both the residential and commercial sectors throughout the U.S. However, many professionals who work with vehicles and transportation infrastructure may lack the expertise needed to install, repair, maintain, and respond to emergencies related to these technologies. Addressing these workforce training needs can reduce cost and wait times for vehicle infrastructure installation, maintenance, and repair; lead to improved safety outcomes; and create employment and career development opportunities for those employed or seeking employment in the vehicle and transportation sector.

Considerable past work has been done to develop training materials and curricula to educate vehicle technicians, electric vehicle infrastructure installers and maintenance workers, code permitting officials, local first responders, and other professionals on zero emission vehicles and infrastructure. However, the reach and scope of these materials is limited and often localized at a time when the need for trained technicians and responders is increasing. Opportunities exist for leveraging new opportunities for virtual and in-person training sessions to reach critical audiences with valuable interactive training material.

Objective
This topic area addresses the development of local, state, regional, or national outreach, awareness, and partnership building efforts. Efforts should include training and education of professionals who work with vehicles and/or transportation infrastructure to address situations involving zero emission vehicles and infrastructure technologies. Existing training materials, curricula, websites, online tools, and other relevant information resources previously developed in cooperation with EERE or accepted by EERE should be leveraged to the maximum extent possible. Projects can develop training in areas where gaps exist in current training curricula. Projects are encouraged to provide in-person training workshops or build partnerships to incorporate existing online training materials into training programs and

encourage widespread reach of these training sessions. Projects addressing communities that are among the top zero emission vehicle markets in the United States are highly encouraged.

General Requirements

- A description of the specific audiences (e.g., mechanics, electricians, permitting officials, firefighters, etc.), topics (e.g. ZEV repair and maintenance, infrastructure installation, ZEV permitting, emergency response, etc.) regions (e.g., regional, national, corridors, etc.), and technologies (e.g., light-duty, medium-duty, or heavy-duty ZEV; Level 2 or DC fast charging stations, etc.) to be addressed by the project. This includes how stakeholder groups will be enabled to comment on and inform the project.
- A description of need for the proposed training project (i.e. description of current training landscape, capacity of professionals to meet current or anticipated needs).
- A description of project partners with defined roles in the project, including critical partners such as Clean Cities and Communities coalitions and educational/training organizations.
- Intended training outcomes, including specifics on the number and type of audiences to be reached and level of expertise to be achieved through training.
- A description of existing information resources to be used in the project.
- A description of any training materials to be developed to address gaps, with specific information on why new materials are being developed.
- A plan for project activities that establishes the steps to be undertaken to complete project objectives and identifies resources to be used to achieve objectives (e.g., training facilities, subject matter expertise, etc.).
- A plan for replicability and continuation of the training and education activities upon the completion of the project, including what information will be publicly available at the conclusion of the project.
- Projects should develop a website to host public resources, recommendations, curricula, and other products that are free for the public.

Teaming Arrangements

Project teams that include one or more of the following partners are strongly encouraged:

- Educational/training institutions with specific expertise in developing and delivering online and/or in-person training curricula
- Government Offices responsible for zoning, codes, permitting, and/or emergency response preparedness
- Fleet owners and/or operators
- Electric vehicle charging infrastructure installers, owners, and/or operators
- Community-based organizations that focus on the needs and perspectives of underserved communities
- Entities responsible for disaster and emergency response and/or planning
- One or more Clean Cities and Communities coalitions (https://cleancities.energy.gov/coalitions/locations/)

Special Deliverables

Recipients must provide supplemental quarterly reporting data needed to calculate Justice40 Initiative metrics measuring the benefits that flow to disadvantaged communities. DOE will provide a reporting template to project awardees. Please see NOFO Part 1, *Diversity, Equity, Inclusion and Accessibility Plan* for a list of examples Justice40 metrics related to the Topic Area described in this announcement.

Applications Not of Interest
Applications that include the following are highly discouraged:

- Training that promotes one specific brand or product
- Only academic studies of curricula gaps and plans for future training
- Curricula that will be solely proprietary at the conclusion of the project

Topic Area 10: Vehicle Technology Integration - Open Topic

Introduction
The Technology Integration Program and its Clean Cities and Communities coalition partners have a broad portfolio of potential technology options with the opportunity to address pressing transportation efficiency and availability issues. Of particular interest are projects that address the needs of communities with respect to vehicles and associated infrastructure that can substantially reduce emissions, improve affordable options and that are not otherwise addressed by topics within this NOFO.

Deployment of low emission, affordable and highly efficient transportation is a complex activity requiring many unique technologies and approaches. In particular, medium-duty and heavy-duty (MDHD) ZEVs have numerous nuances based on specific use cases that can make deployment of ZEVs more challenging. These vehicles are part of a broader system of moving freight across the U.S. that is critical to the economy and U.S. growth. As every user and fleet is unique, many solutions are required to demonstrate replicable best practices in the deployment of low emission freight technologies. Infrastructure for these vehicles is also complex, and although many advances have been made in recent years, more technology solutions may be required.

Objective
The objective of this topic area is to explore novel solutions to transportation and related clean energy and infrastructure challenges through demonstration and deployment projects that will spur market development. This would include projects to address challenges unique to their geographic areas and solutions with potential for replication in other areas across the country. Projects of interest focus on the advancement of medium and heavy-duty on-road vehicles and can include, but are not limited to:

- Extended vehicle demonstration projects of medium and heavy-duty vehicles (some examples include vocational trucks and regional and long-haul tractors)
- Projects that accelerate the transition of high-impact heavy duty fleets to zero emission vehicle technologies
- Projects that develop planning models for fleet transition to zero emission vehicles
- Projects that develop actionable plans for medium and heavy-duty vehicles or associated freight corridor infrastructure
- Projects that help leverage innovations developed by the VTO portfolio to expand their adoption
- Innovative charging solutions to address out-of-home charging needs
- Projects that demonstrate unique workplace charging solutions
- Projects that reduce the cost of at-home charging

Requirements

- Identify the specific challenge to be addressed and the target audience for the technical solution to be implemented.
- Identify specific technologies, approaches, or activities that align with the Topic Area objectives described above.
- Define project team roles and responsibilities as well as funding for specific tasks that Clean Cities and Communities coalitions and partners will undertake.
- Address replicability through a project structure that produces results and insights useful to others across the country; project teams must provide for public release a final technical report that documents project information, analyses, and insights.
- All work under EERE funding agreements must be performed in the United States.

Teaming Arrangements

The project team must include at least one active and DOE designated Clean Cities and Communities coalitions with a significant role (at least 10% of the Federal portion of the project budget). A list of active coalitions can be found at: https://cleancities.energy.gov/coalitions/locations/.

VTO highly encourages project teams and strategic partners such as the following:

- Clean Cities and Communities coalitions
- Consortia comprised of multiple Clean Cities and Communities coalitions
- Local/regional/state governments
- Metropolitan planning organizations
- Community-based organizations that focus on the needs and perspectives of underserved communities
- Transit
- Transportation network providers
- Vehicle, fuel, energy, and infrastructure providers
- Utility companies
- Fleets and other end-user groups

Special Deliverables

Recipients must provide supplemental quarterly reporting data needed to calculate Justice40 Initiative metrics measuring the benefits that flow to disadvantaged communities. DOE will provide a reporting template to project awardees. Please see NOFO Part 1, *Diversity, Equity, Inclusion and Accessibility Plan* for a list of examples Justice40 metrics related to the Topic Areas described in this announcement.

Applications Not of Interest

Applications that include the following are highly discouraged:

- Promotion of a specific brand, product, or invention
- Inclusion of novelty vehicles and recreational or sport vehicles
- Subsidies for fuel cost
- Rebates or tax incentives
- Purchase of land

F. Applications Specifically Not of Interest

The following types of applications will be deemed nonresponsive and will not be reviewed or considered (Please also refer to the Responsiveness Review section below):

- Applications that fall outside the technical parameters specified in Background and Context above and the Topic Areas section above.
- Applications for proposed technologies that are not based on sound scientific principles (e.g., violates the laws of thermodynamics).
- Proposals deemed to be duplicative of research that is already in progress.
- Applications discouraged/not of interest as described in each topic area.

G. Statement of Substantial Involvement

DOE anticipates awarding cooperative agreements under this NOFO, which include a statement of DOE's "substantial involvement" in the work performed under the resulting awards. For cooperative agreements, DOE does not limit its involvement to the administrative requirements of the award. Instead, DOE has substantial involvement in the direction and redirection of the technical aspects of the project. DOE's substantial involvement in resulting awards may include the following:

A. DOE shares responsibility with the recipient for the management, control, direction, and performance of the project.
B. DOE 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.
C. DOE may redirect or discontinue funding the project based on the outcome of DOE's evaluation of the project at the Go/No-Go decision point(s).
D. DOE participates in major project decision-making processes.

H. Statutory Authority

The programmatic authorizing statutes are Public Law (P.L.) 109-58, the Energy Policy Act of 2005 (EPAct 2005), as amended, Section 911 (codified at 42 U.S.C. § 16191).

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

I. Diversity, Equity, Inclusion, and Accessibility Plan

The Federal Government should pursue a comprehensive approach to advancing equity[19] for all, including people of color and others who have been historically underserved, marginalized, and

[19] The term "equity" means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+)

adversely affected by persistent poverty and inequality. Affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments, and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity.

By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone[20].

As part of this whole of government approach, this NOFO seeks to encourage the participation of underserved communities[21] and underrepresented groups. Applicants are highly encouraged to include individuals from groups historically underrepresented[22],[23] in STEM on their project teams. As part of the application, applicants are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to submit a Diversity, Equity, Inclusion, and Accessibility Plan that describes the actions the applicant will take to foster a welcoming and inclusive environment, support people from underrepresented groups in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in, or benefit underserved communities. The plan should include at least one

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persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality.

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

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

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

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

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

SMART (Specific, Measurable, Assignable, Realistic and Time-Related) milestone per budget period supported by metrics to measure the success of the proposed actions. This plan will be evaluated as part of the technical review process and incorporated into the award if selected.

Topic Areas 9 and 10 (only)
The following represents a list of example metrics that VTO may use to measure projects' Justice40 benefits to underserved communities. Some metrics may be more specific to certain Topic Areas or projects than others, and VTO will work with successful applicants to determine which Justice40 metrics are most relevant to their project.

Metric Category	Metric Description
Energy Democracy	Number of organizations with a funded role in the project who represent a DAC
	Project dollars budgeted [$] for organizations who represent a DAC
	Total number of outreach/education events
	Number of outreach/education events designed to benefit members of DACs
	Total number of people reached through outreach/education events
	Number of stakeholder engagement events designed to benefit members of DACs
	Total number of people reached through stakeholder engagement events
Technical Assistance	Number of fleets who were provided technical assistance
	Number of fleets who were provided technical assistance which represent a DAC
	Number of non-fleet organizations who were provided technical assistance
	Number of non-fleet organizations receiving technical assistance which represent a DAC
Workforce Training	Number of workforce development events provided
	Number of workforce development events primarily serving DACs
	Number of attendees receiving workforce development training
	Project $ allocated for training events for people who work or live in DACs
Energy Burden	Net gasoline gallon equivalent (GGE) reduced annually for an underserved community
	Reduced transportation energy burden for an underserved community

Metric Category	Metric Description
Environmental: Vehicle Emissions Reductions	Reduction in PM 2.5 in an underserved community
	Reduction in NOx annually in an underserved community
	Reduction in GHG annually in an underserved community

IV. Application Content and Form

This section includes application information specific to this NOFO Part 1. Refer to the NOFO Part 2, *Application Content and Form* for standard information that applies to all DOE NOFOs such as formatting and content requirements, and funding restrictions.

A. Summary

The application process includes two submission phases: 1. concept paper and 2. application.

Application Submission Phase	Eligibility for Submission
Concept Paper	Required to be submitted by the specified due date and time to be eligible to submit an application.
Application	Must be submitted by the specified due date and time to be eligible for comprehensive merit review.

B. Concept Paper

Each concept paper must be limited to a single concept, technology, or project. The concept paper must conform to the requirements listed below, including the stated page limits.

Section	Page Limit	Description
Cover Page	1 page maximum	The cover page should include the project title, the specific announcement Topic Area being addressed (if applicable), both the technical and business points of contact (including the Administrative Officer, if applicable), names of all team member organizations, the project location(s), and any statements regarding confidentiality.
Technology Description	3 pages maximum	Applicants are required to succinctly describe: • The proposed technology, including its basic operating principles and how it is unique and innovative; • The proposed technology's target level of performance (applicants should provide technical data or other support to show how the proposed target could be met); • The current state of the art in the relevant field and application, including key shortcomings, limitations, and challenges; • How the proposed technology will overcome the shortcomings, limitations, and challenges in the relevant field and application;

		• The potential impact that the proposed project would have on the relevant field and application; • How the proposed location of the proposed project will support technology development and long-term success; • The key technical risks/issues associated with the proposed technology development plan; • The impact that DOE funding would have on the proposed project; and • Any potential impacts on Indian Tribes and describe how the applicant would engage with a potentially impacted Indian Tribe(s).

Total concept paper Maximum Page Limit: 4 pages

DOE makes an independent assessment of each concept paper based on the technical review criteria for Concept Papers described below. DOE will encourage a subset of applicants to submit applications. Other applicants will be discouraged from submitting an application. Please see NOFO Part 2, *Selection and Award Notices—Concept Paper Notifications*.

C. Application Content Requirements

Each application must be limited to a single concept. Applications must conform to the following requirements and must not exceed the stated page limits. Please refer to the NOFO Part 2, *Application Content and Form* for a complete list of application requirements. Detailed guidance on the content and form of NOFO-specific requirements is provided following the Summary of Application Requirements table below.

1. Covered Individual Definition, Designation, and Responsibility

Several of the Application Content Requirements listed below and in the NOFO Part 2 are required of covered individuals.

For the purposes of this NOFO, a Covered Individual means:

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

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

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

The applicant's submission of a current and pending support disclosure and/or biosketch/resume for a particular person serves as an acknowledgement that DOE designates that person as a covered individual.

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

2. Summary of Application Requirements

Component	File Format	Page Limit	File Name
Application for Federal Assistance (SF-424)	PDF	n/a	ControlNumber_LeadOrganization_424
Technical Volume	PDF	30	ControlNumber_LeadOrganization_TechnicalVolume
Letters of Commitment	PDF	1 page each	ControlNumber_LeadOrganization_LOCs
Impacted Indian Tribes Documentation, as applicable	PDF	n/a	ControlNumber_LeadOrganization_ImpactedTribes
Statement of Project Objectives	MS Word	7	ControlNumber_LeadOrganization_SOPO
Budget Justification Workbook	MS Excel	n/a	ControlNumber_LeadOrganization_Budget_Justification
Subrecipient Budget Justification	MS Excel	n/a	ControlNumber_LeadOrganization_Subrecipient_Budget_Justification
Work Proposal for FFRDC, as applicable (see DOE O 412.1A**)**	PDF	n/a	ControlNumber_LeadOrganization_WP
Authorization for Non-DOE or DOE FFRDCs	PDF	n/a	ControlNumber_LeadOrganization_FFRDCAuth
Waiver for Foreign Entity Participation	PDF	n/a	ControlNumber_LeadOrganization__FEW
Performance of Work in the United States (Foreign Work Waiver)	PDF	n/a	ControlNumber_LeadOrganization_FWW
Diversity, Equity, Inclusion & Accessibility Plan (DEIA)	PDF	5	ControlNumber_LeadOrganization_[DEI(A)]
Resumes (for each covered individual)	PDF	3 pages each	ControlNumber_LeadOrganization_Resumes
Current and Pending Support (for each covered individual)	PDF	n/a	ControlNumber_LeadOrganization_CPS
Digital Persistent Identifier (for each covered individual)	N/A	N/A	Include in Current & Pending Support
Research Security Training Requirement (for each covered individual)	N/A	N/A	Include in Current & Pending Support

Transparency of Foreign Connections	PDF	n/a	BusinessSensitive_ControlNumber_LeadOrganization_TFC
Potentially Duplicative Funding Notice	PDF	n/a	ControlNumber_LeadOrganization_PDFN
Data Management Plan (Required for R&D Projects - Topic Areas 1-8)	PDF	n/a	ControlNumber_LeadOrganization_DMP
Location(s) of Work	Excel	n/a	ControlNumber_LeadOrganization_LOW
Disclosure of Lobbying Activities, if applicable (SF-LLL)	PDF	n/a	ControlNumber_LeadOrganization_SF-LLL
Certification Regarding Lobbying (OMB 4040-0013)	PDF	n/a	ControlNumber_LeadOrganization_Cert Lobbying
Summary for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS Power Point	1	ControlNumber_LeadOrganization_Slide

3. Technical Volume

The Technical Volume must conform to the following content and form requirements. This volume must address the technical review criteria as discussed in Technical Review Criteria.

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

The Technical Volume to the 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 information below. The applicant should consider the weighting of each of the technical review criteria (see Technical Review Criteria) when preparing the Technical Volume.

The Technical Volume should clearly describe and expand upon information provided in the concept paper.

Technical Volume Content Requirements Overview	
Section	**Approximate Percent Content of the Technical Volume**
Cover Page	N/A
Project Overview	10%
Technical Description, Innovation, and Impact	30%
Workplan in Statement of Project Objectives	40%
Technical Qualifications and Resources	20%

Cover Page:
The cover page must include all of the following:

- The project title
- Specific NOFO topic areas (if applicable)
- Technical and business POCs
- The project team, including recipient name, entity type and names of all team member organizations
- The project location(s)
- The proposed federal funding level, cost share and period of performance
- Senior/key personnel and other covered individuals
- Statements regarding confidentiality

Project Overview (Approximately 10% of the Technical Volume)
The Project Overview should contain the following information:

- **Background:** The applicant should discuss the background of its organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the 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 or focus area, 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 NOFO, 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. This section should also address the project's access to necessary infrastructure (e.g., transportation, water, electricity transmission), including any use of existing infrastructure, as well as to a skilled workforce.
- **Innovation and Impacts:** The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology or focus area, 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 (Approximately 40% of the Technical Volume)
The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Project Tasks, Milestones, Go/No-Go decision points, and project schedule. A detailed statement of project objectives (SOPO) is separately requested as part of the application. 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, including milestones in the Diversity, Equity, Inclusion and Accessibility Plan.
- **WBS and Task Description Summary:** The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as "we will then complete a proprietary process" is unacceptable). It is the applicant's responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this NOFO. 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 SOPO should provide a summary of appropriate milestones throughout the project to demonstrate progress and 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 NOFO, 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. 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 the Key Facts section above for Go/No-Go and budget period information. The applicant should also provide the specific technical and Diversity, Equity, Inclusion and Accessibility plan criteria to be used to evaluate the project at the Go/No-Go decision point. The summary provided should be consistent with the SOPO. Go/No-Go decision points are considered "SMART" and can fulfill the requirement for an annual SMART milestone.
- **End of Project Goal:** The Workplan should include 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, any milestones, and any Go/No-Go decision points.
- **Build America Buy America (BABA) Requirements for Infrastructure Projects:** Within the first two pages of the Workplan, include a short statement on whether the project will involve the construction, alteration, maintenance and/or repair of public infrastructure in the United States.

See Build America, Buy America | Department of Energy and 2 CFR 184 for applicable definitions and other information regarding Infrastructure Projects and the Buy America Requirement.

- **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, including a plan for securing a qualified workforce and mitigating risks to project performance including but not limited to community or labor disputes or conflicts related to siting;
  - Approach to addressing permits and tory approvals, including compliance with any current permits, and any permits and natural or cultural resource issues that could require discretionary permits or approvals;
  - 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, and product distribution.
  - Identification of current industry interest, commitments for adoption if the project is successful, and impact of those commitments across the industry.

Technical Qualifications and Resources (Approximately 20% of the Technical Volume)

The Technical Qualifications and Resources should contain the following information:

- A description of the project team's unique qualifications and expertise, including those of key subrecipients;
- A description of the project team's existing equipment and facilities, or equipment or facilities already in place on the proposed project site, that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project;
- Relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives;
- The time commitment of the key team members to support the project;
- A description of the technical services to be provided by DOE FFRDCs, if applicable;
- The skills, certifications, or other credentials of the construction and ongoing operations workforce;
- For multi-organizational projects, describe succinctly:
  - The roles and the work to be performed by the project manager and Senior/Key Personnel at the recipient and sub levels;

  - Business agreements between the applicant and sub;
  - How the various efforts will be integrated and managed;
  - Process for making decisions on technical direction;
  - Publication arrangements;
- Strategy to address known resource, including intellectual property and real property, constraints, or challenges; and
- Communication plans.

D. Funding Restrictions

Program-specific funding restrictions applicable to awards funded under this NOFO are identified below. Standard funding restrictions are described in the NOFO Part 2, *Funding Restrictions* section.

Applicable Funding Restrictions		
Title	**Location**	**Additional Information**
Allowable Costs	NOFO Part 2	Applicable to awards made under this NOFO
Pre-Award Costs	NOFO Part 2	Applicable to awards made under this NOFO
Performance of Work in the United States (Foreign Work Waiver Requirement)	NOFO Part 2	Applicable to awards made under this NOFO
Foreign Travel	NOFO Part 2	Foreign Travel is not allowed for awards made under this NOFO without an approved waiver
Lobbying	NOFO Part 2	Applicable to awards made under this NOFO
Equipment and Supplies	NOFO Part 2	Purchasing American-made equipment and supplies is applicable to this award.
Build America Buy America Requirements for Infrastructure Projects	NOFO Part 1	When Applicable to awards made under this NOFO

1. Build America Requirement for Infrastructure Projects

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

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

Please refer to the NOFO Part 2, *Buy America Requirements for Infrastructure Projects; Required Use of American Iron, Steel, Manufactured Products, and Construction Materials* and 2 CFR Part 184 to determine whether the Buy America Requirement applies and if they should consider the application of the Buy America Requirement in the proposed project's budget and/or schedule. (Note that the Buy America Requirement does not apply to prime recipients that are For-Profit Entities.)

V. Submission Requirements and Deadlines

There are several one-time actions applicants must take before applying to this NOFO. Some of these may take several weeks, so it is vital applicants build in enough time to complete them. Failure to complete these actions could interfere with application or negotiation deadlines or the ability to receive an award if selected. These requirements are outlined in detail in the NOFO Part 2, *Get Registered*.

A. Required Registrations

Unique Entity Identifier (UEI) and System for Award Management (SAM)
You must have an active account with SAM.gov. This includes having a Unique Entity Identifier (UEI). SAM.gov registration can take several weeks. To register, go to SAM.gov Entity Registration and click Get Started. From the same page, you can also click on the Entity Registration Checklist for the information you will need to register.

Each applicant must:

1. Be registered in SAM.gov before submitting an application;
2. Provide a valid Unique Entity Identifier in the application; and
3. Continue to maintain an active registration in SAM.gov with current information at all times during which you have an active federal award or an application or plan under consideration by a federal agency.

DOE may not make a federal award to an applicant until the applicant has complied with all applicable UEI and SAM requirements and, if an applicant has not fully complied with the requirements by the time DOE is ready to make a federal award, the DOE will determine that the applicant is not qualified to receive a federal award and use that determination as a basis for making a federal award to another applicant.

1. eXCHANGE

Register and create an account in the eXCHANGE site identified in the Key Facts section of the NOFO Part 1. This account can be used to apply to open NOFOs in eXCHANGE. To view and submit applications to open opportunities under a specific DOE office(s), you must access the applicable instance of the system. You may need to be registered in more than one instance to submit applications for opportunities managed by different DOE offices.

Each organization or business unit, whether acting as a team or a single entity, should use only one account as the contact point for each submission. Applicants must also designate backup points of contact. **This step is required to apply to this NOFO.**

B. Application Package

1. eXCHANGE

The application package requirements are outlined in the Application Content and Form section above. Several templates for application requirements are included in eXCHANGE. To access these materials, select the appropriate NOFO on the Funding Opportunity page of eXCHANGE.

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

- TechnicalVolume_Part_1
- TechnicalVolume_Part_2

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

In addition to eXCHANGE, the application forms and instructions are available at EERE Funding Application and Management Forms and on EERE eXCHANGE. To access these materials on EERE eXCHANGE, go to https://eere-eXCHANGE.energy.gov and select the appropriate funding opportunity number.

Electronic Authorization of Applications and Award Documents
Submission of an application and supplemental information under this NOFO through electronic systems used by the DOE, including eXCHANGE, constitutes the authorized representative's approval and electronic signature.

C. Submission Date and Times

All required submissions must be submitted to the eXCHANGE site identified in the Key Facts section of NOFO Part 1 no later than 5 p.m. ET on the dates provided on Key Facts section.
There may be more than one deadline, depending on whether a letter of intent and a concept paper is required.

Applicants are strongly encouraged to submit all required application documents at least 48 hours in advance of the submission deadline. Under normal conditions (i.e. submit application documents. Once the application documents are submitted in the eXCHANGE site identified in the NOFO Part 1, 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 them before the applicable deadline. DOE will not extend the submission deadline, at least 48 hours before the submission deadline), applicants should allow at least one hour to s for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

D. Intergovernmental Review

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

VI. Application Review Information

A. Standards for Application Evaluation

Applications that are determined to be eligible will be evaluated in accordance with this NOFO 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 October 1, 2020, which is available at: https://energy.gov/management/downloads/merit-review-guide-financial-assistance-and-unsolicited-proposals-current.

B. Responsiveness Review

The following concept papers and applications will be deemed nonresponsive and will not be reviewed or considered:

- Project concepts or approaches not based on established scientific principles.
- Project concepts or approaches identified specifically as NOT of interest (see the Applications Specifically Not of Interest section above).

C. Review Criteria

1. Compliance Criteria

All applicant submissions for concept papers and applications must:

- Comply with the applicable content and form requirements listed in Application Content Requirements and Submission Requirements and Deadlines of the NOFO Part 1 and 2;
- Include all required documents;
- Be uploaded successfully in eXCHANGE site indicated in the Key Facts section above including clicking the "Submit" button; and
- Comply with the submission deadline stated in Key Facts.

DOE will not review or consider submissions submitted through means other than the eXCHANGE site indicated in Key Facts, submissions submitted after the applicable deadline, or incomplete submissions.

If required in the Key Facts section, applicants must submit a concept paper by 5:00 p.m. ET on the due date listed on the Key Facts section to be eligible to submit an application. If required, applicants who do not submit a concept paper are not eligible to submit an application.

Applicants are strongly encouraged to submit all required application documents at least 48 hours in advance of the submission deadline. Under normal conditions (i.e., at least 48 hours before the submission deadline), applicants should allow at least one hour to submit application documents. Once the application documents are submitted in the eXCHANGE site identified in the Key Facts section, 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 them before the applicable deadline. DOE will not extend the submission deadline for applicants that fail to submit required information by the applicable deadline due to server/connection congestion.

2. Technical Review Criteria

Concept Papers

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

Concept paper Criterion: Overall NOFO Responsiveness and Viability of the Project (Weight: 100%)
This criterion involves consideration of the following factors:

- The applicant clearly describes the proposed technology, how the technology is unique and innovative, and how the technology will advance the current state of the art;
- The applicant has identified risks and challenges of the technology, regulatory and financial aspects of the proposal including possible mitigation strategies, and has shown the impact that DOE funding and the proposed project would have on the relevant field and application;
- The applicant has succinctly described their approach to the Diversity, Equity, Inclusion and Accessibility Plan;
- 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 NOFO.

Applications

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

Topic Areas 1-8 (only)

Review Criterion Overview	
Criterion	**Weight**
Technical Merit, Innovation, and Impact	50%
Project Research and Market Transformation Plan	25%
Team and Resources	15%
Diversity, Equity, Inclusion, and Accessibility Plan	10%

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

This criterion involves consideration of the following factors:

Technical Merit and Innovation

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

- Extent to which project has buy-in from needed stakeholders to ensure success;
- Degree to which key manufacturing and supply chain challenges are considered; and
- Extent to which project has the potential to reduce emissions and provide clean energy acceleration benefits for a community or region.

Impact of Technology Advancement

- Ability of the project to advance industry adoption;
- Extent to which the project supports the topic area objectives and target specifications and metrics; and
- Potential impact of the project on advancing the state-of-the-art

Project Management

- Adequacy of proposed project management systems including the ability to track scope, cost, and schedule progress and changes;
- Reasonableness of budget and spend plan as detailed in the budget justification workbook for proposed project and objectives;
- Adequacy, reasonableness, and soundness of the project schedule, as well as periodic Go/No-Go decisions prior to further funds disbursement, interim milestones, and metrics to track process;
- Adequacy, reasonableness, and soundness of the project schedule, as well as annual Go/No-Go decisions prior to a budget period continuation application, interim milestones, and metrics to track process

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

This criterion involves consideration of the following factors:

Research Approach, Workplan, and SOPO

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

Identification of Technical Risks

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

Baseline, Metrics, and Deliverables

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

Market Transformation Plan

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

legal/regulatory considerations including intellectual property, infrastructure requirements, and product distribution.

Criterion 3: Team and Resources (15%)

This criterion involves consideration of the following factors:

- Capability of the Principal Investigator(s) and the proposed team to address all aspects of the proposed work with a high probability of success. The qualifications, relevant expertise, and time commitment of the individuals on the team;
- Diversity of expertise and perspectives of the team and the inclusion of industry partners that will amplify impact;
- Sufficiency of the facilities to support the work;
- Level of participation by project participants as evidenced by letter(s) of commitment and how well they are integrated into the Workplan; and
- Reasonableness of the budget and spend plan for the proposed project and objectives.

Criterion 4: Diversity, Equity, Inclusion, and Accessibility Plan (10%)

This criterion involves consideration of the following factors:

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

Topic Areas 9-10 (only)

Review Criterion Overview	
Criterion	**Weight**
Project Approach and Impact	30%
Project Plan	30%
Project Team and Qualifications	25%
Diversity, Equity, Inclusion, and Accessibility Plan	15%

Criterion 1: Project Approach and Impact (30%)

This criterion involves consideration of the following factors:

- Extent to which the proposed approach is relevant to the Topic Area objectives, demonstrates how DOE funding will impact the problem that is being addressed, and is innovative;
- Extent to which the application objectively describes the current state of the market sector using quantifiable metrics and how the project outcomes will measurably advance the state of the market sector;
- Extent to which the community which will be affected by the project is involved in the design and implementation of the project activities; and
- Extent to which the project includes activities to produce and share valuable insights and best practices that will effectively enable others to replicate the project successes.

Criterion 2: Project Plan (30%)

This criterion involves consideration of the following factors:

- Extent to which the workplan clearly defines the scope, tasks, milestones, and schedule of the project such that the parameters of the project are appropriately defined, the tasks are logically ordered, the task durations are reasonable, and that the overall plan will result in successful achievement of project outcomes and goals;
- Reasonableness of the approach to managing the work, including the extent to which the involvement of project team organizations/individuals are defined in relation to specific work tasks, milestones, and deliverables, and of the structure of the plan for communication among team members;
- Reasonableness of the proposed plan for collecting, utilizing, analyzing, and publicly sharing project data; and
- Reasonableness of the allocation of project resources, including project budget and key personnel time commitment, to ensure the successful completion of the proposed work.

Criterion 3: Project Team and Qualifications (25%)

This criterion involves consideration of the following factors:

- Extent of key personnel qualifications, expertise, and experience, in relation to project and topic area objectives;
- Extent of the alignment between the team organizations' missions/strategic goals with the objectives of the topic area and with the teaming arrangement proposed by the topic area; and
- Appropriateness of the resource commitments proposed by project partners or other key participants as validated by letters of commitment.

Criterion 4: Diversity, Equity, Inclusion, and Accessibility Plan (15%)

This criterion involves consideration of the following factors:

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

D. Other Selection Factors

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

1. The degree to which the proposed project exhibits technological diversity when compared to the existing DOE project portfolio and other projects selected from the subject NOFO;
2. The degree to which the proposed project, including proposed cost share, optimizes the use of available DOE funding to achieve programmatic objectives;
3. The level of industry involvement and demonstrated ability to accelerate demonstration and commercialization and overcome key market barriers;
4. The degree to which the proposed project is likely to lead to increased high-quality employment and manufacturing in the United States;

5. The degree to which the proposed project will accelerate transformational technological advances in areas that industry by itself is not likely to undertake because of technical and financial uncertainty;
6. The degree to which the proposed project, or group of projects, represent a desired geographic distribution (considering past awards and current applications);
7. The degree to which the proposed project incorporates applicant or team members from Minority Serving Institutions; and partnerships with businesses majority owned or controlled by underrepresented persons or groups of underrepresented persons or Indian Tribes;
8. The degree to which the proposed project, when compared to the existing DOE project portfolio and other projects to be selected from the subject NOFO, contributes to the total portfolio meeting the goals reflected in the Diversity, Equity, Inclusion, and Accessibility Plan criteria; and
9. The degree to which the proposed project will employ procurement of U.S. iron, steel, manufactured products, and construction materials.
10. The degree to which the proposed project contributes to the diversity of organizations and organization types and sizes selected from the subject NOFO when compared to the existing DOE project portfolio.
11. The degree to which the proposed project has broad public support from the communities most directly impacted by the project.
12. The degree to which the proposed project avoids duplication/overlap with other publicly or privately funded work.
13. The degree to which the proposed project supports complementary efforts or projects, which, when taken together, will best achieve the research goals and objectives.
14. The degree to which the proposed project enables new and expanding market segments.
15. The degree to which the project's solution or strategy will maximize deployment or replication.
16. The degree to which the project promotes increased coordination with nongovernmental entities for demonstration of technologies and research applications to facilitate technology transfer.

VII. Selection and Award Notices

Please see the NOFO Part 2, *Selection and Award Notices* for information on notifications for Concept Papers (if applicable), Applications, Award Negotiations, and Post-Selection Information Requests.

VIII. Award Administration Information

A. Post-Award Requirements and Administration

DOE requires all award recipients to follow and accept requirements governed by laws and policies – both federal government-wide and DOE or program specific. These post-award requirements include all National and Administrative Policy Requirements; financial assistance general Certifications and Representations; Build America, Buy America requirements; Davis-Bacon Act requirements; Bipartisan Infrastructure Law-Specific Requirements; Fraud, Waste and Abuse requirements; Safety, Security, and Regulatory requirements; and Environmental Review in Accordance with National Environmental Policy Act requirements.

Post-Award requirements and administration applicable to awards funded under this NOFO are identified below. Detailed descriptions of standard funding restrictions are provided in the NOFO Part 2, *Post-Award Requirements and Administration* section. Detailed descriptions of program specific funding restrictions are provided below the table.

Applicable Post-Award Requirements and Administration	
Title	**Location**
Award Administrative Requirements	NOFO Part 2
Subaward and Executive Reporting	NOFO Part 2
National Policy Requirements	NOFO Part 2
Applicant Representations and Certifications	NOFO Part 2
Statement of Federal Stewardship	NOFO Part 2
Uniform Commercial Code (UCC) Financing Statements	NOFO Part 2
Interim Conflict of Interest Policy for Financial Assistance	NOFO Part 2
Whistleblower Protections	NOFO Part 2
Fraud, Waste, and Abuse	NOFO Part 2
Participants and Collaborating Organizations	NOFO Part 2
Current and Pending Support	NOFO Part 2
Prohibition Related to Malign Foreign Talent Recruitment Programs	NOFO Part 2
Foreign Collaboration Considerations	NOFO Part 2
U.S. Manufacturing Commitments	NOFO Part 2
Subject Invention Utilization Reporting	NOFO Part 2
Intellectual Property Provisions	NOFO Part 2
Go/No-Go Review	NOFO Part 2
Conference Spending	NOFO Part 2
Invoice Review and Approval	NOFO Part 2
Cost-Share Payment	NOFO Part 2

Implementation of Executive Order 13798, Promoting Free Speech, and Religious Liberty	NOFO Part 2
Affirmative Action and Pay Transparency Requirements	NOFO Part 2
Human Subjects Research	NOFO Part 2
Real Property and Equipment	NOFO Part 1
Rights in Technical Data	NOFO Part 1

1. Real Property and Equipment

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

For resulting awards under this NOFO, the recipients may (1) take disposition action on the real property and equipment; or (2) continue to use the real property and equipment after the conclusion of the award period of performance with Grants Officer approval. The recipient's written request for Continued Use must identify the property and include: a summary of how the property will be used (must align with the authorized project purposes); a proposed use period, (e.g., perpetuity, until fully depreciated, or a calendar date when the recipient expects to submit disposition instructions); acknowledgement that the recipient shall not sell or encumber the property or permit any encumbrance without prior written DOE approval; current fair market value of the property; and an estimated useful life or depreciation schedule for equipment.

When the property is no longer needed for authorized project purposes, the recipient must request disposition instructions from DOE. For-profit entity disposition requirements are set forth in 2 CFR 910.360. Property disposition requirements for other non-federal entities are set forth in 2 CFR 200.310 – 200.316. In addition, pursuant to the FY23 Consolidated Appropriations Act (Pub. L. No. 117-328), Division D, Title III, Section 309, at the end of the award period the Secretary or a designee of the Secretary, at their discretion, may vest unconditional title or other property interests acquired under this project regardless of the fair market value of the property.

2. Rights in Technical Data

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

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

Government Rights in Technical Data Produced Under Awards: The U.S. government normally retains unlimited rights in technical data produced under government financial assistance awards, including the right to distribute to the public. However, pursuant to special statutory authority, certain categories of data generated under DOE awards under this NOFO may be protected from public disclosure for up to five years after the data is generated ("Protected Data"). For awards permitting Protected Data, the protected data must be marked as set forth in the award's intellectual property terms and conditions and a listing of unlimited rights data (i.e., non-protected data) must be inserted into the data clause in

the award. In addition, invention disclosures may be protected from public disclosure for a reasonable time in order to allow for filing a patent application.

Data protection is not available to non-R&D projects in Topic Areas 9 and 10.

3. Cost Share Payment

DOE requires recipients to contribute the cost share amount incrementally over the life of the award. Specifically, the 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).

B. Helpful Websites

Office of Energy Efficiency & Renewable Energy | Department of Energy
EERE Application Process
Financial Assistance Forms | netl.doe.gov

C. Questions and Support

1. Questions

Upon the issuance of a NOFO, DOE personnel are prohibited from communicating (in writing or otherwise) with applicants regarding the NOFO except through the established question and answer process described below. Questions regarding this NOFO must be submitted to DE-FOA-0003514@NETL.DOE.GOV no later than three (3) business days prior to the application due date and time. Please note, feedback on individual concepts will not be provided through Q&A.

All questions and answers related to this NOFO will be posted on the eXCHANGE site listed in the Key Facts section above. **You must first select the NOFO Number to view the questions and answers specific to this NOFO**. DOE will attempt to respond to a question within five (5) business days unless a similar question and answer has already been posted on the website.

Questions related to the registration process and use of the eXCHANGE site listed in the Key Facts. should be submitted to EERE-eXCHANGESupport@hq.doe.gov.

2. Support

Grants.gov

Grants.gov provides 24/7 support. You can call 1-800-518-4726 or email support@grants.gov. Hold on to your ticket number.

SAM.gov

If you need help, you can call 866-606-8220 or live chat with the Federal Service Desk.

IX. Other Information

Please see the NOFO Part 2, *Other Information* for additional information and requirements that apply to all DOE NOFOs.