U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy

Vehicle Technologies Office
NATIONAL LABORATORY CALL FOR PROPOSALS

VTO Fiscal Year 2023 Lab Call
DE-LC-0000021

National Lab Funding for Fiscal Year 2023-2026

This Lab Call is being issued by the U.S. Department of Energy's (DOE) Office of Energy Efficiency and Renewable Energy (EERE) Vehicle Technologies Office (VTO).

Questions about this Lab Call? Email VTOLabCall@ee.doe.gov
Problems with EERE eXCHANGE? Email *EERE-eXCHANGESupport@hq.doe.gov*.
Include Lab Call name and number in subject line.

Table of Contents

Lab Call Modification(s) History

Modification 1 (p. 6) : Changed the AOI 5 Concept Paper Submission Deadline from April 14, 2023 to April 21, 2023.

Modification 2 (p. 31) : Changed "Concept papers for AOI 5 must be submitted via EERE Exchange by the submission deadline 4/14/2023 at 11:59 PM Eastern." To "Concept papers for AOI 5 must be submitted via EERE Exchange by the submission deadline 4/21/2023 at 11:59 PM Eastern."

Modification 3 (p. 44) : For AOI 5, changed the week that concept papers are anticipated to be encouraged/discouraged from the week of May 8th to the week of May 15th.

I. Lab Call Description

A. Background and Context

i. Overview and Purpose

The Vehicle Technologies Office (VTO) is issuing this lab call for fiscal year 2023 (FY2023).

Building a clean and equitable energy economy and addressing the climate crisis is a top priority of the Biden Administration. This lab call will advance the Biden Administration's goals to achieve carbon pollution-free electricity by 2035 and to "deliver an equitable, clean energy future, and put the United States on a path to achieve net-zero emissions, economy-wide, by no later than 2050"[1] to the benefit of all Americans. The Department of Energy is committed to pushing the frontiers of science and engineering, catalyzing clean energy jobs through research, development, demonstration, and deployment (RDD&D), and ensuring environmental justice and inclusion of underserved communities.[2]

The research and development (R&D) activities to be funded under this lab call will support the government-wide approach to the climate crisis by driving the innovation that can lead to the deployment of clean energy technologies, which are critical for climate protection. Activities to be funded under this Lab Call will support deployment of commercial electric vehicles and effective integration of vehicles with a decarbonized electric grid. Other areas of interest in this Lab Call will create and deploy breakthrough modeling, simulation, and high-performance computing-enabled data analytics to support the development of new transportation-system technologies, which have the potential to improve energy productivity through new mobility solutions and support the equitable transition to a net-zero economy by 2050. This lab call also recognizes the importance of lighter electric vehicles that will require fewer batteries to achieve the same range, which in turn reduces battery cost, material needs, and reduces the greenhouse gas emissions from battery production. Areas of Interest under the VTO FY23 Lab Call will support advances in composite materials, powertrain materials, and lightweighting metals.

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

[2] 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 in the definition of "equity." E.O. 13985. For purposes of this Lab Call, 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.

In addition, this lab call will emphasize increasing diversity of research staff, increasing diversity of voices in research design, and or increasing quantification and emphasis on supporting underserved communities.

ii. Timeline and Process Logistics

Timeline

KEY DATES	
Lab Call Release Date:	March 23, 2023
PROPOSAL DEADLINE AND DECISION DATES	
AOI 5 Concept Paper Submission Deadline: AOIs 1-4 and 6-7 Full Proposal Submission Deadline:	April 21, 2023, 11:59pm ET April 27, 2023, 11:59pm ET
AOI 5 Concept Paper Decision Date: AOIs 1-4 and 6-7 Decision Date:	Late Spring 2023 Early Summer 2023
Expected Beginning Award Issue Date(s):	AOI 1 and 7: 4th Quarter FY23 AOI 2 - 6: 1st Quarter FY24

Process Logistics

All communication to VTO regarding this Lab Call must use VTOLabCall@ee.doe.gov.

- **PROPOSALS:** To apply to this Lab Call, lab personnel must register (and sign in) with their lab email address and submit proposals through EERE eXCHANGE. Proposal materials must be submitted through EERE eXCHANGE at https://eere-eXCHANGE.energy.gov, EERE's online proposal portal. Frequently asked questions for this Lab Call and the EERE Proposal process can be found at https://eere-eXCHANGE.energy.gov/FAQ.aspx.

  Proposal authors are responsible for meeting the deadlines. DOE strongly encourages all applicants to submit the required information at least 24 hours in advance of the deadline. Applicants should not wait until the last minute—internet and data server traffic can be heavy in the last hours before the submission deadline, which may affect the applicants' ability to successfully submit the required information before the deadline.

QUESTIONS DURING OPEN LAB CALL PERIOD: Specific questions about this Lab Call should be submitted via e-mail to VTOLabCall@ee.doe.gov. VTO will provide answers related to this Lab Call on EERE eXCHANGE at: https://eere-eXCHANGE.energy.gov. Please note that you must first select the specific opportunity number for this Lab Call in order to view the questions and answers specific to this Lab Call. VTO will attempt to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website. To ensure fairness for all lab participants, please do not ask individual VTO staff questions directly.

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

- **NOTIFICATION OF SELECTION:** When selections are finalized, lab leads will receive an email from VTO.

B. Key Considerations and Areas of Interest(s)

i. Key Considerations

- **AVAILABLE FUNDING:** There is approximately **$35.8 million in annual funding** available to fund **all** projects solicited in this Lab Call pending appropriations, program direction, and go/no-go decision points.

- **CRADAS AND FOA AWARDS:** The call for proposals below should **NOT** be construed as requiring the renegotiation of an existing Cooperative Research and Development Agreement (CRADA) or previously competed FOA award in which the lab is a prime or sub-recipient. Labs with CRADAs or FOA awards addressing any of the topic areas below may incorporate that work in proposals they submit in response to the Lab Call to demonstrate existing capability and leverage existing partnerships with industry and other partners. If the proposal is not selected for funding under this Lab Call, the work under the CRADA or FOA award will continue—there is no additional risk to the provision of DOE funding.

- **ELIGIBILITY:** All DOE/National Nuclear Security Agency (NNSA) Federally Funded Research and Development Centers (FFRDCs), and all National Laboratories, are eligible to submit proposals as prime awardees, unless specified otherwise. Proposals that involve more than one laboratory are also allowed.

- **DIVERSITY, EQUITY, and INCLUSION:** It is the policy of the Biden Administration that: The Federal Government should pursue a comprehensive approach to advancing equity[3] for all, including people of color and others who have been historically underserved, marginalized, and adversely affected by persistent poverty and inequality. Affirmatively advancing equity, civil rights, racial justice, and equal opportunity is the responsibility of the whole of our Government. Because advancing equity requires a systematic approach to embedding fairness in decision-making processes, executive departments and agencies (agencies) must recognize and work to redress inequities in their policies and programs that serve as barriers to equal opportunity.

  By advancing equity across the Federal Government, we can create opportunities for the improvement of communities that have been historically underserved, which benefits everyone.[4]

  As part of this whole of government approach, this lab call seeks to encourage the participation of underserved communities and underrepresented[5,6] groups. Applicants are highly encouraged to include individuals from groups historically underrepresented in STEM on their project teams. As part of the proposal, applicants are required to describe

[3] The term "equity" means the consistent and systematic fair, just, and impartial treatment of all individuals, including individuals who belong to underserved communities that have been denied such treatment, such as Black, Latino, and Indigenous and Native American persons, Asian Americans and Pacific Islanders and other persons of color; members of religious minorities; lesbian, gay, bisexual, transgender, and queer (LGBTQ+) persons; persons with disabilities; persons who live in rural areas; and persons otherwise adversely affected by persistent poverty or inequality. E.O. 13985.

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

[5] 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

[6] 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.

how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are:

required to reference, if available, the existing laboratory Diversity, Equity, and Inclusion Plan and describe within the technical volume 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. See Section II.B.ii. Technical Review Criteria. Because a diverse set of voices at the table in research design and execution has an illustrated impact on innovation, this implementation strategy for the lab-wide plan will be evaluated as part of the technical review process.

Further, to the extent the proposed project will include external partners, the applicant is encouraged to include Minority Serving Institutions[7], Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses, Veteran Owned Businesses, or entities located in an underserved community. The Selection Official may consider the inclusion of these types of entities as part of the selection decision. See Section II.B.ii Technical Review Criteria.

- **EERE NATIONAL LABORATORY GUIDING PRINCIPLES:** To ensure continued alignment with EERE lab engagement principles, applicants should consider the following when developing their proposals:
  - VTO strongly encourages projects that bring together multiple labs to meet a high-level strategic goal, leveraging multiple lab capabilities with strong, centralized leadership.
  - To the extent possible and appropriate, VTO seeks lab projects that involve industry engagement or industry partners.

ii. Area of Interest (AOI) Descriptions

Summary of AOIs

- **AOI 1: Technology Commercialization Fund (FY 2023 funding)**
  - 1A: Batteries
  - 1B: Charging, and Electric Vehicles
  - 1C: Energy Efficient Mobility Systems
  - 1D: Decarbonization of Off-road, Rail, Marine and Aviation
  - 1E: Materials Technology

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

- **AOI 2: Composites Core Program 2.0 (FY 2024 – FY 2026 funding)**
- **AOI 3: Powertrain Materials Core Program 2.0 (FY 2024 – FY 2026 funding)**
- **AOI 4: Lightweight Metals Core Program 2.0 (FY 2024 – FY 2026 funding)**
- **AOI 5: EEMS Tools and Technologies (FY 2024 – FY 2026 funding)**
  - AOI 5A: Demonstration and deployment of SMART tools
  - AOI 5B: Disruptive technology R&D
- **AOI 6: Freight in the Loop (FY 2024 – FY 2025 funding)**
- **AOI 7: Data and Tools for Vehicle Grid Integration (FY 2023 – FY 2025 funding)**

AOI 1: Technology Commercialization Fund

Eligibility: No restrictions Estimated DOE Funding Available: $3.6 million Estimated DOE funding per project: $250,000 - $1,500,000 Project Duration 24 - 36 months	Estimated Number of Projects Expected: 3 -6 projects Page Length: 8 pages 50% cost share or greater required

VTO expects to make available $3.6 million of Federal funding for award(s) under this AOI. AOI amounts available are dependent on FY 2023 Congressional appropriations. VTO reserves the right to issue one, multiple, or no awards.

The Department of Energy Technology Commercialization Fund (TCF) was established by Congress through the Energy Policy Act of 2005 (EPAct05) and reauthorized by the Energy Act of 2020 (EA 2020) to "promote promising energy technologies for commercial purposes."

This topic will seek proposals from National Laboratories and Facilities to advance the commercialization of individual energy-related technologies. Projects funded under this topic will need to incorporate Lab-created IP and be at a stage that will generate private sector interest. Proposals must demonstrate clear evidence of commercial potential that combines **technology progress** with **market pull or interest** and project teams must include an external partner(s) willing to provide a cost share equal to or greater than the federal funding requested. All VTO TCF proposals **require a minimum 50% cost share**.[8] In kind cost share as well as cash are acceptable.

All national labs and facilities are invited to submit proposals.

[8] AOI 1 is subject to Section 988of the Energy Policy Act of 2005 regarding cost share. VTO requires all funded projects to meet a 50% of the total project cost-share fund requirement.

Examples of evidence of technology progress include:

- Demonstrated analytical and experimental proof of concept in a laboratory environment.
- Experiments or modeling and simulation validating the functional performance of the technology.

Examples of evidence of market pull or interest include:

- Market analysis demonstrating the technology's current or expected future cost and/or performance advantages vis-a-vis incumbent or competing technologies.
- Demonstrated interest from private industry partners or investors.

Ideal proposals will include technologies with identified utility and potential impact to industry, market viability, and a clear commercialization path forward. Key milestones for proposals under this topic must be commercialization focused, not technology focused, and demonstrate a clear understanding of barriers to commercial adoption (e.g., market entry barriers, regulatory barriers, supply chain barriers) and how they can be overcome.

This AOI offers an opportunity for private industry to partner with DOE's National Labs to advance energy-related technologies and Lab intellectual property (IP) toward commercialization and to reduce the barriers to commercializing Lab developed energy related technologies and IP. The intent is to increase the volume and speed to which Lab developed energy-related technologies and IP make it to market.

The proposals must address what the project intends to accomplish in terms of advancing the technology's readiness for commercialization. Proposals must clearly demonstrate the market need the technology will meet, differences that make the technology more competitive than similar technologies, and the feasibility of moving the technology to market.

Strategic CRADA Approach to Increase Commercial Impact: The TCF provides an opportunity to take a more proactive approach to applied program office support for lab-industry collaboration. Through the TCF, VTO and the National Laboratories can pursue a strategic, forward-looking, competitive approach to commercializing technologies. Proposals which establish strategic CRADAs are strongly encouraged.

Partners: Partners can be any nonfederal entity, including private companies, state or local governments (or entities created by a state or local government), colleges, universities, tribal entities, or nonprofit organizations. Partners must agree to engage in activities that focus on commercializing or deploying technologies in the marketplace and to provide cost- share. There must be a clear articulation that the project team, industry partners, and resources are qualified and capable of successfully completing the project. This includes articulating both the facility and private-partner roles, tasks, and activities throughout the project.

Funding Mechanisms: VTO will send all the TCF funds directly to the selected primary lab(s) using existing work authorizations and funds management processes provided by EERE's AOP

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and CPS systems. TCF project funding will be categorized in a way that meets EERE/OTT/DOE reporting requirements.

Proposed Activities: Proposals should describe which activities need to be undertaken to achieve the commercialization goals of the project. There must be a clear explanation of the current state of the technology, as well as the anticipated state of the technology at the end of the project. To the degree they can be anticipated, the applicant should explain any technical challenges and unanswered technical questions that must be addressed to reach commercialization of the technology. There should be an explanation of any complementary technology(ies) necessary for the proposed technology to function and to have relevance in the market.

Proposals including team members who have completed Energy I-Corps or similar programs are strongly encouraged.

Applicants with active projects seeking additional funding to complete their original scope of work are excluded from applying under this topic unless a new scope of work is proposed that meets the intent of this lab call. Determining what that could mean (a phase II effort, a different market, etc.) is at DOE's discretion, but the intention is that applicants cannot use this lab call to ask for additional funding on an existing project.

TCF project recipients will be required to provide annual metrics reporting for a 5-year period beginning with the start of the project and submit a final report at the end of the project. Proposals are required to provide specific targets for identified commercialization metrics identified and are encouraged to provide short-, medium-, and long-term goals when identifying metrics. TCF project recipients will be required to meet with VTO on a quarterly basis at a minimum to discuss project progress, in addition to providing quarterly progress reporting.

Coordination with the applicant facilities Tech Transfer Office (see Appendix B for contact information) is highly encouraged.

See Section II.A for additional proposal requirements.

Areas of interest for this topic are limited to proposals that address one of the technology missions listed below.

AOI 1A: Batteries
The Battery subprogram focuses on high-energy and high-power battery materials and battery systems that will lead to a significant reduction in the cost, weight, volume, and charge-time of electric vehicle (EV) batteries. These activities focus on generating knowledge and addressing technology barriers for batteries. Specific goals include reducing the cost of battery packs to

less than $100/kWh while increasing vehicle range to 300 miles and decreasing charge time to less than 15 minutes by 2028.

Proposals are sought to advance towards commercialization any technology whose development as funded through the Battery Technologies program directly addresses critical needs in battery chemistry and production.

AOI 1B: Charging and Electric Vehicles

The Electrification Technologies subprogram focuses on transportation electrification through two technology areas: (1) Research for fast, secure, and resilient Plug-in Electric Vehicle (PEV) charging that is effectively integrated with the electrical grid and other infrastructure through Electrification R&D activities, and (2) extreme high power density motor and power electronics for PEV traction drive systems under Electric Drive R&D. These activities focus on generating knowledge and addressing technology barriers for electric drive systems, and high-power charging systems that can enable transportation electrification and support the mass adoption of PEVs. Specific subprogram goals include: (1) decreasing charge time to less than 15 minutes by 2028, (2) reducing the cost of electric drive systems to less than $6/kW by 2025 for 100-kW systems, (3) reducing the cost of on-board chargers to less than $20/kW by 2030 for a 19.2-kW system, (4) enabling 1+ MW charging for medium- and heavy-duty PEVs, and (5) technologies that provide ancillary energy services and effective vehicle grid integration, including bidirectional EVs (to enable charging and discharging to the grid).

Proposals are sought to advance the commercialization of energy-related technologies whose development was funded through the through the Electrification Technologies subprogram that directly addresses critical needs in charging technologies and vehicle electrification.

AOI 1C: Energy Efficient Mobility Systems

The Energy Efficient Mobility Systems (EEMS) program envisions an affordable, efficient, low-emission, and accessible mobility system future in which mobility is decoupled from energy consumption. Through EEMS, VTO works to realize a future that provides affordable, reliable, and convenient transportation choices that operate efficiently, acknowledging contributions from automation, connectivity, electrification, and sharing technologies.

EEMS conducts research, development, and demonstration at the vehicle, traveler, and mobility system levels, creating new knowledge, insights, tools, and technology solutions that increase mobility energy productivity and decrease greenhouse gas and pollutant emissions for individuals and businesses. This multi-level approach is critical to understanding the opportunities that exist for optimizing the overall transportation system. This approach informs the development of tools and capabilities to evaluate the energy impacts of new mobility solutions and will lead to the creation of technologies that provide economic benefits to all Americans through enhanced mobility.

Proposals are sought to advance the commercialization of energy-related technologies whose development was funded through the EEMS subprogram.

AOI 1D: Decarbonization of Off-road, Rail, Marine and Aviation Program

The Decarbonization of Off-road, Rail, Marine and Aviation program supports research, development, and demonstration (RD&D) necessary for industry to develop efficient engines that can utilize renewable fuels, such as advanced biofuels, hydrogen, and e-fuels, to reduce GHG and criteria emissions from off-road vehicles including construction, agriculture and forestry, as well as rail, marine and aviation sectors. The Program supports the development of predictive, high-fidelity sub-models and simulation tools that are scalable and can leverage future exascale computing capabilities. These tools simulate and accurately predict the fundamental processes that occur inside engines, including fuel injection sprays, heat transfer, turbulence, flame propagation, and emissions formation, to achieve results that are comparable to detailed experiments. The Program also supports experimental combustion projects to provide data to establish quantitative relationships between fuel properties and efficiency improvements potential for engines used in non-road vehicles. In combination with modeling, the knowledge from experimental research will help industry develop combustion engines that can utilize renewable fuels with higher efficiency and lower GHG and criteria emissions. The Program conducts experiments using high-resolution microscopy and models chemical reactions at the atomistic level on catalyst surfaces and within the catalysts to determine the impact of renewable fuels on emissions.

Proposals are sought to advance the commercialization of energy-related technologies whose development was funded through the Decarbonization of Off-road, Rail, Marine and Aviation Program.

AOI 1E: Materials Technology

The Materials Technology subprogram supports R&D of advanced materials to enable increased vehicle efficiency. Materials play an important role in increasing the efficiency of electric vehicles through weight reduction as well as enabling additional functionalities such as faster charging and new sensing technologies. Lighter weight vehicle structures and electric drivetrains will require fewer batteries to achieve the same driving range, which in turn reduces battery cost, material needs, and reduces the greenhouse gas emissions from battery production. Functional materials with improved properties such as electrical conductivity, thermal conductivity, and unique sensing capabilities will enable innovations in charging and autonomous vehicles. The materials and manufacturing methods used to make vehicles also contribute to greenhouse gases and the Materials Technology subprogram supports research, development, and deployment to increase recyclability and reduce the overall embodied energy of vehicles. To enable the use of materials such as advanced high-strength steel, magnesium, aluminum, and polymer composites, the Materials Technology subprogram focuses on reducing cost, improving prediction of properties, and enabling high volume

manufacturing of components and multi-material assemblies. The Materials Program goal is to reduce the weight of a vehicle's glider by 25% at a cost of less than five dollars per kilogram saved.

Proposals are sought to advance the commercialization of energy-related technologies whose development was funded through the Powertrain Materials Core Program, Light Metals Core Program, Joining Core Program, or Composites Core Program.

AOI 2: Composites Core Program 2.0

- Eligibility: Open Eligibility (Multi-Lab/Multi-Disciplinary Teams are Required)
- Estimated DOE Funding Available: $6M/per year (Total: $18M)
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 36 months
- Page Length: 20 pages

The *Composites Core Program (CCP)* activity aims to achieve significant weight reduction through the development of novel materials, composite preforms/intermediates, advanced processes, and innovative component fabrication techniques for high-volume, high-performance, and affordable polymer composites vehicle applications. The Phase I program (CCP 1.0) funded 12 AOP projects working with ORNL, PNNL, NREL, LLNL, and SRNL, topics targeted *(1) low cost, high-volume components* and *(2) cost-competitive, high-performance components.* Such core innovation early-stage research projects solely focused on polymeric matrix composites research to address fundamental-crosscutting issues and/or incubate novel concepts. This Phase II, *Composites Core Program 2.0,* will aim to fund high-performance fibers and polymer matrix composites in four thrust areas, which are synergistically interconnected from the previous CCP 1.0 program. Cross-cutting modeling and characterization can be proposed as a part of each of the thrusts, if necessary. The CCP 2.0 also anticipates inter-laboratory collaboration to conduct early-stage research innovations in polymer matrix composites for lightweighting to reduce embodied energy of vehicle components and carbon emissions.

Proposal Submission Requirements:

> Teams of up to **3 National Laboratories** are encouraged. National Laboratory teams are encouraged to submit a unified proposal covering all thrust areas described in the topic. Each Proposal must identify a Lead Laboratory Coordinator and the technical expertise and equipment that will be utilized at each supporting laboratory identified in the proposal. Additionally, a Leader for each of the 4 thrusts must be identified in the proposal. Thrust co-leads is optional, if needed.

See Section II.A for additional proposal requirements.

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These four thrusts of interest include:

Thrust 1: Innovative Low-Cost Carbon Fiber and Alternative Reinforcing Fiber Technologies ($1.5M/yr)

Performance targets:

Strength	Modulus	Strain at Failure	Cost
>250 Ksi	>25 Msi	>1%	<$5/lb

- Aim upstream and downstream low-cost carbon fiber production into supply chain
- Develop high-performance thermoplastic fiber and bio-based cellulosic fiber reinforced composites
- Develop novel approaches to reduce embodied energy of fiber composite systems
- Develop scalable manufacturing processes to reduce carbon emissions for low-cost fiber-reinforced composites
- For scale-up process, collaborating with Carbon Fiber Technology Facility at ORNL is strongly encouraged.

Thrust 2: Multi-functional Materials and Structures ($1.5M/yr)

Performance targets:
In addition to lightweighting, must be greater than 2 functionalities noted below, but not limited to:

Lightweighting	Self-sensing/monitoring	Energy harvesting	Thermal management	Electromagnetic interference	Fire retardation
>30-50%	Yes	Yes	Yes	Yes	Yes

- Design composite systems via structural health monitoring and repairability
- Improve composites toughness, safety, and multifunctionalities
- Utilize hybridized composites for low cost and low carbon emissions
- Explore biomimetic functional composites

Thrust 3: Circularity and Sustainability of Polymer Composites ($1.5M/yr)

Performance targets:

Reduction of embodied energy	Reduction of carbon emissions (GHG)	Mechanical property retention	Reduction of manufacturing cost	Recyclability or reuse in useful products	Cost benefit
>50%	>75%	>90%	>50%	>95%	<$5/kg-saved

- Reintegrate and repurpose polymeric composite materials through the use of low-cost recycled materials for circular economy and lower carbon footprint
- Upcycle carbon fiber and other polymers and/or resins, and recycled batteries for use of the second life
- Incorporate sustainability within manufactured parts via use of renewables
- Develop and industrialize separation and sorting pathways and quantify environmental and economic benefits of recycled material content to enable circularity for end-of-life vehicles

Thrust 4: Polymeric Materials and Their Composites in Additive Manufacturing ($1.5M/yr)

Performance targets:

Objective/Goal	Metric	Minimum	Stretch
Reduce carbon Intensity (production or life cycle)	% carbon intensity change as measured by kg CO2e / kg product	20%	40%
Reduce energy consumption	Energy/unit (product mass or component basis)	15%	30%
Reduce production cost	$/product mass or component basis	20%	40%
Improve material performance (e.g., mechanical, physical, corrosion)	Performance property	15%	30%
Increase component lifetime	Time before replacement/failure	15%	30%
Increase throughput	Production rate per unit of time	15%	50%
Increase part size (size scale-up in AM parts)	Applicant defined	15%	30%

- Develop innovative additively manufactured polymer composites through use of micro-/nano-fillers
- Integrate composites design flexibility through hierarchical materials/structures
- Increase throughput and decrease cycle time in scale-up manufacturing
- Develop bio-inspired low carbon bottom-up manufacturing

Proposals ***must***:

- To be competitive, the proposal must convince expert reviewers that the proposed research project itself is novel.
- The proposal should provide a credible case that the research result(s) has the potential to address the technical needs/barriers associated with the major vehicle challenges.
- A competitive proposal will demonstrate that the proposed research meets the high-risk, high-impact nature of the research approach and potential outcomes.
- A scientifically sound technical plan with milestones and associated metrics and access to adequate resources (e.g., personnel with appropriate scientific and technical expertise, equipment, and facilities) is necessary for a proposal to be competitive.

AOI 3: Powertrain Materials Core Program 2.0

- Eligibility: Open Eligibility (Multi-Lab/Multi-Disciplinary Teams are Required)
- Estimated DOE Funding Available: $6M/per year (Total: $18M)
- Estimated Number of Projects Expected: 1
- Estimated Duration: 36 months
- Page Length: 20 pages

The Powertrain Materials Core Program (PMCP) goals are to encourage Inter-laboratory collaboration aimed at developing new materials and manufacturing methods to improve powertrain efficiency and support materials weight reduction targets by reducing the weight of vehicle powertrain while reducing the demand for critical materials. To reach these goals, thrust areas have been identified that offer opportunities for improved powertrain efficiency and total system weight reduction. The areas identified are improved electrical conductors for electrical wires and motor windings, hard and soft magnetic materials for electric motors, monitoring the material needs for non-electrified low greenhouse gas powertrains, and exploratory projects to evaluate potential emerging technologies to support the program. In addition to these technical thrust areas there is a characterization and modeling thrust to ensure that the resources necessary to validate the performance or predict properties of these new materials are available and accessible in an efficient timely manner to ensure rapid transition from materials concepts to commercial viability.

Proposal submission Requirements:

National Laboratory teams are encouraged to submit a **unified proposal** covering all thrust areas described in the topic. Each Proposal must identify a lead laboratory and the technical expertise and equipment that will be utilized at each supporting laboratory identified in the proposal. The technical Approach should identify the resources and expertise within Thrust 4 that will be utilized to accelerate the programs pathway to commercialization.

See Section II.A for additional proposal requirements.

Thrusts to be included in Technical Volume:

Thrust 1: Electrical Conductors ($1.5M/yr)
Copper is used extensively in vehicle applications and electric vehicles are expected to double the demand for this material. There are several materials that could be used as substitutes for copper, but most are less conductive and would not meet the high current capacity that would be needed in electric vehicles. In addition, the conductivity of copper wires in motors often limits the energy efficiency and power density of electric motors. Materials that can reduce the demand for copper, increase the efficiency of electric motors, or reduce the weight of electric vehicles have the potential to improve electric vehicle range and performance.

- Ultra-conductors – Higher than Copper
- Lightweight Conductors – Lighter than Copper but near copper performance

Note: Performance targets at 50C, 100C, 150C, 200C; low temperature super conductive materials are excluded.

Thrust 2: Magnetic and Electric Motor Materials ($1.5M/yr)

Magnetic materials are the heart of electric motors and wireless charging technologies. There are 2 primary types of electric motors, permanent magnet and inductance motors each have unique materials challenges. Permanent magnet motors rely on HARD magnetic materials which are dominated by expensive rare earth magnetic materials. Inductance motors and wireless charging technologies rely on a combination of high efficiency conductors and SOFT magnet materials to control the magnetic fields and forces within the electric motors. Many of these soft magnetic materials are brittle high silicon steels that are difficult to work with or ceramic ferrites that are heavy and have unique manufacturing needs. Developing Hard and Soft magnetic materials can reduce the demand for critical rare-earth materials, increase electric motor power density, improve electric vehicle sustainability, reduce component weights, and improve BEV system performance.

- Soft Magnetic Materials
  - Laminates for motor cores
  - Ferrites and similar materials for field control and enhancement
- Hard Magnetic Materials
  - Low-rare earth magnets
  - Non-rare earth magnetics
- Specialty Motor Materials
  - Magnetic materials that can be additively manufactured
  - Magnetic materials that can be formed or modified to achieve the application requirements.
  - Thermal management and lubrication for electric motors and controllers.

Thrust 3: Materials for Non-Electric Low Carbon Power Systems ($750K/yr)

Some of the decarbonization strategies for non-road vehicles may need materials support to meet the demands of using low carbon fuels such as Hydrogen in combustion or other non-battery power systems. Monitoring the needs and state of the art for these systems is essential to provide adequate warning of material needs and opportunities for materials-based improvements of these systems.

- Monitor the state of the art for low carbon power systems and identify potential materials needs:
  - Materials for fuel storage and delivery systems
  - Materials for power system structure
  - Materials for gas handling and aftertreatment
- Identify opportunities to support decarbonization efforts by the Vehicle Technologies Office

Thrust 4: Advanced Characterization and Computational Methods ($1.5M/yr)

It has been demonstrated that combining experimental alloy development with multi-scale characterization and modeling can greatly accelerate the materials development process and shorten the timeline to commercialization.

- Advanced Characterization capabilities and expertise
  - SEM, TEM, APT…; Mechanical Properties Measurements; Electrical Property Measurements; Magnetic Property Measurements.
- Computational Methods, facilities, and expertise
  - Modeling resources and availability; Modeling tools currently used; Modeling expertise and availability.
- Materials Based Life Cycle Green House Gas modeling of technologies supported by the program.

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- Modeling resources and availability; Modeling tools currently used; Modeling expertise and availability.

Thrust 5: Technology Demonstration and Exploratory topics (Competitive, as required) ($750K/yr)

- Demonstrations of successful Thrust 1-3 Technologies for commercial viability with industry partners
- Exploratory topics addressing targets of thrust 1-5
- Program management ($150k/yr)

AOI 4: Lightweight Metals Core Program 2.0 (LMCP)

- Eligibility: Argonne National Lab, Oak Ridge National Lab, and Pacific Northwest National Lab
- Estimated DOE Funding Available: $6M/per year (Total: $18M)
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 36 months.
- Page Length: 20 pages

The Vehicle Technologies Office (VTO) Materials Program enables improved energy efficiency across the transportation system through the judicious use of enhanced materials and materials processing methods. The Lightweight Metals Program (LMCP) accomplishes this goal by reducing the vehicle weight in a cost-effective manner. Phase 1 of LMCP focused on developing the base knowledge and understanding of cost-effective processing methods to locally enhance the properties of aluminum (Al) and magnesium (Mg) alloys to enable broader implementation of lightweight alloys in vehicles. This will be Phase 2.0 of the LMCP. In Phase 2.0, The Materials Program seek proposals to expand on high performance processes developed in Phase 1 to targeted scalable, cost-effective, and optimized processing methods. In addition, expanding focus to developing methods to implement sustainable materials across processes developed in Phase 1.0 as well as any improved and newly developed methodologies developed during Phase 2.0.

Restricted to Labs which participated in Phase 1 of LMCP**.** The participating Labs are encouraged to submit a unified proposal covering all thrust areas described.

See Section II.A for additional proposal requirements.

Thrust 1: Large Scale (Giga) Casting $1.5M

A significant contribution to vehicle lightweighting is consolidating components into a single entity. This cuts down on manufacturing time, cost, and complexity with the added benefit of

reducing weight of sub-assemblies. By replacing tens to hundreds of welded and joined components with a single module, Large Scale Casting will help simplify manufacturing and enables achievement of lightweighting goals. As the scale of HPDC components increase for a single part, casting flaws including porosity and thermo-mechanical fatigue due to inconsistencies in cooling rate become problematic.

- Explore process developments to address casting flaws in large scale HPDC
  - Localized property enhancements for cast structural aluminum applications.
  - Explore how the proposed methods could fit into high volume automotive production.
- Fundamental studies of creep and thermo-mechanical fatigue (TMF) mechanisms in cast alloys
  - Develop damage mechanism maps as a function of temperature, load, cyclic loading conditions.

Capital Equipment Expected in Year 1: HPDC equipment sufficient to validate and prove new alloys and casting methods on castings between 50 and 100 pounds.

Thrust 2: Use of Sustainable Materials for Large- and Small-scale casting $2.0M

Most of the Aluminum used in conventional ICE vehicles is high silicone cast aluminum such as A356 or A319. These alloys can accept a large percentage of recycled aluminum and can tolerate some of the impurities in these feed stocks. When used to replace steel in vehicle bodies and structures manufacturers tend to use high strength wrought alloys or large single casting using High Pressure Die Casting using a wrought like alloy. The use of secondary aluminum in High Pressure Die Casting for components in the automotive industry is limited by the high Fe contents in recycled alloys which often result in the formation of brittle β-Al5FeSi phase which reduces the ductility of aluminum castings**.** Neither stamping nor HPDC are currently conducive to accepting large quantities of recycled cast aluminum and thus there is a large volume of cast aluminum scrap that could need to be replaced with virgin aluminum materials. Developing alloys and processing methods that can use an increased percentage of recycled cast aluminum material while still being able to meet the demands of wrought and high pressure die casting would be of significant benefit to the sustainability of an electrified transportation system.

- Design of Lightweight cast alloys using 50% more recycled feedstock than current baselines, performance must be within 95% of baseline materials:
  - Alloys for traditional castings
  - Alloys for high pressure die casting and ultra-large high pressure die casting (giga-casting)
  - Alloys for additive manufacturing
- Process development to enable use of recycled/highly impure alloys

- Investigate the use of high Fe (or similar/impure) Al in the HIDC/HPDC process.
- Developing/exploring new casting/production methods with the use of recycled/sustainable materials
- Developing/exploring new casting/production methods with the use of Eutectic HEA
- Residual stress for AM (molten material processes on the same lay-up)
- CAE design and process tools to reduce support structures for AM processes.
- Assess new materials / processes for sustainability impact against incumbent material / process

Thrust 3: Localized Property Enhancements for Aluminum and Magnesium $1M.

Increasing the deployment envelope of Aluminum and Magnesium can be accomplished by focusing on getting the right properties in the right place by intentional control of heterogeneous materials. This allows the ability to deploy proven alloys in high performance applications, streamlines supply chain with fewer unique alloys, demonstrates a reduction in cost by only putting performance where needed as well as simplifying recycling, both during manufacturing and end of life.

Thrust 3A: Local Property Enhancement for Sheet Aluminum

- Develop and demonstrate scalable, cost-effective processing methods to locally enhance the properties of aluminum (Al) to enable broader implementation of lightweight alloys in vehicles.
  - This is to include improvements in: Yield Strength, room temp ductility and formability, grain structure.
  - Reduction in GHG and CO2 generation for targeted process(s)
  - Localized enhancement of the mechanical properties
- Detail how the proposed methods could fit into high volume automotive production.

Thrust 3B: Local Property Enhancement or Magnesium Applications

- Develop and demonstrate scalable, cost-effective processing methods to locally enhance the properties of magnesium (Mg) alloys to enable broader implementation of lightweight alloys in vehicles.
  - This is to include improvements in: Yield Strength, room temp ductility and formability, grain structure and porosity.
  - Reduction in GHG and CO2 generation for targeted process(s)
  - Localized enhancement of the mechanical properties
- Detail how the proposed methods could fit into high volume automotive production.

Thrust 4: Magnesium Corrosion $0.5M

Magnesium's high chemical instability means it can corrode quickly, limiting its use in a number of applications. Environment exposure to elements such as road salts and slurries can penetrate damaged conventional electrocoat paints, creating sites for rapid electrochemical dissolution of magnesium. For this reason, it is imperative a solution is developed to allow for vast implementation in vehicles. It has been shown in LCMP 1.0 that surface coatings have been proven to mitigate the effects of corrosion of Magnesium.

- Localized surface modification in cast Mg components that will improve overall corrosion performance.
    - Explore various surface treatment methods to improve the corrosion performance of Magnesium.
- Detail how the proposed surface modifications could fit into high volume automotive production.
    - Applied to automotive components.
    - Life Cycle Analysis of surface modification in production environment
    - Compatibility of surface modification with lubricants, pre-treatments, and coatings
    - Explore the integration into currently deployed application methods.

Thrust 5: Advanced Characterization and Computational Methods $1.0M

The access to advanced characterization and computation provides a unique opportunity to accelerate the development of Al- and Mg-based lightweight alloys with intentionally heterogenous microstructure. In addition, this provides a significant database for material properties to be used for process optimization.

- Advanced Characterization capabilities and expertise
    - SEM, TEM, APT…; Mechanical Properties Measurements; Electrochemical property measurement
- Computational Methods, facilities, and expertise
    - Modeling resources and availability; Modeling tools currently used; Modeling expertise and availability.
- Development of modeling tools for intentionally heterogeneous materials that capture the proper parameters on the component level
- Accurate model of anisotropy, porosity, residual stress, distortion, and shrinkage on build parameters and part performance
- Capture experimental data to enable AI based parameter exploration

AOI 5: Mobility Systems RDD&D

- Eligibility: Open Eligibility
- Estimated DOE Funding Available: Up to $10 million per year total, annually, across all projects selected
- Estimated DOE funding per project: $1,000,000 - $2,000,000
- Estimated Number of Projects Expected: 5 to 10 projects – fewer, larger projects are encouraged
- Estimated Project Duration(s): 24-36 months (project are not required to span all three years)
- Page length: 3-page concept paper. (The Cover Page, References, summary of Diversity, Equity, and Inclusion Implementation Plan, and Letters of Commitment/Support do not count toward the page limit.) Full proposals for encouraged concept papers will be requested later, based on the concept paper review. **Note: Concept papers for AOI 5 are due earlier than proposals from other AOIs** (see Proposal Process section for dates).

The Energy Efficient Mobility Systems (EEMS) Program envisions an affordable, efficient, low-emission, and accessible mobility system future in which mobility is decoupled from energy consumption. Through EEMS, the Vehicle Technologies Office (VTO) works to realize a future that provides affordable, reliable, and convenient transportation choices that operate efficiently, acknowledging contributions from automation, connectivity, electrification, and sharing technologies.

EEMS conducts research, development, and demonstration at the vehicle, traveler, and mobility system levels, creating new knowledge/insights, tools, and technology solutions that increase mobility energy productivity and decrease greenhouse gas and pollutants emissions for individuals and businesses. This multi-level approach is critical to understanding the opportunities that exist for optimizing the overall transportation system. This approach informs the development of tools and capabilities to evaluate the energy impacts of new mobility solutions and will lead to the creation of technologies that provide economic benefits to all Americans through enhanced mobility.

More specifically, EEMS acknowledges that this solicitation timing aligns with the conclusion of activities supported under the SMART (Systems and Modeling for Accelerated Research in Transportation) Mobility laboratory consortium. From FY17–FY20, SMART Mobility 1.0 supported research across Advanced Fueling Infrastructure, Connected and Automated Vehicles, Mobility Decision Science, Multi-Modal Freight, and Urban Science research pillars, and from FY21–FY23, SMART Mobility 2.0 has built on the research results and insights from the first phase of SMART Mobility as well as new research projects in integrated modeling and simulation, mobility energy productivity, connected and automated vehicles, drones, curb management, and micromobility. In this context, this FY23 Mobility Systems RDD&D Lab Call

topic solicits proposals that A) leverage SMART and other meritorious EEMS mobility projects ready for demonstration and deployment, and/or B) fill the gap as projects transition.

AOI 5A: Demonstration and deployment of EEMS tools

Historically, VTO and the EEMS Program have required a robust, accurate, and validated suite of vehicle- and transportation-related data and modeling/simulation tools and capabilities to serve as the foundation upon which analyses of future mobility technologies and services may be built. VTO and EEMS alike—including, but not limited to, via the SMART Mobility series of laboratory consortia—have previously supported the creation, development, maintenance, and improvement of model-based systems engineering tools, vehicle energy modeling software, lab-based technology evaluation expertise, drive-cycle analysis capabilities, agent-based transportation system simulation tools, and secure data storage, management, dissemination, and analysis platforms.

Starting in FY24, the EEMS Program seeks proposals to shift these previous investments from the modeling and simulation R&D stage to targeted application via demonstration and deployment with stakeholders in the following illustrative topic areas (the following list is not exhaustive):

- Systems energy impacts across multimodal mobility systems
- CAVs (including CAVs controls and CAV modeling in cities)
- Systems approaches to infrastructure planning, potentially including considerations of EVs, transit (e.g., electrified transit and/or electrified mobility system approaches to complementing/supporting transit), and/or integrated freight/delivery (or a combination thereof)
- Mobility systems approaches to grid integration of electrified mobility

Note that proposals for this sub-topic require non-laboratory implementation partners. For the concept paper phase, give as much detail as possible on the implementation partners, but due to the quick turnaround time lack of commitment from partners will not be held against a proposal. During the full proposal review, preference will be given to proposals that already have implementation partners, but partners must be committed no later than end of Year 1 Go/No-Go.

Proposals (both concept papers and eventually full proposals) to this sub-topic should explicitly describe the proposed non-laboratory implementation partners, the level of engagement to date, and the anticipated engagement going forward.

Proposals are encouraged to consider approaches that combine demonstration and deployment with real-world lessons learned, including data collection and sharing (at least, but not limited to, via the LiveWire Data Platform).

See Section II.A for additional proposal requirements.

AOI 5B: Disruptive technology R&D

As work done under SMART 2.0[9] is taken to the next level of demonstration and deployment in AOI 5A, there is the opportunity for EEMS to refresh its research technology portfolio to research and development with clear potential to disrupt the historical reliance of mobility systems on carbon-based fuels. Additionally, this novel research can and should align with decarbonization strategies highlighted in the 2023 multi-agency Transportation Decarbonization Blueprint, as is shown below (in Figure A). EEMS in particular is poised to invest in technologies across all of the categories shown—convenient, efficient, and clean—and in particular systems approaches that span or combine these categories.

Figure A. Summary of transportation decarbonization strategies.

Technologies and approaches should promote the transition to decarbonizing transportation and mobility systems by improving efficiency, increasing convenience, and/or lowering cost. Technologies could include but are not limited to:

- Interaction between land use and mobility
- Mobility systems approaches to grid integration
- Novel approaches to and the impacts of telework technologies
- Characterization of vehicle and infrastructure communications technologies
- Sensing/computing energy demand

Where possible, proposals are encouraged to consider potential connections to and even collaboration with other relevant Federal agencies (in particular the other three Transportation

[9] Systems and Modeling for Accelerated Research in Transportation (SMART) Lab Consortium 2.0 is comprised of 6 National Laboratories and supports continuing research from SMART 1.0 as well as new research projects. The Consortium is the EEMS Program's primary effort to create tools and generate knowledge about how future mobility systems may evolve and identify R&D gaps that the EEMS Program may address through its research portfolio.

Decarbonization Blueprint agencies: EPA, DOT, HUD) on topics such as communications (vehicle-to-everything, "V2X"), air quality, city planning, safety, etc.

Proposals (both concept papers and full proposals) to this sub-topic should explicitly describe any proposed collaboration with other relevant Federal agencies, the level of engagement to date, and the anticipated engagement going forward.

See Section II.A. for additional proposal requirements.

AOI 6: Freight in the Loop

- Eligibility: AOI 6 – Open Eligibility
- Estimated DOE Funding Available: Total $5/M. Estimate $2.5 million per year
- Estimated Number of Projects Expected: 1 project
- Estimated Project Duration(s): 24 months
- Page Length: 12 pages.

Freight trucks produce nearly a quarter of all transportation-generated greenhouse gases in the U.S. and that percentage is expected to increase. To meet the goals of the Transportation Decarbonization Blueprint resources should be directed to the study and reduction of freight GHG emissions. To fully study the GHG implications of alternative fuel (e.g., electric and hydrogen) medium- and heavy-duty (MD/HD) vehicles a MD/HD chassis dynamometer is needed.

Historically, stand-alone chassis dynamometers have been sufficient to characterize medium and heavy vehicles that do not have connected and automated vehicle (CAV) technologies. However, studying potential energy consumption and GHG emissions reductions from connected and automated M/HDVs and associated vehicle controls requires a chassis dynamometer integrated as part of a complete everything-in-the-loop (XIL) set-up, i.e., simulation software to be able to implement software-in-the-loop, hardware such as communication radios to implement hardware in the-loop, and a connected dynamometer to implement vehicle-in-the-loop. An XIL set-up can evaluate how the CAV responds to its built environment and other traffic, while simply putting a CAV on a conventional chassis dynamometer and evaluating the response to a predefined drive cycle would not be sufficient for understanding how the vehicle would respond to other vehicles and surroundings. An XIL set-up also provides a more cost effective and safer way to test CAV technology before moving to on-road or on-track experiments.

VTO has previously invested in complete light-duty XIL set ups, but VTO does not have the same capabilities for MD/HD vehicles. The Energy Efficient Mobility Systems and Technology Integration programs are jointly seeking proposals to design, build, and provide an initial demonstration of a medium-duty/heavy-duty chassis dynamometer as part of a larger XIL set-up.

Proposals to this topic should include an operations and maintenance plan and budget to continue the facility operations for five years after the project is complete to clearly identify the long-term future resources needed. Proposals should identify the resources (staff time, facility space, etc.) the laboratory will invest to help create this capability. Additionally, proposals should identify what capabilities will be operational at the completion of this lab call project verse what will be developed in the future with other funding sources.

Proposals should describe ways in which external stakeholders (industry, etc.) could use the dynamometer capabilities and any financial contributions expected from these stakeholders for using the capabilities. Proposers are encouraged to describe any previous feedback received from these external stakeholders on the value of the MD/HD dynamometer capability and the potential needs these stakeholders foresee that may be met through this capability (through letters of support, etc.). Proposals that connect the "freight-in-the-loop" MD/HD chassis dynamometer to XIL setups at other National Laboratories to create multi-lab simulation capabilities are encouraged. Chassis dynamometer equipment and facilities should be capable of accommodating future MD/HD advanced technology vehicles that may have increased size and weight versus today's conventional MD/HD vehicles.

Proposals are encouraged to briefly explain how they will utilize any similar light-duty capabilities at their laboratory. Proposals are encouraged to look for opportunities for a multi-lab collaboration.

To ensure VTO investments can also be leveraged across DAS-T sister offices, proposals should also include a discussion of how the proposed facility could be leveraged for alternative fuel vehicles such as hydrogen fuel cell vehicles, including an alternative fuel infrastructure plan, detailing safety features and fueling infrastructure improvements needed to fuel and test MD/HD vehicles. Proposals are encouraged to leverage existing or future alternative fueling infrastructure at the National Laboratories.

See Section II.A for additional proposal requirements.

AOI 7: EV Ecosystem Stakeholders Toolkit and Data for Vehicle Grid Integration

- Eligibility: Open Eligibility (Multi-Lab Teams are Required)
- Estimated DOE Funding Available: $2.5M/per year (Total: $5M)
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 24 months
- Page Length: 12 pages

The rapid adoption of electric vehicles (EVs) and the build-out of charging infrastructure, spurred by the Bipartisan Infrastructure Law and the Inflation Reduction Act, has placed increased emphasis on the integration of these EVs and associated infrastructure with the electric grid. The Vehicle Technologies Office is working closely with the Joint Office of Energy

and Transportation and the Office of Electricity to ensure coordination across the Department of Energy on this crucial topic. Since much of the planning for this integration is being done at the state and local level by a diverse range of entities, there is a need for modeling tools, data, and analytical insights that the various stakeholders can use to effectively create their plans. Stakeholders that need these tools, data, and analysis include groups such as Public Utility Commissions/Public Services Commissions (PUC/PSC), State Departments of Transportation (DOT), utilities, Charging Network Operators (CNO), and state and municipal planning entities.

The Department of Energy national laboratories have developed multiple tools that could be used to answer many of the questions the stakeholder groups must address regarding effective integration of EVs and charging with the grid, referred to as Vehicle Grid Integration (VGI). The Department of Energy seeks to build upon these tools to provide assistance to these stakeholders, but the sheer number of stakeholders does not make it practicable for the labs to provide hands-on assistance to every stakeholder. This creates the need for stakeholder friendly versions of these tools to be developed and made available for use by the stakeholders with minimal to no expert support or data sets or analytical insights that stakeholders can use directly or with low levels of technical assistance. DOE envisions a modeling and analysis toolbox, containing multiple tools, data and/or analysis organized by stakeholder group, that can be accessed on-line and used by stakeholders to assist in their planning efforts or with low levels of hands-on technical assistance.

The purpose of this lab call topic area is to fund a coordinated multi-lab team to develop this EV/EVSE planning toolbox and associated datasets and analysis products and make it available to the stakeholder groups mentioned above. This effort should take a coordinated approach across the labs and across the VGI landscape – vehicles, chargers and the grid, reflective of the coordinated funding for this effort. A successful project will require the identification of existing DOE tools that are most appropriate for each stakeholder group to meet their needs, identification of gaps where additional tools, data, or analysis is needed and plans to fill those gaps, and development of the toolbox with self-service versions of the DOE tools that can be used by stakeholders to accelerate informed decision making. Projects should proactively identify how datasets feed into existing cross-EERE data repositories that enable consistency and ease of accessibility such as the Annual Technology Baseline, Standard Scenarios and DECARB. The labs participating in this effort should have experience with development and use of at least one of the VGI modeling and analysis tools that could be useful to the stakeholder groups and experience developing versions of tools that can be used by non-lab entities. Understanding the needs and modeling capabilities of the EV ecosystem stakeholder groups is also required. Proposals must include a plan to show how tools will provide value to stakeholders in future years.

See Section II.A for additional proposal requirements.

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II. Proposal Submission and Review Information

A. Proposal and Submission Details

i. Proposal Process

Proposals for AOIs 1-4 and 6-7 must be submitted via EERE Exchange by the submission deadline 4/27/2023 at 11:59 PM Eastern. Concept papers for AOI 5 must be submitted via EERE Exchange by the submission deadline 4/21/2023 at 11:59 PM Eastern.

To apply to this Lab Call, applicants must register with their lab email address and submit proposal materials through EERE eXCHANGE at https://eere-eXCHANGE.energy.gov, EERE's online application portal. Potential applicants will be required to have a Login.gov account to access EERE eXCHANGE. As part of the eXCHANGE registration process, users will be directed to create an account in https://login.gov/. Please note that the email address associated with Login.gov must match the email address associated with the eXCHANGE account. For more information, refer to the Exchange Multi-Factor Authentication (MFA) Quick Guide in the Manuals section of eXCHANGE.

For AOI 1, applicants are strongly encouraged to collaborate with their respective technology transfer offices. Points of contact are listed in Appendix B.

A complete application consists of Project Information entered through Exchange and the Proposal uploaded in Exchange. All proposals must conform to the guidelines for format and length, and be submitted at, or prior to, the deadline listed.

Proposers will be required to first register and then provide several categories of project information and details in eXCHANGE that will be used to develop and accelerate negotiations of FY 2023 and FY24 AOPs (Annual Operation Plans) if selected. Appendix C provides a worksheet to guide applicants through this process in eXCHANGE. This is in addition to uploading the proposal document itself. Any information the applicant considers to be of significance for the review process must be included in the uploaded proposal document, as reviewers will not have access to the AOP development information entered in eXCHANGE.

ii. General Proposal Requirements

Proposals should be formatted for 8.5 x 11 paper, single spaced, and have 1-inch margins on each side. Typeface size should be 12-point font for body text with headings and subheadings sized accordingly. Tables and figures may be in 10-point font.

Proposals for Area of Interest 1 should be no more than 8 pages in length. Proposals for Areas of Interest 2 – 4 should be no more than 20 pages in length. Concept papers for Area of Interest 5 should be no more than 3 pages in length. Proposals for Areas of Interest 6 and 7 should be

no more than 12 pages in length. **For all AOIs the Cover Page, References, Diversity, Equity, and Inclusion Implementation Plan, Letters of Commitment/Support, Summary Slide, and Resumes do not count toward the page limit.** Proposals should contain the following sections.

iii. Proposal Content

Proposal content of the technical volume aligns with content required in the EERE AOP project forms, with additional information to assist reviewers in evaluating technical details. The narrative should build on the information provided as part of the EERE eXCHANGE template. **Applicants must include all content they wish to have reviewed in the proposal (proposal reviewers will not review any information provided in eXCHANGE for AOP development).**

The requirements for the Diversity, Equity, and Inclusion Implementation Plan, the letters of commitment and support, and the summary slide are the same across AOIs, except where noted. Please see below for the AOI specific requirements for the technical volume.

DIVERSITY, EQUITY, AND INCLUSION: As part of the proposal, proposal authors for ALL AOIs are required to describe how diversity, equity, and inclusion objectives will be incorporated in the project. Specifically, applicants are required to provide a description of how the project will support or implement the lab-wide Diversity, Equity, and Inclusion Plan and describe the actions the applicant will take to foster a welcoming and inclusive environment, support people from groups underrepresented in STEM, advance equity, and encourage the inclusion of individuals from these groups in the project; and the extent the project activities will be located in or benefit underserved communities. The plan should include SMART milestones supported by metrics to measure the success of the proposed actions. Please see page 7, Section I.B.i for background on DOE and DEI.

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

- Diversity on the research team
  - Include persons from groups underrepresented in STEM as PI, co-PI, and/or other senior personnel;
  - Include persons from groups underrepresented in STEM as student researchers or post-doctoral researchers;
  - Implement evidence-based, diversity-focused education programs (such as implicit bias training for staff) in your organization;
  - Identify Minority Business Enterprises, Minority Owned Businesses, Woman Owned Businesses and Veteran Owned Businesses to solicit as vendors and sub-contractors for bids on supplies, services and equipment;

    - Include faculty or students from Minority Serving Institutions as PI/co-PI, senior personnel, and/or student researchers;
    - Enhance or collaborate with existing diversity programs at your home organization and/or nearby organizations;
    - Collaborate with students, researchers, and staff in Minority Serving Institutions;
- Explicit diversity in research impact
    - Illustrated outcome impact in underserved communities;
    - Disseminate results of research and development in Minority Serving Institutions or other appropriate institutions serving underserved communities;
- Explicit diversity in research design. Inclusion of a broad community, academic, policymaking staff in research design and execution phase

Save the Diversity, Equity, and Inclusion (DEI) Implementation Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_DEIIP"

LETTERS OF COMMITMENT AND SUPPORT: Submit letters of commitment from all subrecipient and third-party cost share providers. If applicable, also include any letters of commitment or support from partners/end users (1-page maximum per letter). Save the letters of commitment in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_LOCs".

SUMMARY SLIDE: AOIs 1-4 and 6-7 applicants are required to provide a single MS Powerpoint slide summarizing the proposed project. This slide is used during the evaluation process and may be made available to the public. The Summary Slide template requires the following information:

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

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

Note: Concept papers from AOI 5 that are selected will submit a summary slide with their full proposal at a later date.

RESUMES: Save resumes of key participants (one page per individual) in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Resumes".

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Include Lab Call name and number in subject line.

Note: AOI 5 concept paper submissions should include any resumes for consideration as they will not be accepted as part of full proposals.

The **Technical Volume** must be submitted in PDF format as a single file (do not bundle multiple proposals in a single file). The Technical Volume must conform to the following content and form requirements for the correct AOI, including maximum page lengths listed above. If applicants exceed the maximum page lengths indicated above, VTO will review only the authorized number of pages and disregard any additional pages. Save the Technical Volume in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TechnicalVolume".

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

AOI 1 Proposal Requirements

The Technical Volume for Area of Interest 1 must conform to the following content requirements:

Cover Page (1 page): The cover page is not included in the page limit and should include the project title, the specific Lab Call Area of Interest being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.

Project Overview: The project overview **is** included in the page limit and should provide a truncated explanation of the proposed project; a clearly defined, easily communicated, end-of-project goal; and a high-level overview of estimated project budget, listing an estimated breakdown for each proposed year. The applicant should discuss the impact 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.

Project Description: The Project Description should contain the following information:

- Relevance and Outcomes: The applicant should provide a detailed description of the technology. This section should describe the relevance of the proposed project to the goals and objectives of AOI 1 and the subtopic. The applicant should clearly specify the expected outcomes of the project.
- Describe the expected path for the proposed project toward commercialization successes, including the anticipated timeline for market entry or increased market adoption for technologies involved in the proposal.

- Innovation and Impacts: The applicant should describe the current state-of-the-art in the applicable field, the specific innovation of the proposed technology, the advantages of proposed technology over current and emerging technologies, and the overall impact on advancing the state-of-the-art/technical baseline if the project is successful.

Workplan: The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, Go/No-Go Decision Points, and Project Schedule. The Workplan should contain the following information:

- Project Objectives: The applicant should provide a clear and concise (high-level) statement of the goals and objectives of the project as well as the expected outcomes.
- Technical Scope Summary: The applicant should provide a summary description of the overall work scope and approach to achieve the objective(s). The overall work scope is to be divided by performance periods that are separated by discrete, approximately annual decision points (see below for more information on Go/No-Go decision points). The applicant should describe the specific expected end result of each performance period.
- WBS and Task Description Summary: The Workplan should describe the work to be accomplished and how the applicant will achieve the milestones, will accomplish the final project goal(s), and will produce all deliverables. The Workplan is to be structured with a hierarchy of performance period (approximately annual), task and subtasks, which is typical of a standard WBS for any project. The Workplan shall contain a concise description of the specific activities to be conducted over the life of the project. The description shall be a full explanation and disclosure of the project being proposed (i.e., a statement such as “we will then complete a proprietary process” is unacceptable). It is the applicant’s responsibility to prepare an adequately detailed task plan to describe the proposed project and the plan for addressing the objectives of this Lab Call.
- Milestone Summary: The applicant should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. Unless otherwise specified in the Lab Call, 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.
- Project Metrics: Provide specific targets for identified commercialization metrics and when possible provide short-, medium-, and long-term goals when identifying metrics.
- Go/No-Go Decision Points: The applicant should provide a summary of project-wide Go/No-Go decision points at appropriate points in the Workplan. A Go/No-Go decision point is a risk management tool and a project management best practice to ensure that, for the current phase or period of performance, technical success is definitively

achieved and potential for success in future phases or periods of performance is evaluated, prior to actually beginning the execution of future phases. At a minimum, each project must have at least one project-wide Go/No-Go decision point for each budget period (12 to 18-month period) of the project. The applicant should also provide the specific technical criteria to be used to evaluate the project at the Go/No-Go decision point. Go/No-Go decision points are considered "SMART" and can fulfill the requirement for an annual SMART milestone.

- End of Project Goal: The applicant should provide a summary of the end of project goal(s). At a minimum, each project must have one SMART end of project goal.
- Project Schedule (Gantt Chart or similar): The applicant should provide a schedule for the entire project, including task and subtask durations, milestones, and Go/No-Go decision points.
- Project Management: The applicant should discuss the team's proposed management plan, including the following:
    - The overall approach to and organization for managing the work
    - The roles of each project team member
    - Any critical handoffs/interdependencies among project team members
    - The technical and management aspects of the management plan, including systems and practices, such as financial and project management practices
    - The approach to project risk management
    - A description of how project changes will be handled
    - If applicable, the approach to Quality Assurance/Control
    - How communications will be maintained among project team members

Market Transformation Plan: The applicant should provide a market transformation plan, including the following:

- Identification of target market, competitors, and distribution channels for proposed technology along with known or perceived barriers to market penetration, including a mitigation plan
- Identification of a product development and/or service plan, commercialization timeline, financing, product marketing, legal/regulatory considerations including intellectual property, infrastructure requirements, data dissemination, U.S. Manufacturing Plan, and product distribution. Describe the project team's unique qualifications and expertise, including those of key subrecipients.

Technical Qualifications and Resources:

- Describe the project team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project.
- This section should also include relevant, previous work efforts, demonstrated innovations, and how these enable the applicant to achieve the project objectives.
- Describe the time commitment of the key team members to support the project.

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

Cost-Share: Provide a detailed table describing 50% or greater cost-sharing, clearly articulating cash versus in-kind. Submit letters of commitment from all cost-share providers. Cost-share should be equal to or greater than the federal funding being requested.

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

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

AOI 2 – 4 Proposal Requirements

The Technical Volume for Area of Interests 2 – 4 must conform to the following content requirements:

Teams of up to **3 National Laboratories** are encouraged. National Laboratory teams are encouraged to submit a unified proposal covering all thrust areas described in the topic. Each Proposal must identify a Lead Laboratory Coordinator and the technical expertise and

equipment that will be utilized at each supporting laboratory identified in the proposal. Additionally, a Leader for each of the thrusts must be identified in the proposal. Thrust co-leads is optional, if needed.

Each submission is expected to include a **Technical Volume** covering **Management Structure** and the **Technical Approach** planned for addressing the needs of each of the thrusts laid out in the topic. The technical approach should include a clear project plan with specific performance targets, metrics, and go/no-go decision points. The technical volume should be limited to no more than 20 pages. The technical volume should be supported by a suite of Appendices with detailed information supporting the team's proposal.

Appendices:

- **Appendix A: Commercialization:**
- **Appendix B: Tools and Resources:**
- **Appendix C: Publications and Awards:**
- **Appendix D: Team Members:**
- **Appendix E: Resumes:**

This is an applied science research program aimed at developing technologies with commercial application in the transportation sector; As such each proposal must include an **Appendix A: Commercialization:** listing successful projects and CRADAs with industry including the Proposed Team participant(s) involved with the work and the industry partner and contact who can verify the results.

This program requires heavy utilization of advanced computation, characterization, and materials processing equipment, therefore an **Appendix B: Tools and Resources:** is required listing the tools and resources available to the Proposed Team, the availability of the resources to the team and identify the Team Member(s) with experience and direct access to those resources. If resources are based on competitions, the Proposal must include that information and a list of successful prior competitions for those resources by team members (team member must be identified).

Each proposal must include an **Appendix C: Publications and Awards:** A complete list of industry awards (such as R&D 100) and publications on research relevant to materials development for transportation applications. The Team Member(s) associated with each publication or award must be cited.

Each proposal must include an **Appendix D: Team Members**: Containing a complete **list** of proposed Team members, their organizational affiliation, and their expected availability for each thrust area within the proposed body of work.

Resumes may be included in a separate **Appendix E: Resumes.**

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AOI 5 – 7 Proposal Requirements

The Technical Volume for Areas of Interest 5 - 7 must conform to the following content requirements:

COVER PAGE: The cover page should include the project title, the specific Lab Call Area of Interest being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality. (The cover page is not included in the page limit.)

PROJECT OVERVIEW: For AOIs 5-7, the Project Overview should provide a concise background for the proposed effort that addresses the background of the opportunity or issue addressed, the technology barriers and how the project will address them, and how this project's approach differs from (and/or continues) existing projects funded by VTO.

Additionally, for AOI 6 and 7 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. The applicant should discuss the impact that DOE funding would have on the proposed project. If this is a multi-performer project, this section should include a description of each performer's role and responsibility.

PROJECT OBJECTIVES AND TECHNICAL DESCRIPTION: The Project Objectives should describe the project-specific goals, objectives, and expected outcomes and the targeted improvements to the baseline technology and the critical success factors in achieving that goal.

The proposal should include a clearly defined, aggressive and quantitative end-of-project goal that supports larger VTO programmatic goals.

The applicant should provide a detailed description of the technology and its feasibility, including the scientific and other principles and objectives that will be pursued during the project. Details on the technical aspects of the goals, objectives, and outcomes should be included in this section to explain the specific technical areas to be addressed.

Note for AOI 5: In this section a high-level description of the technology and its feasibility is acceptable with a detailed description expected if the project is selected for a full proposal.

PROJECT MANAGEMENT/ WORK PLAN: Key milestones should be stated here, with dates and specific descriptions of what needs to be accomplished to achieve milestones, with one go/no-go decision annually and quarterly progress measures stated explicitly. Key tasks should be listed with brief descriptions for each task, including roles and responsibilities of any partners. A cost estimate (total) for each major task group should be provided here.

Note: For AOI 5 due to page limitations, this section should focus on tasks and go/no-go decisions, but does not need to go into the level of detail of a full proposal.

For AOIs 6 and 7:

- This section should describe a project schedule with 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 proposal should provide a summary of appropriate milestones throughout the project to demonstrate success. A milestone may be either a progress measure (which can be activity based) or a SMART technical milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate a technical achievement rather than simply completing a task. 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).

TECHNICAL QUALIFICATION AND RESOURCES: The Technical Qualifications and Resources should describe the project team's unique qualifications and expertise, including those of key subrecipients, and the project team's existing equipment and facilities that will facilitate the successful completion of the proposed project; include a justification of any new equipment or facilities requested as part of the project. For AOI 6 and 7, for multi-organizational or multi-investigator projects, if not done elsewhere in the proposal, please describe the roles and the work to be performed by each PI and Key Participant and how the various efforts will be integrated and managed.

Note: For AOI 5, this section should be brief and more detail can be given if selected for a full proposal.

B. Proposal Review Details

i. Merit Review and Selection Process

Upon receipt and review for initial compliance with requirements, all proposals received in eXCHANGE by the deadline will undergo a thorough technical review. VTO will use expert reviewers familiar with the VTO portfolio, goals, and objectives. VTO will collect and collate review scores and comments for use in making final project selections. The VTO Selection Official will consider the merit review results to make the final project selections. VTO will not review or consider ineligible proposals.

Some labs have continuing multi-year projects that have already gone through the merit review process. These will continue to be reviewed through the annual peer review process. Labs should work with VTO project and program managers to ensure that ongoing projects are included in the annual operating plans (AOP) to meet AOP deadlines. This lab call will only pertain to the new topic areas below.

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ii. Technical Review Criteria

Technical Review Criteria AOI 1

Criterion 1: Technical Merit, Innovation, and Impact (Weight: 40%)
This criterion involves consideration of the following factors:

- How innovative and impactful is the project, assuming the stated outcomes can be achieved as written?
- Evidence of Commercial Potential.
- Project demonstrates both technology progress and market pull or interest. Extent to which the proposed technology will result in a commercially successful product and/or company.
- Extent to which the proposed technology can be successfully commercialized in a reasonable timeframe.
- Extent to which the proposed technology can be successfully commercialized in a reasonable timeframe.
- Diversity, Equity, and Inclusion (DEI) Implementation plan:
    - The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and
    - Extent to which the project benefits underserved communities.

Criterion 2: Project Approach (Weight: 40%)
This criterion involves consideration of the following factors:

- Are the stated goals of the project SMART, and are they likely to be accomplished within the scope of this project? Is there a likelihood of success for the proposed project?
- Measurable—Degree to which the proposal is structured to produce a measurable result/impact, including the required DEI milestones. Extent to which the applicant shows a clear understanding of the importance of SMART, verifiable milestones and proposes milestones that demonstrate clear progress, are aggressive but achievable, and are quantitative.
- Risks mitigated — Extent to which the applicant understands and discusses the risks, core barriers, and challenges the proposed work will face, and the soundness of the strategies and methods that will be used to mitigate risks. Degree to which the proposal adequately describes how the team will manage and mitigate risks.
- Validated—Level of validation (letters of support/interest, partners, customer trials, data from prior work, report references, etc.).
- Reasonable assumptions—Reasonableness of the assumptions used to form the execution strategy (e.g., lab staff participation, costs, throughput at full scale, speed of proposed scale-up or adoption, and mode of long-term funding).
- Reasonable budget—The reasonableness of the overall funding requested to achieve the proposed project and objectives. The reasonableness and clarity of the budget and

scope options. Level of proposed cost-share for the project will be taken into consideration.

Criterion 3: Team and Resources (Weight: 20%)
This criterion involves consideration of the following factors:

- Is the team well-qualified and positioned to successfully complete this project?
- Capable—Extent to which the training, capabilities, and experience of the assembled team will result in the successful completion of the proposed project. Extent to which this team (including proposed subrecipients) will be able to achieve the results on time and to specification.
- Participation—The level of participation by project participants, as evidenced by letter(s) of commitment demonstrating cost-share and how well they are integrated into the work plan.
- Extent to which teams include representation from diverse entities, such as, but not limited to: Minority Serving Institutions, including Historically Black Colleges and Universities/Other Minority Institutions, or through linkages with Opportunity Zones. Diversity, Equity, and Inclusion. The quality and manner in which the measures incorporate diversity, equity and inclusion goals in the project; and extent to which the project benefits underserved communities.
- Team Quality—Extent to which the final team required to complete this project is fully assembled and committed to the project (e.g., Are there any key members that are "to be hired" in the future?).
- Past Performance—Extent to which the assembled team has shown success in the past. (Note: new performers will not be penalized.) DOE encourages new entrants and new ideas, but past successes and/or failures will be noted.

Technical Review Criteria AOI 2-7

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

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

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

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

- Research Approach and Workplan
  - 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 will succeed in meeting the project goals.
- Identification of Technical Risks
  - Discussion and demonstrated understanding of the key technical risk areas involved in the proposed work and the quality of the mitigation strategies to address them.
- Baseline, Metrics, and Deliverables
  - The level of clarity in the definition of the baseline, metrics, and milestones; and
  - Relative to a clearly defined experimental baseline, the strength of the quantifiable metrics, milestones, and mid-point deliverables defined in the proposal, 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, Data Management Plan, Open-Source Software Distribution Plan, U.S. manufacturing plan etc., and product distribution.

Criterion 3: Team and Resources (Weight: 15%)
This criterion involves consideration of the following factors:

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

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

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

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

iii. Selection for Award Negotiation

VTO carefully considers all information obtained through the proposal process and makes an independent assessment of each compliant and responsive proposal based on the criteria set forth in this Lab Call. VTO may also postpone a final selection determination on one or more proposals until a later date, subject to availability of funds and other factors. VTO will notify applicants if they are, or are not, selected for award negotiation.

If selected for award, DOE reserves the right to request additional or clarifying information for any reason deemed necessary.

iv. Selection Notification

For AOIs 1-4 and 6-7, VTO anticipates completing the project selection process and notifying labs of selections during the week of June 1, 2023 **(subject to change)**. For AOI 5, concept papers are anticipated to be encouraged/discouraged during the week of May 15th.

VTO will notify lab leads of selection results from VTOLabCall@ee.doe.gov. This notice of selection is not an authorization to begin performance.

v. Questions and Agency Contacts

Specific questions about this lab call should be submitted via e-mail to VTOLabCall@ee.doe.gov To ensure fairness across all labs, individual VTO staff cannot answer questions while the lab call remains open. To keep all labs informed, VTO will post all questions and answers on EERE eXCHANGE.

Appendix A: TCF Cost-Share and Nonfederal Cost-Share Information

COST-SHARE

This lab call is subject to Section 988 of the Energy Policy Act of 2005 regarding cost-share.

Cost-share funds are subject to audit by the Department or other authorized government entities (e.g., General Accounting Office). A written agreement may be advisable—either between the DOE facility and the third party or between the CRADA partner and the third party—that requires the third party to provide the cost-share funds. Consult your DOE facility legal staff for advice about how to obligate the third party to provide the cost-share funds, and to ensure the cost-share funds meet the requirements for in-kind contributions, if applicable. The lead DOE facility is responsible for any funding gap should a TCF project fail to obtain from partners or other collaborators the statutorily required 50% of total project costs from nonfederal sources.

Applicants must make sure their prospective partnership arrangements comply with all DOE directives and conditions.

WHAT QUALIFIES FOR NONFEDERAL COST-SHARE

Please consult the Federal Acquisition Regulations for the applicable cost-sharing requirements.

In addition to the regulations referenced above, other factors may also come into play, such as timing of in-kind contributions and length of the project period. For example, the value of 10 years of donated maintenance on a project that has a project period of 5 years would not be fully allowable. Only the value for the 5 years of donated maintenance that corresponds to the project period is allowable and may be counted.

Additionally, DOE will not allow pre-award costs.

As stated above, the rules about what is allowable are generally the same within like types of organizations. The following are the rules found to be common, but again, the specifics are contained in the regulations and cost principles specific to the type of entity:

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

1. They are verifiable from the recipient's records
2. They are not included as contributions for any other federally assisted project or program
3. They are necessary and reasonable for the proper and efficient accomplishment of project or program objectives
4. They are allowable under the cost principles applicable to the type of entity incurring the cost
5. They are not paid by the federal government under another award unless authorized by federal statute
6. They are provided for in the approved budget.

B. Valuing and documenting contributions.

1. Valuing recipient's property or services of recipient's employees. Values are established in accordance with the applicable cost principles, which means amounts chargeable to the project are determined on the basis of costs incurred. For real property or equipment used on the project, the cost principles authorize depreciation or use charges. The full value of the item may be applied when the item will be consumed in the performance of the award or fully depreciated by the end of the award. In cases where the full value of a donated capital asset is to be applied as nonfederal cost-share funds, that full value must be the lesser of the following:
    a. The certified value of the remaining life of the property recorded in the recipient's accounting records at the time of donation; or
    b. The current fair market value. If there is sufficient justification, the contracting officer may approve the use of the current fair market value of the donated property, even if it exceeds the certified value at the time of donation to the project. The contracting officer may accept the use of any reasonable basis for determining the fair market value of the property.

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

3. Valuing volunteer services. Volunteer services furnished by professional and technical personnel, consultants, and other skilled and unskilled labor may be counted as nonfederal cost-share if the service is an integral and necessary part of an approved project or program. Rates for volunteer services must be consistent with those paid for similar work in the recipient's organization. In those markets in which the required skills are not found in the recipient organization, rates must be consistent with those

paid for similar work in the labor market in which the recipient competes for the kind of services involved. In either case, paid fringe benefits that are reasonable, allowable, and allocable may be included in the valuation.

4. Valuing in-kind contributions by third parties.
    a. Donated supplies may include such items as office supplies or laboratory supplies. Value assessed to donated supplies included in the nonfederal match share must be reasonable and must not exceed the fair market value of the property at the time of the donation.
    b. Normally only depreciation or use charges for equipment and buildings may be applied. However, the fair rental charges for land and the full value of equipment or other capital assets may be allowed, when they will be consumed in the performance of the award or fully depreciated by the end of the award, provided that the contracting officer has approved the charges. When use charges are applied, values must be determined in accordance with the usual accounting policies of the recipient, with the following qualifications:
        i. The value of donated space must not exceed the fair rental value of comparable space as established by an independent appraisal of comparable space and facilities in a privately owned building in the same locality.
        ii. The value of loaned equipment must not exceed its fair rental value.

5. Documentation. The following requirements pertain to the recipient's supporting records for in-kind contributions from third parties:
    a. Volunteer services must be documented and, to the extent feasible, supported by the same methods used by the recipient for its own employees.
    b. The basis for determining the valuation for personal services and property must be documented.

Appendix B: Technology Transfer Office Point of Contacts

Points of Contact at DOE National Lab TTOs

Facility	TCF Points of Contact
The Ames Laboratory	Julienne Krennrich jmkrenn@ameslab.gov 515-294-1202
Argonne National Laboratory	Hemant Bhimnathwala hbhimnathwala@anl.gov 630-252-2354 David McCallum dsm@anl.gov 630-252-4338
Brookhaven National Laboratory	Poornima Upadhya pupadhya@bnl.gov 631-344-4711 Eric Hunt ehunt@bnl.gov 631-344-2103 Ivar Strand istrand@bnl.gov 631-344-7579
Fermi National Accelerator Laboratory	Mauricio Suarez suarez@fnal.gov 630-840-6947

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	Cherri J. Schmidt cherri@fnal.gov 630-840-5178
Idaho National Laboratory	Lisa Aldrich lisa.aldrich@inl.gov 208-569-0405 Jason Stolworthy jason.stolworthy@inl.gov 208-526-3437
Kansas City National Security Campus	Andrew Myers amyers@kcnsc.doe.gov 816-488-4432
Lawrence Berkeley National Laboratory	Shanshan Li shanshanli@lbl.gov 510-486-5366 Todd Pray tpray@lbl.gov 510-486-6053 Gail Chen gailchen@lbl.gov Jasbir (Jesse) Kindra jkindra@lbl.gov
Lawrence Livermore National Laboratory	Elsie Quaite-Randall quaiterandal1@llnl.gov 925-423-5210

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	Chris Hartman hartmann6@llnl.gov
Los Alamos National Laboratory	MaryAnn D. Morgan mary_ann@lanl.gov 505-667-5324 Andrea Maestas andream@lanl.gov 505-667-1230 Jerome Garcia jgarcia@lanl.gov 505-665-9090
National Energy Technology Laboratory	Jessica Lamp jessica.lamp@netl.doe.gov 412-452-3645 Chris Bond chris.bond@netl.doe.gov 412-386-5133 Samantha Zhang Samantha.zhang@netl.doe.gov 541-918-4517
National Renewable Energy Laboratory	Jennifer Fetzer jennifer.fetzer@nrel.gov 303-275-3014 Eric Payne eric.payne@nrel.gov

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	303-275-3166
Nevada National Security Site	Robert Koss kossrj@nv.doe.gov 702-295-1213 Matthew Pasulka pasulkmp@nv.doe.gov 702-295-2963
Oak Ridge National Laboratory	Michael J. Paulus paulusmj@ornl.gov 865-574-1051 Eugene Cochran cochraner@ornl.gov 865-576-2830 Jennifer Caldwell caldwelljt@ornl.gov 865-574-4180
Pacific Northwest National Laboratory	Christina Lomasney christina.lomasney@pnnl.gov Allan C. Tuan allan.tuan@pnnl.gov 509-375-6866
Pantex Plant	Jeremy Benton jeremy.benton@cns.doe.gov 865-241-5981

Princeton Plasma Physics Laboratory	Laurie Bagley lbagley@pppl.gov 609-243-2425
Sandia National Laboratories	Liz Hillman elucero@sandia.gov 505-206-8434 Mary Monson mamonso@sandia.gov 505-844-3289 Monica Martinez monmart@sandia.gov Lily Shain lshain@sandia.gov
Savannah River National Laboratory	Amy Ramsey amy.ramsey@srnl.doe.gov Byron Sohovich Byron.sohovich@srnl.doe.gov
SLAC National Accelerator Laboratory	Diana Creswell ddoon@slac.stanford.edu 650-926-8608 Jose Zavala jzavala@slac.stanford.edu
Thomas Jefferson National Accelerator Facility	Deborah Dowd dowd@jlab.org 757-269-7180

Questions about this Lab Call? Email VTOLabCall@ee.doe.gov
Problems with EERE eXCHANGE? Email *EERE-eXCHANGESupport@hq.doe.gov*.
Include Lab Call name and number in subject line.

	Marla Schuchman marla@jlab.org
Y-12 National Security Complex	Jeremy Benton Jeremy.Benton@cns.doe.gov 865-241-5981

Appendix C: Lab Call Full Application Worksheet for Exchange

Lab Call Full Application Worksheet

IMPORTANT: This document is provided as a courtesy to allow Lab Call applicants to collaborate offline to develop Full Applications for Lab Calls. All information must be entered into the eXCHANGE system and cannot be submitted with this document.

Please contact ITSIHelp@ee.doe.gov with any questions.

Project General Information

Control Number:

Applicant (Name and Email Address):

Organization:

Project Title:

Topic:

Project Start Date:

Project End Date:

Partner Laboratories:

Partner Laboratory	Email	First Name	Last Name

Is this a continuation of an existing project?

WBS Number:

Fiscal Year Existing Project:

Project Overview (Multi-year):

Project Objectives (Multi-year):

Questions about this Lab Call? Email VTOLabCall@ee.doe.gov
Problems with EERE eXCHANGE? Email *EERE-eXCHANGESupport@hq.doe.gov*.
Include Lab Call name and number in subject line.

Contact Information

Lab Lead Point of Contact and Business Contact Information

Name:

Email:

Title:

Address:

Phone:

Fax:

Financials

Please add a separate table for each partner laboratory.

Lead Laboratory Name:

Year		Planned Project Costs
2024		
2025		
2026		
Subtotal:		

Partner Laboratory (If Applicable) Name:

Year	Planned Project Costs
2024	
2025	
2026	
Subtotal:	

Total Planned Project Costs:

Performers

Please add a separate table for each partner laboratory.

Lead Laboratory Name:

Subcontractor Name	Sub Type	Start Date	End Date	2024 Planned Costs	2025 Planned Costs	2026 Planned Costs	Total Funding
Subcontractor Subtotal:							

Partner Laboratory (If Applicable) Name:

Subcontractor Name	Sub Type	Start Date	End Date	2024 Planned Costs	2025 Planned Costs	2024 Planned Costs	Total Funding
Subcontractor Subtotal:							

Total Planned Project Costs:

Project Plan

Project Tasks:

Task Number	Title	Description	Team Members	Planned Costs	Start Date	End Date

Project Milestones:

Item Number	Type	Title	Description	End Date	Team Members	Criteria

Risks

Risk Name	Description	Response Plan	Severity	Probability	Response	Source	Classification	Team Members	Target Completion Date

Modalities/TRL

Modalities:

Modality Number	Modality	FY24 Weight (%)	FY24 Planned Costs ($)
Total:			

Current TRL of the proposed technology (1-9):
Estimated TRL the technology will reach at project end (2-9):

Project Impacts

Deliverable/Product or "Output" Description:

Audience/Customer:

Audience/Customer Use:

Communications/Outreach Strategy:

Does this project involve significant industry engagement?
Description of Engagement:

Associated CRADAs?

CRADA Text