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

Advanced Materials and Manufacturing Technologies Office

NATIONAL LABORATORY CALL FOR PROPOSALS

DATA, ANALYSIS, AND MODELING TOOLS

National Lab Funding for Fiscal Year 2024

DE-LC-0000120

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

Questions about this Lab Call? Email ammto.analysislabcall@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

I. Lab Call Description

A. Background and Context

i. Overview and Purpose

EERE National Laboratory Guiding Principles require all offices to pursue a merit review of direct-funded National Laboratory work. In line with these principles, AMMTO is issuing this lab call for fiscal year 2024 (FY2024).

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 AMMTO 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.

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. Specifically, this lab call will support data collection, analysis, and modeling tool development for the advanced materials and manufacturing technology spaces that are essential to reducing emissions and accelerating clean energy in the power, transportation, and industrial sectors. In addition, this lab call will emphasize

[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.

increasing diversity of research staff, increasing diversity of voices in research design, and or increasing quantification and emphasis on supporting underserved communities.

This lab call, and all AMMTO's initiatives, are aimed at advancing its central vision and mission summarized below.

AMMTO's Vision: A globally competitive U.S. manufacturing sector that accelerates the adoption of innovative materials and manufacturing technologies in support of a clean, decarbonized economy.

AMMTO's Mission: We inspire people and drive innovation to transform materials and manufacturing for America's energy future.

Situated at the intersection of manufacturing and energy, AMMTO plays a strategic role in building a strong, vital domestic manufacturing sector through investments in research, development, and demonstration (RD&D) activities, and by advancing workforce development with key stakeholders. AMMTO aims to inform the prioritization of these investments and the work performed by stakeholders to maximize impacts and accelerate commercialization of advanced materials and manufacturing technologies.

This lab call will support this prioritization through data collection, analysis of these data, and development of tools using these data. Data collection will focus on current market and technology landscapes, as well as historical impacts of investments. This will enable AMMTO and its stakeholders to better understand the current needs for technologies associated with the topic areas below and better direct RD&D funds to maximize beneficial impacts. The analyses of these data will enable AMMTO and its stakeholders to better understand the risks and impacts associated with new technologies, helping to focus research efforts on the most impactful options. The development of models that formalize and automate these analyses will establish frameworks that AMMTO and its stakeholders can leverage in the future. Finally, this lab call will develop systems of tools that inform actions to accelerate commercialization, increase circularity, and/or increase resilience in the supply chain.

Co-funding Topic 3, the mission of the Advanced Scientific Computing Research (ASCR) program within the Office of Science is to discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to the Department of Energy (DOE). As part of its mission, ASCR supports the improvement and expansion of these programs to maximize their use and impact on the nation, including U.S. manufacturers.

This lab call includes 8 topics:

Topic 1 – Analysis Tools for Manufacturing for Next-Generation Batteries: This topic supports the development of analysis tools to improve estimates of battery manufacturing costs and commercialization time scales for battery manufacturing start-ups. In Phase 1, the lab will compile comprehensive baseline data and perform a meta-analysis. Phase 2 will involve the development of an analysis tool to provide estimations of scale up costs and/or commercial time scales.

Topic 2 – Framework for Battery Manufacturing Testbeds: This topic supports translational research - collaborative RD&D that translates battery manufacturing technologies at very low Technology/Manufacturing Readiness Level (TRL/MRL) to much higher levels of readiness. In Phase 1, the lab will conduct a landscape analysis of test bed facilities. Phase 2 is to develop the framework for a translational battery manufacturing test bed facility.

Topic 3 – Codes for High Performance Computing for Manufacturing: Jointly funded by AMMTO and the Office of Science's Advanced Scientific Computing Research (ASCR) program, this topic seeks proposals for projects that will improve national lab developed software with the goal of increasing the ability to leverage high performance computing (HPC) resources to help U.S. manufacturers solve critical problems through advanced modeling and simulation. Such projects should be aimed at expanding or improving modeling and simulation codes and libraries in ways that make them more useful to solving materials & manufacturing challenges and accelerating innovation useful to the industrial sector, primarily challenges related to clean energy technology manufacturing, domestic supply chain resiliency, decarbonization, critical material sourcing and recovery, and Re-X processes. Additional consideration will be given to relevance to the HPC4EI program.

Topic 4 – Analysis for Critical Materials Processes and Technologies Benchmarks: This topic seeks a project, or pair or projects, to determine benchmark metrics for cost, environmental performance, and the technical performance of materials, processes, and/or technologies. These set of benchmark metrics are meant to represent the state-of-the-art (SOTA) of two sectors (industry and research) to enable AMMTO to measure progress and success of its critical materials RD&D portfolio and inform future research direction.

Topic 5 – Impact Analysis of Materials and Manufacturing Innovation on Environmental Justice: Environmental Justice (EJ) Analysis proposals are sought for data identification, data collection, decision-making methodology development, and prototype tool development to facilitate EJ harm prevention or reduction in communities. The EJ analysis pilot will be focused on the following AMMTO technical areas: (1) Critical Minerals and Materials (CMM) and (2) Circular Economy Technologies and Systems (circularity).

The mining, separation, and production of CMM and the recycling of e-waste and plastics are all examples of AMMTO-related processes that can cause harmful EJ impacts. This pilot seeks to find patterns of causation and avoidance of harm in data on past and potential future harms as well as in AMMTO-sponsored and AMMTO—related innovation. The pilot also seeks proposals for a prototype tool that could illuminate paths for innovations that avoid EJ harm and might be used by industrial and community stakeholder decision-makers.

Topic 6 – Tools for Data Curation of Open Life Cycle Assessment Databases: The impacts of circular economy approaches are accounted for by assessing contributions over the full lifecycle of the product, including multiple uses, in analyses called lifecycle assessments (LCA). As environmental impacts become more of a factor in purchasing and procurement decisions, LCAs are increasingly being used to tout the benefits of products with lower embodied carbon and other benefits. There are challenges facing the expanded use of LCAs, including a lack of publicly available up-to-date background data. This topic aims to address data gaps through the development of tools and methodologies that will keep data current, particularly those data we anticipate will change significantly over the coming years.

Topic 7 – **Analysis of Material Flows for the Circular Economy**: Material circularity is a paradigm shift that transforms the use pattern of materials from sending to a landfill after single use to circulating in the economy through multiple uses. Current material flows set the baseline and point towards where the greatest opportunities for circularity are. AMMTO seeks proposals that identify materials for which there is high potential for materials circularity and for which a material flow assessment would fill a gap. The selected proposal will complete a material flow assessment at the agreed upon level of detail.

Topic 8 – **Framework for Material Reuse Clearing House (MARCH) for Recycled Material Feedstocks:** AMMTO seeks to establish a material reuse clearing house to provide the information infrastructure and ecosystem needed to overcome the information deficits that hamper adoption of recycled feedstocks. It is often

difficult for manufactures to assess the relative environmental impacts of virgin and recycled feedstocks, and the quality and quantity of recycled feedstock available. This project will provide an assessment of the need for such a clearing house, insight into the needs of the intended user base, propose a framework for the clearing house, and develop a plan for how to build, pilot, and launch the clearing house including a recommendation for what material(s) should be the initial focus.

The analysis performed in this lab call will establish a framework that will inform AMMTO's work and support its mission. The market, landscape, impact, and risk analyses performed in this lab call and in future work will enable AMMTO to identify high priority RD&D targets needed to address materials and manufacturing challenges. This will, in turn, help AMMTO to shape the national clean energy agenda and inform the national advanced manufacturing agenda by identifying emerging and manufacturing challenges required to meet national goals.

These analyses will support the development of predictive models, testbeds, and other tools that will accelerate the transfer to market of advanced technologies. These tools will provide stakeholders access to information and capabilities that they could not obtain individually, enabling them to more rapidly develop and demonstrate their technologies at laboratory and pilot scales. These systems and tools will enable stakeholders to address more complex technology challenges through integrating insights from multiple disciplines.

Impact analyses will bring understanding on the impact AMMTO's work has on underrepresented and underserved communities, enabling AMMTO to anticipate the impacts of future projects and maximize positive societal benefits.

While many of the efforts in this lab call will have an immediate impact, this lab call also seeks to lay the groundwork for future work that will further refine this framework, enabling AMMTO and its stakeholders to make better investment decisions and accelerate commercialization. This lab call focuses on building a foundation of data that will be used here and in future work to evaluate impacts and to develop systems, tools, and predictive models that support both AMMTO, its stakeholders, and the broader innovation ecosystem.

ii. Timeline and Process Logistics

Timeline

KEY DATES	
Lab Call Release Date:	April 11, 2024

PROPOSAL DEADLINE AND DECISION DATES	
Full Application Submission Deadline:	June 11, 2024 5:00 PM ET
Expected Decision Date:	August 2024
Expected Beginning Award Issue Date(s):	September 2024

Process Logistics

All communication to AMMTO regarding this Lab Call must use ammto.analysislabcall@ee.doe.gov.

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

  Applicants are responsible for meeting the submission deadlines. DOE strongly encourages all applicants to submit the required information at least 24 hours in advance of the submission 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 ammto.analysislabcall@ee.doe.gov AMMTO 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. EERE will attempt to respond to a question within 3 business days, unless a similar question and answer have already been posted on the website.

  Questions related to the registration process and use of the EERE Exchange website should be submitted to: EERE-eXCHANGESupport@hq.doe.gov. To ensure fairness for all lab participants, please do not ask individual AMMTO staff questions directly.

- **NOTIFICATION OF SELECTION:** When selections are finalized, lab leads will receive an email from ammto.analysislabcall@ee.doe.gov.

B. Key Considerations and Topic Area(s)

i. Key Considerations

- **AVAILABLE FUNDING:** There is approximately **$8,330,000 in total federal funding** available to fund **all** projects solicited in this Lab Call pending appropriations and program direction.

- **NON-LAB PARTNERS:** Labs partnering with industry, academia or other non-lab entities to perform work under this Lab call must enter into CRADAs with those partners within time parameters set forth by the funding program.

- **ELIGIBILITY:** All National Laboratories are eligible to submit proposals as prime awardees, unless specified otherwise. Proposals that involve more than one laboratory are also allowed. The number of proposals allowed to be submitted by each National Lab varies by topic (see topic descriptions below).

- **DIVERSITY, EQUITY, INCLUSION, and ACCESSIBILITY:**
  It is the policy of the Biden Administration that:

  > [T]he 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

[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).

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 application, applicants are required to describe 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, Inclusion, and Accessibility 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.

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

[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.

[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.

underserved community. The Selection Official may consider the inclusion of these types of entities as part of the selection decision.

- **EERE NATIONAL LABORATORY GUIDING PRINCIPLES:** To ensure continued alignment with EERE lab engagement principles, applicants should consider the following when developing their proposals:
    - AMMTO strongly encourages projects that bring together multiple labs in a consortia-based approach to meet a high-level strategic goal, leveraging multiple lab capabilities with strong, centralized leadership.

ii. Topic Area Descriptions

Topic Area	Maximum Funding Available ($)	Number of Awardees	Duration of Work (months)
Analysis Tools for Manufacturing of Next-Generation Batteries	1,230,000	1-2	18
Framework for a Battery Manufacturing Testbed Facility	1,000,000	1-2	12
Codes for High Performance Computing for Manufacturing	3,000,000	3-6	12
Analysis for Critical Materials Processes and Technologies Benchmarks	1,000,000	1-2	8-10
Impact Analysis of Materials and Manufacturing Innovation on Environmental Justice	600,000	1-2	18
Tools for Data Curation of Open Life Cycle Assessment Databases	500,000	1	12-18
Analysis of Material Flows for Circular Economy	500,000	1	12-18
Framework for MAterials Reuse Clearing House (MARCH) for Recycled Material Feedstocks	500,000	1	12

Topic 1: Analysis Tools for Manufacturing of Next-Generation Batteries

- Eligibility: No more than **3** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $1,230,000
- Estimated Number of Projects Expected: 1-2
- Estimated Project Duration: 18 months

Background

AMMTO's vision for the future is a competitive US manufacturing sector that accelerates the adoption of innovative battery and battery manufacturing technologies. AMMTO desires to increase battery manufacturing analysis capabilities as a means to catalyze cooperation between competing battery manufacturers early in a product's development life cycle to compress development timelines.

AMMTO's role in battery manufacturing innovation requires it to identify promising battery technologies and assess costs and commercialization time scales associated with battery manufacturing. While DOE national labs have successfully developed several key assessment studies and analysis tools[8], gaps remain in the analysis of state-of-the-art battery technologies and battery manufacturing. The first gap is the lack of knowledge and understanding of the dynamic relationship between supply chains and specific impacts on the costs of materials, cells, packs, and modules for battery manufacturing. The second gap is the lack of focus on decreasing the time needed for commercialization.

This topic will address both gaps through the analysis of 1) costs and 2) timelines for the development of batteries and battery manufacturing technologies. This topic is intended to decode complex relationships between and interdependencies among manufacturing costs and supply chains and how they impact product development and manufacturing timelines. This will help battery manufacturers, entrepreneurs, academics, and government agencies better understand these relationships by providing meta-analyses and developing analysis tools. Its results will allow users to identify supply chain weaknesses, mitigate costs, and decrease time for the development and manufacture of new battery technologies.

Description

This topic focuses on understanding battery technologies' commercial manufacture. The analysis should cover the breadth and depth of the battery manufacturing sector and related equipment suppliers as well as pathways and timelines for the commercialization of battery technologies. Particular emphasis should be placed on identifying impactful, next-generation batteries and battery manufacturing technologies.

AMMTO seeks projects for the five next-generation battery technologies listed below. Applicants should select one battery technology from the list, complete the following phases

[8] Study examples include the Storage Futures Study recently published by National Renewable Energy Laboratory (NREL) and the 2022 Grid Energy Storage Technology Cost and Performance Assessment developed by Pacific North National Lab (PNNL). Analysis tools include Battery Manufacturing Cost Estimation (BatPaC), EverBatt (Excel-based Battery Recycling Process and Supply Chain Model), Global Critical Materials Agent-based Model (GCMatt), and GREET life-cycle analysis model. These tools allow battery designers and manufacturers to output manufacturing costs and product life cycle analysis based on input factors, such as material, labor, cell design, packing, and the quantity of recycled materials.

for either mobile OR long-duration energy storage applications, and produce deliverables according to the phases described below. The list of battery technologies includes:

1. Lithium metal
2. Solid-state
3. Sodium ion
4. Redox or hybrid flow battery
5. Other next-generation technologies, that the applicant must justify.

Phase 1: Compile Comprehensive Baseline Data and Perform Meta-Analysis

The applicant should collect related battery manufacturing assessments that are comprehensive enough to enable a novel meta-analysis (i.e., analysis of analysis) of the current state of the chosen battery technology with respect to the commercialization requirements for either mobile OR long-duration energy storage (i.e., stationary) applications. The objective of Phase 1 is to compile a repository of data that comprehensively describes the current development and commercialization status for the battery technology of interest. This will be achieved through a systematic review[9] and meta-analysis[10] of existing studies and must include the following steps:

1. Conduct a thorough search of existing analysis studies, this will involve acquiring, consolidating, and analyzing relevant, high-quality studies from industry reports, as well as public and academic databases.
2. Identify and extract relevant data points from each individual study that indicate the development and commercialization status of the battery technology. This may include metrics related to technical performance, stage of development (e.g. TRL/MRL, manufacturing capabilities, production scale) and cost estimates.
3. Choose appropriate statistical techniques to analyze and visualize the extracted data. Incorporate the results into a report summarizing the overall findings.

The baseline data need to be tabulated in a designated DOE-approved open access public repository using appropriate data formats for the relevant battery technology. Data should meet the principles of findability, accessibility, interoperability, and reusability (FAIR). A meta-analysis can be as simple as a regression analysis of a particular variable (e.g. time-to-market) or far more complex.

[9] The systematic review provides a comprehensive review of all available scientific literature related to the current development and commercialization status for the battery technology of interest.
[10] The meta-analysis combines the results of multiple studies and uses statistical methods to pool the data in a way that provides valuable insights about the phenomenon under investigation. An example of this kind of approach can be found in the 2022 Grid Energy Storage Technology Cost and Performance Assessment.

Phase 2: Develop Analysis Tool(s)

Based on the baseline data of Phase 1, the applicant then needs to develop an analysis tool that can produce data-driven estimations of commercialization time scales (i.e., time to commercialization) AND/OR commercial manufacturing costs and scale-up costs.

The tool should cover all aspects of battery development and production (including components, cell, and pack level). The model should also include aspects of manufacturability, scalability, and/or circularity as well as time scales for each aspect. While the analysis tool should initially focus on the single battery technology chosen in Phase 1, features that enable broader application to other battery technologies are highly desirable.

The public repository and analysis tools are intended to be used to identify vulnerable supplies, processes, or companies in the battery manufacturing supply chain and bottlenecks in the commercialization timeline. The findings will allow manufacturers and manufacturing equipment providers to better meet individual manufacturer's needs and identify an area of collaborate to advance nascent battery manufacturing technologies.

Applicants must clearly identify intended project outcomes and justify their proposed target metrics, ensuring alignment with the criteria provided in the following table.

Topic 1 Deliverable	Performance Metrics
Phase 1: Meta-analysis report and baseline data repository with a report to show submission of the data to the repository (6 months with quarterly reports)	The applicant should include metrics associated with: • Accessibility/discoverability of the data and ease of use of the user interface; • Lifecycle spectrum, e.g. stages of research, development, use, and disposal of the study; • Depth and breadth, e.g., the categories included within battery manufacturing and the extent of analysis of batteries, suppliers, and equipment manufacturers in each category; • Where baseline is known, % difference from baseline.
Phase 2: Analysis tool(s) focusing on costs and/or commercialization time (12 months with quarterly reports and a final project report)	The applicant should include metrics relating to: • Planned inputs, e.g., material costs, lab costs, type of battery, infrastructure costs, transportation costs, manufacturing/processing steps, etc., and whether these inputs are constants or variable; • Outputs, which may include battery costs, cells($/kWh), packs ($/kWh), rate production/time, time for commercialization, time for scale-up from rate x to rate y, costs to scale up from rate x to rate y, etc.;

	• Assessment of real-world usability and impact, including factors, such as predictive accuracy and precision, ease of use, and adaptability to other related technologies; • Where baseline is known, % difference from baseline.

Impact

Through Topic 1 of this Lab Call, AMMTO will accelerate commercial battery manufacturing by providing stakeholders with information and tools to identify opportunities as measured in improvements to batteries and battery manufacturing and decreases in costs and timelines associated with product commercialization. The public repository will house baseline data, benchmarking efforts, and key metrics for next-generation batteries. Additionally, the performer will develop analysis tools to estimate timelines, bottlenecks, and costs associated with scaling up production of new battery technologies. The data and tools will be openly accessible to industry professionals, entrepreneurs, academics, DOE FOA applicants, and DOE analysts, enabling effective estimations of commercialization timelines, identification of potential manufacturing and commercialization hurdles, and assessment of costs associated with bringing new battery technologies to market. This initiative has the potential to significantly accelerate commercial battery manufacturing by equipping stakeholders with the knowledge and resources necessary to navigate the commercialization and scale-up processes more efficiently.

Topic 2: Framework for a Battery Manufacturing Testbed Facility

- Eligibility: No more than **3** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $1,000,000
- Estimated Number of Projects Expected: 1-2
- Estimated Project Duration: 12 months

Background

AMMTO seeks to shorten the concept-to-commercialization cycle for a more competitive U.S. battery manufacturing sector. Acceleration of commercialization can be achieved by catalyzing cooperation between competing battery manufacturers early in a product's development life cycle to compress commercialization timelines.

Translational research is best known in the context of medicine, where promising ideas from basic research are translated into products that directly benefit patients. This translation is achieved through collaborative partnerships called "bench-to-bedside" that promote early engagement, prioritize the needs and perspectives of end users, and effectively disseminate

and implement results.[11] Similarly, battery manufacturing collaborative RD&D partnerships can be created to solve challenges related to scaling up material processing, component manufacture, and product assembly that directly benefit U.S. battery manufacturing. A manufacturing test bed facility allows stakeholders to participate in collaborative research projects to overcome technical challenges and translate science and engineering breakthroughs into commercial outcomes.

Description

This topic focuses on the development of a testbed facility for translational battery manufacturing research. The one-year project will be organized in two phases. The objective of the first phase is to identify the unmet needs in battery manufacturing development that slow time to commercialization and determine how the testbed facility can shorten the time. In the second phase, performers must develop a blueprint for establishing the testbed. AMMTO will use the outcomes of this topic to guide future investment in the establishment of the translational manufacturing testbed facility.

Phase 1: Perform Landscape Analysis

- Benchmark existing (or planned) manufacturing testbed facilities and analyze their features, capabilities, and target audiences.
- Evaluate emerging battery technologies and summarize the challenges around applied research, developing manufacturing processes, and scaling for commercialization.
- Combine results to identify potential gaps that could be filled to differentiate the proposed testbed from existing options.
- Identify best practices in translational battery manufacturing that shorten the commercialization time of conventional manufacturing. Four considerations should be taken into account:
    1) Ability to consolidate and parallelize sequential processing steps for the manufacture of battery materials, components, and systems;
    2) Capacity to incorporate platform technologies [12] (e.g. smart manufacturing, machines/equipment, and characterization tools) into translational battery manufacturing;

[11] Program examples include National Center for Advancing Translational Sciences (NCATS), NIH Blueprint Neurotherapeutics Network (BPN) for small molecules, EATRIS — European infrastructure for translational medicine, and Translational Research Informatics (TRI) Center in Japan.

[12] See definition of platform technologies in DE-FOA-0003236 EERE eXCHANGE: Funding Opportunity (energy.gov).

3) Usability of the translational activities and their applicability to the construction of future testbed facilities; and
4) Effectiveness in promoting collaborative RD&D and streamlining processes for stakeholder engagement.

- Identify key stakeholder groups, including researchers, industry representatives, government agencies, investors, and their needs, priorities, and concerns. This may optionally involve various methods of direct engagement, including focus/expert groups, workshops, and any other possible mechanisms to collect input from the stakeholders.

Phase 2: Develop Testbed Framework

- Activities/Goals: Identify collaborative lab-to-market activities and the respective project goals of the activities.
- Metrics: Establish metrics for the success of the facility based on stakeholder feedback, landscape analysis, and identified stakeholder activities and project goals.
- Design: Develop testbed facility design options. Details may include (but are not limited to) potential layouts, processing machine and equipment needs, digital tools for smart manufacturing, user access procedures, identified activities, and staffing models.
- Resources: Estimate resource requirements and develop financial projections.
- Identify potential challenges associated with establishing the facility and develop mitigation strategies.

Applicants must clearly identify intended project outcomes—especially time to market—and justify their proposed target metrics, ensuring alignment with the evaluation criteria provided in the following table.

Topic 2 Deliverable	Performance Criteria
Phase 1: Landscape analysis report(s) (6 months with quarterly reports)	• Comprehensively analyzes existing manufacturing testbed facilities features, capabilities, and target audiences. • Identifies developments in battery manufacturing technology that are relevant to the design and operation of proposed facility. • Recognizes gaps in existing options, potential areas of differentiation, and best practices to emulate. • Summarizes feedback, key insights, and identified needs. • Demonstrates high level of stakeholder buy-in and support for the proposed testbed facility.

	• Establishes communication channels and collaboration strategies with stakeholders.
Phase 2: Framework document(s) (6 months with quarterly reports and a final project report)	• Comprehensive framework that reflects stakeholder input and addresses identified needs. • Presents a feasible and sustainable operating model for testbed and addresses potential risks. • Plans for dissemination of project findings and recommendations.

Impact

In Topic 2 of this Lab Call, AMMTO will lay the foundation for new translational manufacturing testbed facilities that will accelerate innovation, enhance the competitiveness of the domestic battery manufacturing industry, and foster collaboration within the innovation ecosystem. Desired testbeds being built will be interdisciplinary, modular, reconfigurable to bridge the "valleys of death" (Figure 1). These facilities will translate promising research ideas from the lab to real-world applications by promoting rapid commercialization of innovative manufacturing technologies and equipment. As a crucial first step in establishing the translational manufacturing testbed facility, proposers must develop a framework document to establish a clear direction and vision for the testbed that will identify the facility's goals, align stakeholders, and guide decision-making. In this document, the scientific and operational principles underlying each step of the translation process and how they will help battery innovations bridge these valleys should be described. The document also should describe how advanced equipment, resources, and expertise will be provided for researchers, startups, and established companies to test and refine new manufacturing technologies in a controlled environment—thus reducing development time and costs.

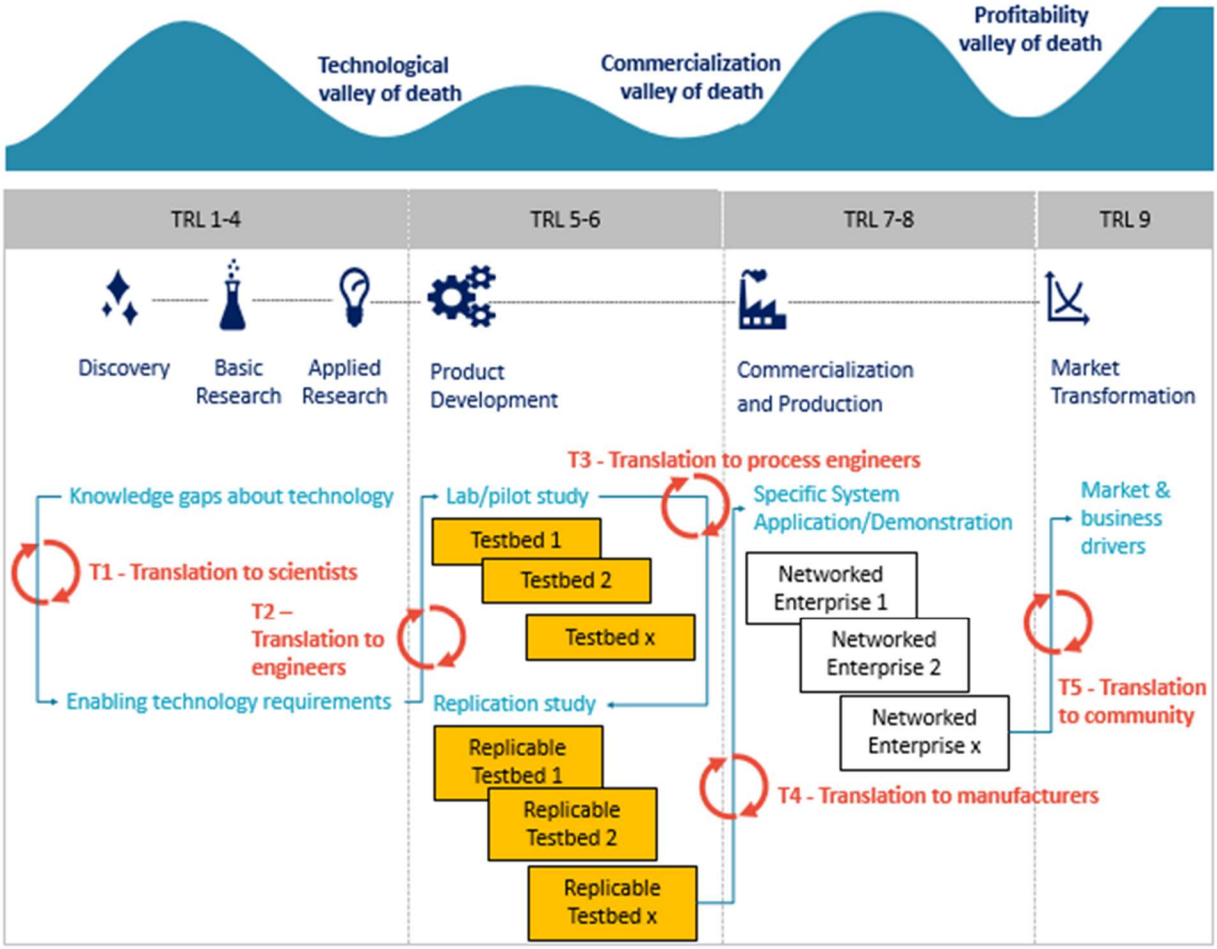

Figure 1: The three valleys of death that must be overcome using the concepts of translation and testbeds.

Topic 3: Codes for High Performance Computing for Manufacturing

- Eligibility: No more than **3** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $3,000,000
- Estimated Number of Projects Expected: 3-6
- Estimated Project Duration: 12 months

Background

DOE maintains world-class HPC expertise and facilities, currently hosting several of the top 20 most powerful computers in the world as ranked by TOP500 in November 2022. From detailed subatomic-level simulations to massive cosmological studies, researchers use HPC to probe

science and technology questions inaccessible by experimental methods. Scientific insights gained from these computational studies have drastically impacted research and technology across industrial sectors and scientific fields. Examples include additive manufacturing, aerospace, oil recovery, drug development, climate science, genomics, and exploration of fundamental particles that make up our universe. From industry to academia, the scientific need for advanced computing continues to drive innovation and development for future high-performance computers and their capabilities.

As an integral part of its mission to inspire people and drive innovation, AMMTO supports the creation and strengthening of connections between manufacturers and advanced modeling & simulation activities to help spread awareness of HPC as a resource that can be harnessed to help solve manufacturing problems more quickly and economically than otherwise possible. Such connections serve the twin goals of democratizing access to advanced computing and increasing the range of tools U.S. manufacturers use to innovate and remain globally competitive. **AMMTO recognizes that advanced modeling and simulation is a tool that can help the office's portfolio of focus areas (see list below) as well as other R&D that improves manufacturing energy efficiency, enhances global competitiveness, and enables a transition to a clean energy economy.**

Manufacturing focus areas of interest:

- **energy storage manufacturing,**
- **power electronics design & manufacturing,**
- **microelectronics energy efficiency improvement,**
- **high performance materials,**
- **near-net shape manufacturing,**
- **composites manufacturing,**
- **additive manufacturing,**
- **smart manufacturing,**
- **critical material sourcing, processing, and recovery, and**
- **supply chain circularity**

In support of these goals, AMMTO is the primary sponsor of the HPC for Manufacturing (HPC4Mfg) program, under the umbrella HPC for Energy Innovation (HPC4EI) program which is also funded by the Office of Fossil Energy and Carbon Management (FECM) and the Industrial Efficiency and Decarbonization Office (IEDO). The primary goals of the HPC4Mfg Program are to 1) improve manufacturing performance to lower the cost and improve the functionality of clean energy technologies, 2) optimize and scale up emerging innovative manufacturing processes for new clean energy technologies, 3) improve the efficiency and productivity of U.S. manufacturing, and 4) reduce carbon emissions across the industrial sector. The program

solicits proposals that require HPC modeling and simulation to overcome impactful manufacturing challenges to new or existing materials or processes resulting in faster scale up of new clean energy technologies as well as improved performance, reduced lifecycle energy consumption, greenhouse gas emissions, and/or increased productivity of high-impact manufacturing processes. The HPC4EI Program provides this HPC expertise by supporting targeted collaborations between industry and DOE's National Laboratories.

The advanced modeling and simulation software developed at the national laboratories is a key resource for HPC4Mfg projects. HPC4Mfg projects are typically focused on using the software to develop specific models and simulations, with little to no time or budget available to update or expand the core code of the software to make them more useful for future HPC4Mfg projects. AMMTO aims to enhance the utility of these software programs for the HPC4Mfg program and any other advanced modeling and simulation work that AMMTO-funded projects may do, especially in ways that increase capabilities and broaden industries that can leverage the program. To this end, we are seeking to fund projects focused specifically on improving and/or expanding their capabilities in ways that relevant to domestic manufacturers.

As a joint funder of this topic, the mission of the Advanced Scientific Computing Research (ASCR) program within the Office of Science is to discover, develop, and deploy computational and networking capabilities to analyze, model, simulate, and predict complex phenomena important to the Department of Energy (DOE). Effective scientific utilization of high-end capability computing requires dynamic partnerships among application scientists, applied mathematicians, computer scientists, and facility support staff. Therefore, close coordination both within and across ASCR subprograms and with partner organizations is key to the success of the ASCR program. ASCR has supported the development of multiple software programs to aid researchers in advanced modeling and simulation to use the DOE's world leading HPC resources to solve uniquely challenging problems. As part of its mission, ASCR supports the improvement and expansion of these programs to maximize their use and impact on the nation, including U.S. manufacturers.

Description

This topic seeks proposals for projects that will develop software code that is compatible with and/or part of existing national lab-developed software used for advanced modeling and simulation on HPC systems. Awards will be up to $500,000 each and are expected to be approximately 12 months in duration.

Projects under this topic area are intended to improve national lab HPC4EI relevant codes in the following key ways, by:

1. increasing their cross-platform GPU compatibility and performance,

2. improving their connections and use of AI technologies and design optimization techniques, and
3. increasing their applicability for addressing materials development & manufacturing process challenges, particularly in focus areas of priority for AMMTO, listed in the background section of this topic area.

Proposals will be evaluated mainly on their ability to address these three criteria above. Proposals will also be evaluated on the openness and/or accessibility of the code they will generate.

All proposals should explicitly mention which existing software the work will impact and how it will be improved and/or expanded. Please provide contextual details about the code, such as age and origin of the code, what the code is currently used for, accessibility aspects of the code, and current scalability of the code (e.g. number of cores that can be leveraged, GPU compatibility, etc.). Be clear about performance goals of the software to be achieved by the end of the project. If scalability is to be improved, please provide quantitative goals.

Proposals should provide details on relevant connections to specific industries and known manufacturing challenges that the proposed projects would have, as well as what impacts (both types and size) the outcomes of the project are likely to generate through future projects with industry. Industries particularly of interest include clean energy[13] manufacturing and the industries related to AMMTO's focus areas, listed I the background section of this topic. To the extent known, proposals should reference prior engagement of the project team with HPC4EI and/or prior use of the software in HPC4EI projects. Please include a detailed breakdown of the proposed work including tasking, timelines, roles and responsibilities of team members, etc. Please provide details regarding potential risks of failure and any possible approaches to mitigate said risks. Proposed goals and milestones should adhere to SMART[14] principles. Proposals must include details in their data management plan describing how they will address openness and/or accessibility of the resulting code.

Particular areas of interest are:

- Improvements to the cross-platform GPU performance of codes used by national laboratories for HPC4EI projects or other industrial collaborations. For proposed work in this are of interest, please specify which types of GPUs will be addressed and, where applicable, which DOE HPC systems the proposed usage expansion would apply to. Examples of potential goals in this area of interest include, but are not limited to:

[13] Clean Energy industries are generally considered to be sustainable energy generation technologies such as wind, solar, hydro, and nuclear, as well as energy storage technologies.
[14] SMART refers to Specific, Measurable, Achievable, Relevant, and Timely

    - Improvements to expand the portions of a GPU enabled code to include more methods that would be of use to industrial applications.
    - Improvements to expand GPU enabled code to additional architecture, for instance adding a HIP or SYCL enabled backend to a CUDA enabled code.
    - Improvements to the GPU scalability of a code to enable it to run industrial useful problems that are currently unachievable.
- Improvements to software libraries or connections to software libraries that enable the use of AI and design optimization tools for use with codes used by national laboratories for HPC4EI projects or other industrial collaborations. For proposed work in this area of interest, please specify what libraries will be leveraged and why. Please include details on what AI algorithms or approaches plan to be leveraged. Examples of potential goals in this area of interest include, but are not limited to:
    - Improvements to neural network software and sampling methods utilized to generate Reduced Order Models (ROMs) of multiphysics simulations.
    - Improvements to Multiphysics models to obtain analytic derivatives usable for optimization frameworks.
    - Improvements to design optimization, shape optimization, and topology optimization frameworks, of particular interest are optimizations for lightweighting and strength improvement of wind turbine blade aerostructures.

AMMTO is also interested in activities included in the proposed projects that will focus on the education and training of people in advanced modeling & simulation approaches, particularly activities aimed at increasing the diversity of this workforce.

Preference will also be given to proposed work with clear ties to impacts that will likely benefit disadvantaged communities, for example reduced pollution in areas that disproportionately affect disadvantaged communities.

Letters of support from relevant industry stakeholders submitted with proposals will be considered, provided those letters of support indicate specific details as to how the proposed project will help address a specific problem or challenge that stakeholder is facing and recognition that the proposed project would benefit the broader industry, not that specific stakeholder alone. To the extent letters of support can include details of the likely impact on energy efficiency, decarbonization, and global competitiveness, it is encouraged.

Specifically not of interest:

AMMTO is not seeking

- Projects that would be directly partnered with a single company or organization to benefit a specific technology or product that they have
- Projects improving or expanding commercially developed software

- Work that would improve modeling and simulation for problems outside of AMMTO's scope, such as bio-fuels development, direct air capture processes, etc.

Topic 4: Analysis for Critical Materials Processes and Technologies Benchmarks

- Eligibility: No more than **3** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $1,000,000
- Estimated Number of Projects Expected: 2
- Estimated Project Duration: 8-10 months

Background

Critical minerals and materials – referred to here as critical materials – are one of two focus areas under AMMTO's Secure and Sustainable Materials Program. AMMTO has the following objectives to for its critical materials research, development, and demonstration (RD&D) portfolio:

- Build resilient domestic supply chains to support the clean energy transition;
- **Accelerate adoption of innovative S&T solution to improve efficiency and reduce negative impacts;** and
- Foster a robust innovation ecosystem to meet industry and research workforce needs.

To realize these objectives, AMMTO is seeking to define a set of benchmark metrics against which to measure progress and success of its critical materials RD&D portfolio. This will enable AMMTO to quantify the impact potential of the set of innovation solutions advanced through its portfolio, inclusive of material, process, and technology development.

In 2023, AMMTO led the Critical Materials Assessment – identifying a set of 18 critical materials for energy known as the "electric eighteen". AMMTO's critical materials RD&D portfolio emphasizes criticality in the medium-term, as described in the figure below.

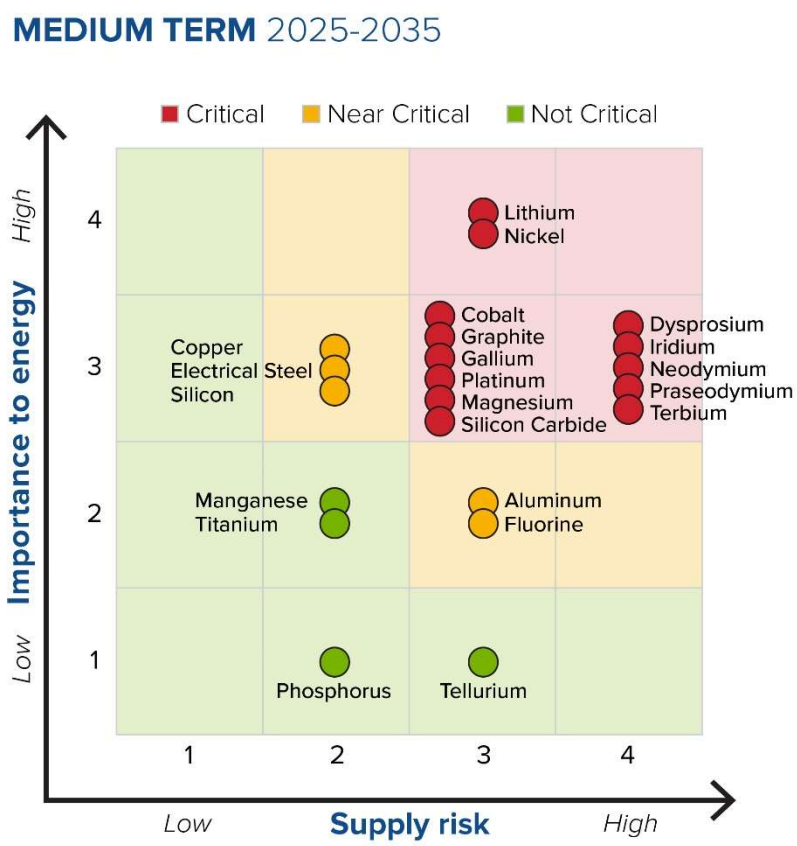

Figure 2: Medium-term (2025-2035) criticality matrix.

Topic Area Description

This topic seeks proposals to determine a set of benchmark metrics for cost, environmental performance, and the performance of materials, processes, and/or technologies. These set of benchmark metrics are meant to represent the state-of-the-art (SOTA) of two sectors: industry and research. Awards will be up to $500,000 each and are expected to be approximately 8 to 10 months in duration.

Projects under this topic area are intended to support AMMTO in identifying a set of foundational and crosscutting research topics for critical materials. The goal of the topic area is to quantify the impact potential that AMMTO's current and future investments in critical materials by identifying the SOTA. The project teams will work in close collaboration with AMMTO to identify a set of materials, processes, and technologies that represent high-impact research areas for benchmarking. Projects under this topic are intended to:

- systematically identify the SOTA of materials, processes, or technologies used in both existing critical material supply chains and emerging techniques in the research field; and
- determine salient benchmark metrics for the cost, environmental performance, and performance of each selected material process, or technology;

For example, a project may identify solvent extraction as the industry SOTA for rare earth element separations and then quantify separation factor as a benchmark metric for that industry SOTA for performance of the process. In parallel, the analysis project would identify the research SOTA for rare earth element separations and quantify the corresponding separation factor(s). In addition, the appropriate cost and environmental performance metric(s) would also be identified. This may require techno-economic analysis or life-cycle assessment. The project will be able to leverage existing results and tools, such as the Commercial Adoption Readiness Assessment Tool (CARAT)[15], where available.

Critical materials, end-uses, and stages of the supply chains of interest as indicated in green.

Material	End-Use	Extraction	Separations*	Refining	Recycling	Manufacturing
Rare Earth Elements: Neodymium, Praseodymium, Dysprosium, Terbium	Motors for clean energy, inclusive of energy-efficient technologies					
Lithium	Energy Storage		N/A			
Gallium	Wide bandgap power electronics		N/A			

[15] https://www.energy.gov/sites/default/files/2023-03/Commercial%20Adoption%20Readiness%20Assessment%20Tool%20%28CARAT%29_030323.pdf

Platinum Group Metals: Iridium & Platinum	Electrolyzers for green hydrogen production and fuel cells		N/A			
Aluminum, Copper, Electrical Steel	Motors and transformers		N/A			

*For the purpose of this topic area, "Separations" refers specifically to the separation of adjacent lanthanides. Extraction may include techniques to separate a form of the critical material from a primary or secondary feedstock.

Proposals should include a description of the project team's experience similar benchmarking assessments, familiarity with critical materials technologies, and their analytical capabilities. Proposals should also provide a detailed statement of project objectives (SOPO) that includes tasking, timelines, and roles and responsibilities. It should be evident how each team member is well-positioned to accomplish the task based on their experience and/or capabilities. Projects will be expected to engage in regular touchpoints with AMMTO, which should be included in the SOPO. Proposals should provide details on which set of materials classes the project team is well positioned to analyze, describing relevant connections to specific industries and/or research communities, and any outreach plans. Industries and research areas of interest are described in the table above. To the extent possible, project teams will be encouraged to normalize metrics to enable comparison between the industry and research SOTA. Proposals will be evaluated on their ability to achieve the intended outcomes described above.

Topic 5: Impact Analysis of Materials and Manufacturing Innovation on Environmental Justice

- Eligibility: No more than **1** proposal may be submitted per National Lab
- Estimated DOE Funding Available: $600,000
- Estimated Number of Projects Expected: 1-2

Background

The clean energy transition is dependent upon critical materials such as lithium, copper, cobalt, and nickel. Resulting past and ongoing negative impacts of mining, processing, and recycling these elements on the environment, local communities, and the miners and other workers are well documented. The current global rally to manufacture clean energy technologies and connected low-cost electronics is causing an uptick in demand for critical materials that

threatens to cause new and exacerbate existing negative EJ impacts associated with mining, processing and recycling.

The impacts on communities and the environment of copper mining in Panama, cobalt mining in the Democratic Republic of Congo and lithium mining in the Carolinas (United States) and the American West (with a majority of the Western lithium reserves being on Tribal lands) have been revealed in recent news stories by *On Point*.

Similarly, plastics have revolutionized modern life but have created a global waste crisis driven by our reliance and demand for low-cost, disposable materials[16]. The rapid pace of plastic and e-waste disposal has had environmental and EJ impacts, as have some of the recycling solutions.

Environmental Justice is a relatively new topic area for DOE and AMMTO. For this reason, EJ data and a data-backed understanding of potential EJ impacts has been lacking. Building AMMTO's understanding of EJ for critical materials and circularity is a priority given numerous global examples of past harmful impacts related to these two areas. To date, however, publicized impacts have been primarily anecdotal. For example, for critical materials, negative health impacts due to the poor working conditions of certain mineral miners, and for circularity, the conditions for those who sort waste by hand for recycling overseas. AMMTO's analysis would build upon and offer quantitative data to guide manufacturing process metrics and policies that reduce EJ harm for future workers and their communities.

Description

The overarching goal of proposals to this topic should be to identify, collect and curate data, and to develop a decision-making methodology and prototype tool to assist AMMTO and its stakeholders in beginning to understand causality for EJ impacts and their reduction or avoidance. AMMTO seeks a strategic approach to its future investments that accounts for both past and anticipated EJ impacts. The EJ Impact Analysis Pilot is an effort to better understand the context of our investments within the EJ ecosystem using data-driven analysis to promote environmental justice in the US and globally. This pilot is the first step in establishing a methodology, data collection, and geographic and impact identification of relevant stakeholders that can be partners. Finally, this tool should provide a more consistent measure across all investments.

Part I, Data: The data identification and collection phase should consider indicators for the full lifecycle of mining or recycling processes and their varying EJ impacts. Ideally, both qualitative and quantitative data would illuminate pathways that would avoid or minimize harm to the environment, communities and mine, recycling and other workers.

[16] https://par.nsf.gov/servlets/purl/10284092

This analysis would explore best approaches to data identification (including developing quantitative indicators of EJ impacts such as local and regional cancer and respiratory disease prevalence) and collection of EJ locations and communities impacted by critical materials and materials circularity across the lifecycle of the materials. Due to the free global movement of electronic devices and the location of many of the critical materials, the analysis should seek data from within and outside of the US.

While some AMMTO-related processes that can cause harmful EJ impacts are known, proposals are sought to collect more comprehensive national, and where appropriate, international data on EJ impacts of the mining, separation, and production of critical materials and the recycling of e-waste and plastic. Data on innovations that avoid such impacts also is sought. Applicants must provide a detailed description of how the data will be collected and the data should be in a format that is shareable.

Part 2, Prototype Tool: The prototype decision-making tool should assist AMMTO in developing future programs that are EJ conscious and assist in identifying suitable circumstances to creatively invest in EJ. Specifically, this pilot seeks tools that enable decision makers to find patterns of causation and avoidance of harm in data on past and potential future harms as well as in AMMTO- sponsored and AMMTO—related innovation. AMMTO requires that the tool address a methodology that can be employed in identifying appropriate EJ progress metrics of future projects. The tool also should allow AMMTO researchers (including future applicants) and industry members the ability to understand the environmental, community and worker health impacts associated with how materials are extracted, separated, used and finally re-cycled.

Applicants also should give the prototype tool the ability to prioritize investment decisions by stakeholders in complementary programs. For example, it might assist R&D researchers in integrating EJ outcomes to their research goals from the early stages of innovation through applied R&D and into deployment investments.

AMMTO is embarking on this journey because there is a lack of quantitative accepted metrics that can be used to gauge EJ impacts in the lifecycle of AMMTO focus area technologies. There is also a need for a framework and proof-of-concept for an EJ impact analysis tool that includes total supply chain impacts.

Deliverables:

- Geographic mapping of critical materials and circularity industry and related innovation ecosystem overlaid with historic U.S. EJ zones; as well as those global EJ hotspots that are driven by US clean energy demand for materials to support the above industries.

When available, leverage existing resources from the US EPA and other similar global information repositories to include key metrics such as: environmental health impacts, emissions levels, human health impact, etc.

- A model giving insight to EJ causality within criticality, circularity, and innovation ecosystems that accounts for past and current EJ scenarios while providing the ability to project possible future pathways.
- Identification of stakeholders in critical materials and circularity within the manufacturing ecosystem that intersect with EJ areas along with recommendations on potential partnership pathways for AMMTO leveraging existing EJ efforts for wider impact.
- Structured methodology for AMMTO and stakeholder decision makers to consider and make decisions based on the EJ implications of potential AMMTO projects. Applicants should prioritize tools that encourage industry leadership on lowering environmental impacts.

Topic 6: Tools for Data Curation of Open Life Cycle Assessment Databases

- Eligibility: No more than **2** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $500,000
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 12-18 months

Background

AMMTO's Secure and Sustainable Materials Program develops technologies that promote material circularity with the aim of addressing supply chain constraints, reducing embodied energy and emissions of clean energy materials, and promoting environmental justice. Lifecycle analysis (LCA) is a tool that can both help AMMTO assess the potential impacts of different efforts that can inform our program direction and be leveraged by stakeholders to support material and process selection.

To address the Nation's climate goals, state and federal policies have been developed to incentivize the production and purchasing of products with lower embodied emissions and other environmental impacts, which are assessed through LCA. Since assessing lifecycle impacts is relatively new for many companies and requires a specific skill set with access to data, many companies contract this work out to consultants who may use their own confidential data sets or leverage proprietary databases whose data sets are not fully transparent. As a result, LCA comparisons across materials produced by different entities may be inaccurate and misleading. In addition, small and medium companies often cannot afford to contract out LCA generation and do not have access to the background data to do their own assessment.

The utility of an LCA is dependent on using high quality background data and using that data consistently when comparing processes and products. To provide access to high quality background data and other LCA resources, the US government developed the LCA Commons as a publicly available repository for LCA data, tools, and guidance. However, there are many data gaps that still exist within the LCA Commons. Even if background data exists, if it is not current, it could lead to inaccurate results.

Keeping data up to date is particularly important for data coming from sectors that are undergoing transformation, such as the energy, manufacturing, and transportation sectors. With the push towards sourcing energy from renewable sources, energy use and the associated emissions in these sectors is expected to change in the next 25 years as we approach net zero. In these years of transition, it will be important to easily and rapidly update background data from these sectors. For example, the relative benefits of recycling compared to virgin production can be heavily influenced by the source of electricity and transportation emissions.

Data availability, quality, and transparency are all important issues as LCAs are now being used to make product claims and purchasing decisions. Maintaining data quality is particularly challenging for data that is rapidly changing over time. For example, with the increased use of electricity and renewable fuels in the manufacturing sector, the emissions and environmental impacts associated with manufacturing products is expected to change significantly in the coming decades. Developing a tool or methodology that enables facile transfer of source data into a format that is interoperable with other data in the Federal LCA Commons would increase the accuracy of that data over time.

AMMTO is interested in developing tools and/or methodologies for the facile transfer of data from primary sources to the Federal LCA Commons and developing a proposed schedule for the updating of that data.

Description

This topic seeks to address the need to have high quality, current data that is publicly available for all to use. The Federal LCA Commons[17] is such a resource that provides public access to data repositories that can be used for LCA. It is also lists resources from several federal agencies that include data and tools that support LCA. As the use of LCA has expanded beyond that of a research tool, the importance of accurate background data for use by a researchers, LCA practitioners, and producers of goods and services has become increasingly important.

This topic seeks proposals for the development of a methodology or tool that will enable rapid and facile updating of background data for a data source from a sector that is in flux, with significant changes expected over the next 20-30 years. A successful project would deliver a

[17] www.lcacommons.gov

process that can easily and rapidly convert/update background data from a primary source to the LCA Commons. Proposals should describe the process by which the background data will be assessed and should include a discussion of what metrics will be used to prioritize data for replication. Applicants should describe experience with the LCA Commons, with LCA Commons data formatting and with converting data to a format appropriate for use on the LCA Commons. We would also like to see examples of how this data could be used by AMMTO to conduct analyses that inform program direction in areas that include critical materials, material circularity, materials for harsh service conditions, highly conductive materials, and clean energy manufacturing.

Deliverables:

- An assessment of background data that is both a) needed in the LCA Commons and b) expected to change significantly enough over the next 20 years to impact conclusions drawn from the resulting LCAs. Of particular interest are those data with high relevance to clean energy technologies and manufacturing. As part of this work, AMMTO requests a sensitivity analysis that highlights what data the assessment results are most sensitive to.
- A tool or methodology that will rapidly and easily convert source data identified in the assessment into the format required by the LCA Commons.
- An estimate of the time and cost associated for doing future updates once the tool is developed.
- A recommended schedule of how frequently the identified data source should be updated including when the updates should start and when less frequent updating is expected to be needed.
- Recommendations for how this updated data and LCAs in general can be used by AMMTO to inform program direction.

Topic 7: Analysis of Material Flows for the Circular Economy

- Eligibility: No more than **2** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $500,000
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 12-18

Background

The interest in material circularity started in the Advanced Manufacturing Office (AMO), where the initial focus was on the energy use reductions that could be gained through material

efficiency[18,19] and led to the creation of the REMADE Institute. Similar to the Advanced Materials and Manufacturing Technologies Office (AMMTO), REMADE is interested in technology solutions across the full value chain of materials that will lead to circularity. In addition to funding research and development projects, REMADE has commissioned analysis, including material flows, to help them direct research efforts in areas that will lead to the highest energy savings. This work helped REMADE members and leadership better understand the quantities of materials that are currently disposed of, what products/forms they are in, what waste streams they are currently a part of, and their ultimate fate (landfill, incineration, recycling, etc.). This type of information not only points qualitatively to where improvements could be most impactful, but also supports metrics development and sets a baseline for which improvements can be quantified.

In addition to REMADE, AMMTO and AMO before it, supported analysis efforts related to material circularity. For example, in 2020, AMO co-funded a series of circular economy-related analysis efforts with the Strategic Analysis Office. Some of these traced material flows that could then be used to run scenarios to understand how technology advancements could impact material circularity outcomes. For example, Hendrickson et al.[20] generated a material flow for polymers that was used to assess different scenarios that would lead to zero waste, per a policy proposed in California. Among other things, this work showed that use of advanced sortation technologies could lead to an increase in mechanical recycling over chemical recycling, resulting in higher energy and emissions savings.

Over the years, AMO, now AMMTO has commissioned several material flow analyses both with the national labs and through other efforts such as REMADE. These flow analyses have been instrumental in highlighting areas of opportunity where technology advancements can increase material circularity. AMMTO is interested in revisiting the need for additional or updated material flows for several reasons.

First, the focus of this sub-program has evolved with the birth of AMMTO to have broader objectives beyond energy efficiency. AMMTO's circular economy sub-program has a strong focus on material circularity pathways that reduce energy use, GHG emissions, and other environmental burdens, particularly on disadvantaged communities, and alleviate supply chain challenges, particularly for materials critical to the clean energy transition. With this broader set of objectives, AMMTO is interested in reexamining and/or filling gaps in the material flows information collected to date to be able to use that information as a baseline for improvement-based metrics as well as running scenarios that can help identify potential areas for impactful

[18] Sustainable Manufacturing Technology Assessment Overview Cresko.pdf (energy.gov)
[19] Chapter 6: Innovating Clean Energy Technologies in Advanced Manufacturing | Sustainable Manufacturing - Flow of Materials through Industry Technology Assessment
[20] Paths to Circularity for Plastics in the United States by Thomas Hendrickson, Baishakhi Bose, Nemi Vora, Tyler Huntington, Sarah Nordahl, Brett Helms, Corinne D. Scown :: SSRN

technology investment. As a result, this expands the materials of interest beyond materials with high embodied energy that are made in abundance to include materials for which there is a high dependence in clean energy supply chains and/or that are highly polluting to the environment and local communities.

The second reason to revisit material flows is that material flows can shift over time, depending on economic trends, trade policy, or a number of other factors. Certain materials may have very stable flows while others have high volatility or have lacked robust data in the past to generate a material flow with sufficient fidelity. For example, the ramp up in the production of technologies for the clean energy economy, such as electric vehicles, wind turbines, power electronics, and LED lighting is changing material demands. An example of changes in policy that have impacted material flows include China's "Operation National Sword" policy limiting the imports of recycled materials as well as evolving international policies related to e-waste (Basel convention).

Description

How materials flow through the economy provides the basis for many of the analyses we would be interested in to assess the potential impacts of improving material circularity. These include identifying where improvements could be made, running scenarios to compare different ReX pathways and/or technology improvements, and quantifying the potential impacts of those improvements. This topic seeks proposals for a project or projects that will assess the needs for updated material flows and develop a material flow diagram for the identified material(s) of interest at sufficient granularity to be used for assessing potential impacts of material circularity. Awards will be up to $500,000 each and are expected to be approximately 12-18 months in duration.

In the first phase of this project, AMMTO would like an assessment of the material flows that exist for materials of interest to identify gaps, identify deficiencies (poor data quality or resolution), and make a recommendation for which materials are in most need of updates. The recommendation should include the appropriate level of detail/granularity needed to be useful for each recommended material, including whether regionality is an important aspect to address for the selected material(s). A report should be provided that includes these recommendations as well as potential uses for the resulting material flows and how they may inform AMMTO strategy for investment in material circularity technologies.

After AMMTO aligns with the performing team on the material(s) and the level of detail required in the material flow, the performing team would develop a Sankey Diagram (or similar material flow) that tracks a material from production to end of life and includes an assessment of amounts (weight), energy, emissions, and other environmental factors that are available for the material as it flows through the economy.

Materials of interest to AMMTO include:

- Metals, including steel, aluminum, and copper
- Glass
- Paper
- Polymers
- Textiles
- Building materials, including concrete and other components of demolition debris
- Engineered materials, including composites
- Critical minerals and materials as defined in the 2023 Criticality Assessment
- Semiconductors and other materials relevant to clean energy and energy transmission

Proposals should clearly describe the process by which these materials will be assessed, including what source materials and/or resources will be leveraged and what metrics will be used for prioritization. In addition, there should be a discussion of how the level of granularity of data needed will be evaluated. Applications should include a description of the applicant's experience in material flow analyses and scenario assessments that use them. References to material flow analyses developed by the applicant and how they have been used subsequently to inform program direction is highly encouraged.

Deliverables include:

- In the first quarter of the project, the team should provide a survey of material flows with a recommendation for which material(s) should be selected for this analysis effort and the recommended level of granularity needed to be useful.
- After AMMTO approves the material selection, the team should develop a Sankey Diagram or similar assessment of the material flows of the selected material(s) through the economy from production to end of life disposition that includes amounts (weight) and associated energy, emissions, and other salient environmental factors.

Topic 8: Framework for Material Use Clearing House (MARCH) for Recycled Material Feedstocks

- Eligibility: No more than **2** proposals may be submitted per National Lab
- Estimated DOE Funding Available: $500,000
- Estimated Number of Projects Expected: 1
- Estimated Project Duration: 12 months

Background

The overarching goal is for AMMTO to create the information infrastructure needed to encourage manufactures to use more sustainable, recycled feedstocks. One mechanism to do that is through development of a tool and information infrastructure that helps secondary material producers and manufacturer overcome information gaps. This decreases barriers to recycled feedstock use and enables the establishment of new and expanded domestic recycling supply chains. These barriers can include 1) a lack of information on material benchmarks and manufacturer specification that the recycled content must meet to be adopted and 2) limited insight into how the embodied emissions of recycled materials produced from different recycling routes compare to virgin feedstocks. This information deficit is particularly challenging for emerging recycling technologies and feedstock/waste streams, for example for critical materials needed for magnets or batteries. With new recycling technologies emerging and demand for recycled content shifting either due to supply constrains for virgin materials or due to recycled content mandates, developing ways to bridge these information gaps can accelerate manufacturer adoption of recycled materials with improved environmental impacts or economics.

AMMTO seeks to establish a material reuse clearing house to provide the information infrastructure and ecosystem needed to overcome the information deficit related to supply, demand, costs, product requirements/specs, and environmental impacts (transparent, comparable LCA benchmarking of virgin and recycled counterparts) of recycled feedstocks. It is often difficult for manufactures to assess the relative environmental impacts of virgin and recycled feedstocks, and the quality and quantity of recycled feedstock available. There are existing marketplaces that aim to connect end-of-life products with resale opportunities (mostly these focus on textile, office furniture, building materials, and electronics). These tend to be regional efforts with limited reach. Additionally, these marketplaces do not address the knowledge gap between output of recycling processes and manufacturer materials requirements, nor do they include LCA information for different recycled materials.

The clearing house should incentivize information sharing among manufacturers, recyclers, and other actors in the recycling supply chain. This project is the first phase of developing and deploying such a clearing house.

Expected outcomes of this project:

- an assessment of the needs for such a clearing house for a variety of recycled materials and the role such a clearing house would play in the current landscape;
- insight into the needs and concerns of intended user base to inform assessment and design;
- a proposal of a framework for the clearing house;
- and a plan for how to build, pilot, and launch the clearing house including a recommendation for what material(s) should be the initial focus.

Description

AMMTO seeks proposals for a new one-year analysis project that supports the office ambition to develop an information infrastructure to overcome information gaps hampering robust recycling supply chains. The proposal should describe the approach that will be taken to conduct the landscape study and to develop a proposed framework for the clearinghouse, including the metrics used to prioritize the material(s) or feedstock stream(s) that are assessed. The proposal should also include a stakeholder engagement plan with target user base to understand needs/desires across different materials/supply chains, inform clearing house design, and gain insight into stakeholder motivation and potential incentives to engage in the clearinghouse. Experience establishing knowledge-sharing platforms like the material clearinghouse proposed should be highlighted and preliminary ideas about how such a platform could be designed to be useful to the community are encouraged.

AMMTO will judge proposals on the feasibility of the proposed work based on experience of the team to execute this or similar work and access to resources needed to conduct the work.

Deliverables:

- **Landscape study**
    - Describe what clearing houses currently exist, how they are run/operated, and how MARCH can leverage existing initiatives and what value a clearing house could add to the landscape. The landscape study should be completed and discussed with AMMTO in the first quarter of the project.
    - **Existing capabilities and knowledge within the national lab complex as well as relevant** consortia/institutes/trade associations (e.g. CMI, REMADE, BOTTLE, IACMI …) should be included in the assessment and recommendation for material(s) or feedstock(s) of interest. This includes previous and current analysis activities funded via AMMTO or other relevant DOE offices.
    - Based on the outcome of the landscape study there will be a Go / No Go decision taken.
- **Proposed Framework for the clearing house**. This should include:
    - **Proposed structure** for clearing house including identification of important information gaps and description of how the design addresses them. This framework should be expandable to multiple materials in the future and should be designed to leverage existing knowledge and capabilities housed within the National Labs, consortia, and trade associations to the extent possible.
- **Plan for how to pilot and launch the clearing house**
    - The plan should address considerations such as:
        - How data/input is envisioned to be collected and vetted

        - How the clearing house will monitor access (e.g. fully open, open only to members, open only to those who submit data, how user identifies/data will be handled)
        - How the clearing house can scale and grow to encompass additional materials
- **Identification of target material class / scope for piloting clearing house**
    - Perform a survey and analysis to identify materials to target for piloting the clearing house.
        - **Provide top three target materials** for piloting of the clearing house in order of best fit with a description of why they would be the most successful / impactful choices.
        - This assessment should include identifying what the critical knowledge gap(s) that the clearing house will help address for this material, an assessment of the current maturity of the recycling supply chain for this material (emerging versus established), and the potential impact of increasing recycled material use (including environmental, economic, and potential for increasing clean energy).
        - Most promising materials will be those where there is significant room for increased recycled material use if knowledge gaps are addressed and for which the value of the material is sufficient to drive more material recycling. Materials for which increased recycling has the potential for the greatest energy, environmental, and society impacts should be prioritized.
    - The scope should include identifying what data should be collected for characterizing output of recycling processes as well as what material specifications are needed for use of recycled content. Plans for stakeholder engagement to collect this information should be included.

II. Application Submission and Review Information

A. Application and Submission Details

i. Application Process

To apply to this Lab Call, applicants must register with their lab email address and submit application materials through EERE eXCHANGE at https://eere-eXCHANGE.energy.gov, EERE's online application portal. Beginning on July 8, 2022*,

* Please note that these dates are tentative and subject to change.

eXCHANGE will be updated to integrate with Login.gov. As of August 5, 2022*, 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.

All submissions must conform to the guidelines for format and length, and be submitted at, or prior to, the deadline listed.

Applicants will be required to include project information and details in eXCHANGE that will be used to develop and accelerate negotiations of FY 2024 AOPs if selected. Appendix A provides a worksheet to guide applicants through this process in eXCHANGE. Any information the applicant considers to be of significance for the review process must be included in the proposal, 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, except tables and figures, which may be in 10-point font.

iii. Proposal Content

Proposal content 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).**

Full Applications

- EERE will not review or consider ineligible Full Applications.
- Each Full Application shall be limited to a single concept or technology. Unrelated concepts and technologies shall not be consolidated in a single Full Application.

Full Applications must conform to the following requirements:

SECTION	FILE FORMAT	PAGE LIMIT	FILE NAME
Technical Volume	PDF	15	ControlNumber_LeadOrganization_TechnicalVolume

Resumes	PDF	1	ControlNumber_LeadOrganization_Resumes
Summary/Abstract for Public Release	PDF	1	ControlNumber_LeadOrganization_Summary
Summary Slide	MS PowerPoint	1	ControlNumber_LeadOrganization_Slide
DOE Work Proposal for FFRDC, if applicable (see DOE O 412.1A, Attachment 3)	PDF	N/A	ControlNumber_LeadOrganization_WP
SF-LLL Disclosure of Lobbying Activities	PDF	N/A	ControlNumber_LeadOrganization_SF-LLL
Foreign Entities and Foreign Work Waivers, if applicable	PDF	N/A	ControlNumber_LeadOrganization_Waiver
Data Management Plan, if applicable	MS Word	[X]1	ControlNumber_LeadOrganization_DMP
Diversity, Equity, Inclusion, and Accessibility (DEIA) Implementation Plan	PDF	2	ControlNumber_LeadOrganization_DEIIP

Technical Volume

The Technical Volume must be submitted in PDF format. The Technical Volume must conform to the following content and form requirements, including maximum page lengths. If applicants exceed the maximum page lengths indicated below, EERE will review only the authorized number of pages and disregard any additional pages. Save the Technical Volume in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_TechnicalVolume".

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

The Technical Volume to the Full Application may not be more than 15 pages, including the cover page, table of contents, and all citations, charts, graphs, maps, photos, or other graphics, and must include all of the information in the table below. The applicant should consider the weighting of each of the evaluation criteria when preparing the Technical Volume.

The Technical Volume must conform to the following content requirements:

SECTION / PAGE LIMIT	DESCRIPTION
Cover Page (1 page)	The cover page should include the project title, the specific Lab Call Topic Area being addressed, both the technical and business points of contact, names of all team member organizations, and any statements regarding confidentiality.
Project Overview (Approximately 10% of the Technical Volume)	The Project Overview should contain the following information: • Background: The applicant should discuss the background of their organization, including the history, successes, and current research and development status (i.e., the technical baseline) relevant to the technical topic being addressed in the Full Application. • Project Goal: The applicant should explicitly identify how the proposal addresses the aim of the relevant topic area and clearly identify the critical success factors in achieving that goal.The applicant should discuss the impact that DOE funding would have on the proposed project. Applicants should specifically explain how DOE funding, relative to prior, current, or anticipated funding from other public and private sources, is necessary to achieve the project objectives.
Technical Description, Innovation, and Impact (Approximately 30% of the Technical Volume)	The Technical Description should contain the following information: • Relevance and Outcomes: This section should describe the relevance of the proposed project to the goals and objectives of the lab call, including the potential to meet specific DOE technical targets or other relevant performance targets. The applicant should clearly specify the expected outcomes of the project. • Innovation and Impacts: The applicant should describe the specific novelty of the proposed work, the advantages of proposed work scope over other possible scopes, and the overall impact on advancing DOE and AMMTO goals that the proposed work will have if the project is successful.
Workplan (Approximately 40% of the Technical Volume	The Workplan should include a summary of the Project Objectives, Technical Scope, Work Breakdown Structure (WBS), Milestones, 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, objectives, and expected outcomes of the project and how they related to the relevant topic area.

	• 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 milestones. 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, 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 milestone. SMART milestones should be Specific, Measurable, Achievable, Relevant, and Timely, and must demonstrate an 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 milestone over the duration of the project (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.
	• 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, and milestones.
	• 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
Technical Qualifications and Resources (Approximately 20% of the Technical Volume)	The Technical Qualifications and Resources should contain the following information: • Describe the project team's unique qualifications and expertise, including those of key subrecipients. • Describe the project team's existing equipment, facilities, and resources that will facilitate the successful completion of the proposed project; include a justification of any new equipment, facilities, or resources 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

Resumes

Applicants are required to submit one-page resumes for key participating team members. Multi-page resumes are not allowed. Save the resumes in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Resumes".

Summary/Abstract for Public Release

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".

Summary Slide

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

The Summary Slide template requires the following information:

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

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

DOE Work Proposal for 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".

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

1. Foreign Entity Participation:

All lab partners receiving funding under this Lab Call must be incorporated (or otherwise formed) under the laws of a State or territory of the United States. To request a waiver of this requirement, the applicant must submit an explicit waiver request in the Full Application. Appendix B lists the necessary information that must be included in a request to waive this requirement.

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

All work under EERE funding agreements must be performed in the United States. This requirement does not apply to the purchase of supplies and equipment, so a

waiver is not required for foreign purchases of these items. However, the prime recipient should make every effort to purchase supplies and equipment within the United States. Appendix B lists the necessary information that must be included in a foreign work waiver request.

Save the Waivers in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_Waiver".

Data Management Plan

Each proposal under this lab call must have a data management plan (DMP). A DMP explains how, when appropriate, data generated in the course of the proposed work will be shared and preserved in order to validate the results of the work or how the results could be validated if the data is not shared or preserved. The DMP must provide a plan for making all research data displayed in publications resulting from the proposed work digitally accessible at the time of publications.

A lab may have a previously DOE approved DMP, such as a lab-wide DMP, and to the extent that the DMP applies to the proposal submitted under this lab call, the lab may rely on that DMP to satisfy the DMP requirement of this lab call. If there is no existing DMP that can apply and the applicant fails to submit a DMP as part of the proposal, then the default DMP for the proposal is the following:

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

Save the DMP in a single Microsoft Word file using the following convention for the title "ControlNumber_LeadOrganization_DMP".

Project Diversity, Equity, Inclusion, and Accessibility (DEIA) Plan

The Project Diversity, Equity, Inclusion, and Accessibility Implementation Plan should be integrated into the technical volume. As part of the application, applicants are required to describe how DEIA objectives will be incorporated in the project. Specifically, applicants are required to submit a description of how the project will support or implement the lab wide DEIA 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, as well as the extent to which the project activities will be located in or

benefit underserved communities. The plan should include at least one SMART milestone per budget period supported by metrics to measure the success of the proposed actions, which will be incorporated into the award if selected. The DEIA section should contain the following information:

- Equity Impacts: the impacts of the proposed project on underserved communities, including social and environmental impacts;
- Benefits: The anticipated overall benefits of the proposed project, if funded, to underserved communities;
- How DEIA objectives will be incorporated in the project.

The following is a non-exhaustive list of actions that can serve as examples of ways the proposed project could incorporate DEIA elements:

- Include faculty or students from Minority Serving Institutions as PI/co-PI, senior personnel, and/or student researchers, as applicable;
- 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;
- Disseminate results of research and development in Minority Serving Institutions or other appropriate institutions serving underserved communities;
- 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 subcontractors 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, Inclusion, and Accessibility (DEIA) Implementation Plan in a single PDF file using the following convention for the title "ControlNumber_LeadOrganization_DEIAIP".

Treatment of Application Information

Proprietary Information

In general, DOE will use data and other information contained in proposals only for evaluation purposes, unless such information is generally available to the public or is already the property of the government.

Proposals should not include trade secrets or commercial or financial information that is privileged or confidential unless such information is necessary to convey an understanding of the proposed project or to comply with a requirement in the Lab Call.

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

If a proposal contains confidential, proprietary, or privileged information, it must include a cover sheet marked as follows identifying the specific pages containing confidential, proprietary, or privileged information:

> **1. Notice of Restriction on Disclosure and Use of Data:**
> Pages [List Applicable Pages] of this proposal may contain confidential, proprietary, or privileged information that is exempt from public disclosure. Such information shall be used or disclosed only for the purposes described in this Lab Call. The government may use or disclose any information that is not appropriately marked or otherwise restricted, regardless of source. In addition, (1) the header and footer of every page that contains confidential, proprietary, or privileged information must be marked as follows: "Contains Confidential, Proprietary, or Privileged Information Exempt from Public Disclosure" and (2) every line and paragraph containing proprietary, privileged, or trade secret information must be clearly marked with double brackets or highlighting.

B. Application 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. AMMTO will use expert reviewers familiar with the AMMTO portfolio, goals, and objectives. AMMTO will collect and collate review scores and comments for use in making final project selections. The AMMTO Selection Official will consider the merit review results to make the final project selections. For transparency, AMMTO will provide summaries of the review results to assist labs in understanding how their submission reviewed and aid in improving future work.

ii. Technical Review Criteria

Final Applications

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

Criterion 1: Technical Merit, Innovation, and Impact (50%)
This criterion involves consideration of the factors listed below. Topic specific factors, where applicable, apply only to applications submitted under that topic area:
Technical Merit and Innovation

- Extent to which the proposed work is novel;
- Degree to which the current state of the applicable field and the proposed work are clearly described;
- Extent to which the application specifically and convincingly demonstrates how the applicant will achieve the proposed activities or advancement in the applicable field; and
- Sufficiency of technical detail in the application to assess whether the proposed work is scientifically meritorious and novel, including relevant data, calculations, and discussion of prior work in the literature with analyses that support the viability of the proposed work.

Impact of Proposed Work

- How the project supports the topic area objectives and target specifications and metrics; and
- The potential impact of the project on advancing the applicable field.

Topic Specific Factors for Criterion 1
These factors should be considered additional to the factors above for the specific topic areas; they do not replace the previous factors.

- *Additional Factors Specific to Topic 1 – Analysis Tools for Manufacturing for Next-Generation Batteries*
    - The strength of justification behind selecting the battery technology of interest for analysis (lithium metal, solid-state, sodium ion, redox or hybrid flow battery, other next-generation

battery technology), in terms of applicability to either mobile OR long-duration energy storage applications;
    - The comprehensiveness of the plan to obtain baseline data and perform meta-analysis, including the depth and breadth of the analysis and the extent to which varying uncertainties have been addressed, explanation of how key metrics will be extracted from the literature and processed, breakdown of how data will be tabulated and stored in a public repository that meets FAIR principles (findability, accessibility, interoperability, and reusability);
    - The suitability of the methodology used to incorporate the baseline data/meta-analysis into the proposed analysis tool(s), and its ability to produce data-driven estimations of commercialization timelines and costs associated with scaling up production of new battery technologies;
    - The real-world usability and impact of the proposed analysis tool(s), including factors, such as predictive accuracy and precision, ease of use, and adaptability to other related technologies.
- *Additional Factors Specific to Topic 2 – Framework for Battery Manufacturing Testbeds*
    - The comprehensiveness of the landscape analysis plan and inclusion of the following features: 1) Evaluation emerging battery technologies, 2) Analysis of existing manufacturing testbed facilities recognizing gaps and potential areas of differentiation, 3) Best practices in translational battery manufacturing that shorten commercialization time, and 4) Identification of key stakeholder groups and plan to establish communication channels and collaboration strategies with stakeholders;
    - The depth and breadth of the process used to identify developments in battery manufacturing technology that are relevant to the design and operation of proposed facilities;
    - The feasibility and sustainability of the proposed testbed model based on factors such as ease of action and economic/business structure;
    - The extent to which proposed framework document will establish clear direction and vision for the testbed, identify the facility's goals, align stakeholders, and guide decision-making.

- *Additional Factors Specific to Topic 3 – Codes for High Performance Computing for Manufacturing*
    - Degree to which the relevant manufacturing applications for the proposed advancement are clearly described;
    - The potential impact of the project on advancing clean energy technology manufacturing or decarbonization of manufacturing processes;
    - Accessibility of the software produced (e.g. open source, popularity of code base software being expanded, compatibility licensing options, etc.)
    - Impact on code scalability above current levels. (i.e. maximum number of cores that can be leveraged, number of GPU types that will be compatible, etc.);
    - If AI/ML approaches are being incorporated, the potential impact on use of those approaches and/or libraries in future HPC-enabled modeling and simulation work.

Criterion 2: Project Research (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 baseline, the strength of the quantifiable metrics, milestones, and any mid-point deliverables defined in the application, such that meaningful interim progress will be made.

Criterion 3: Team and Resources (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 of the proposed work;
- The reasonableness of the budget and spend plan for the proposed project and objectives.

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

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

iii. Selection for Award Negotiation

AMMTO carefully considers all of the 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. AMMTO may select or not select a proposal for negotiations. AMMTO may also postpone a final selection determination on one or more proposals until a later date, subject to availability of funds and other factors. AMMTO will notify applicants if they are, or are not, selected for award negotiation.

iv. Selection Notification

AMMTO anticipates completing the project selection process and notifying labs of selections during the month of August 2024 **(subject to change)**.

AMMTO will notify lab leads of selection results from ammto.analysislabcall@ee.doe.gov and will provide lab leads with summaries of anonymized review comments for each proposal submitted.

v. Questions and Agency Contacts

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

Appendix A: 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):

Organization Name:

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):

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	2026 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

Project Tasks:

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

Appendix B: Waiver Requests and Approval Processes: 1. Foreign Entity Participation as Lab Partners; and 2. Performance of Work in the United States (Foreign Work Waiver)

1. Waiver for Foreign Entity Participation as Lab Partners

Many of the technology areas DOE funds fall in the category of critical and emerging technologies (CETs). CETs are a subset of advanced technologies that are potentially significant to United States national and economic security.[31] Lab partners (industry and/or organization partners that are **not** DOE/National Nuclear Security Agency (NNSA), Federally Funded Research and Development Centers (FFRDCs) and all National Laboratories) providing cost share as part of a Lab-led team must be organized and chartered or incorporated (or otherwise formed) under the laws of a state or territory of the United States; have majority domestic ownership and control; and have a physical location for business operations in the United States. To request a waiver of this requirement, an applicant must submit an explicit waiver request in the Full Application.

Waiver Criteria

Foreign entities seeking to participate in a project funded under this Lab Call must demonstrate to the satisfaction of DOE that:

a. Its participation is in the best interest of U.S. industry and U.S. economic development;
b. The project team has appropriate measures in place to control sensitive information and protect against unauthorized transfer of scientific and technical information;
c. Adequate protocols exist between the U.S. subsidiary and its foreign parent organization to comply with export control laws and any obligations to protect proprietary information from the foreign parent organization;
d. The work is conducted within the U.S. and the entity acknowledges and demonstrates that it has the intent and ability to comply with the U.S. competitiveness provision (see Section VI.B.xxi.); and
e. The foreign entity will satisfy other conditions that DOE may necessary to protect U.S. government interests.

Content for Waiver Request

A foreign entity waiver request must include the following:

a. Information about the entity: name, point of contact, and proposed type of involvement in the project;
b. Country of incorporation, the extent of the ownership/level control by foreign entities, whether the entity is state owned or controlled, a summary of the ownership breakdown of the foreign entity, and the percentage of ownership/control by foreign entities, foreign shareholders, foreign state, or foreign individuals;
c. The rationale for proposing a foreign entity participate (must address criteria above);
d. A description of the project's anticipated contributions to the U.S. economy;
    - How the project will benefit the U.S., including manufacturing, contributions to employment in the U.S. and growth in new markets and jobs in the U.S.;
    - How the project will promote manufacturing of products and/or services in the U.S.;
e. A description of how the foreign entity's participation is essential to the project;
f. A description of the likelihood of Intellectual Property (IP) being created from the work and the treatment of any such IP; and
g. Countries where the work will be performed. (Note: If any work is proposed to be conducted outside the U.S., the applicant must also complete a separate request foreign work waiver.).

DOE may also require:

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

DOE may require additional information before considering the waiver request.

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

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

All work funded under this Lab Call must be performed in the United States. To seek a waiver of the Performance of Work in the United States requirement, the lab partner must submit an explicit waiver request in the Full Application. A separate waiver request must be submitted for each entity proposing performance of work outside of the United States.

Overall, a waiver request must demonstrate to the satisfaction of DOE that it would further the purposes of this Lab Call and is otherwise in the economic interests of the United States to perform work outside of the United States. A request for a foreign work waiver must include the following:

1. The rationale for performing the work outside the U.S. ("foreign work");
2. A description of the work proposed to be performed outside the U.S.;
3. An explanation as to how the foreign work is essential to the project;
4. A description of the anticipated benefits to be realized by the proposed foreign work and the anticipated contributions to the U.S. economy;
5. The associated benefits to be realized and the contribution to the project from the foreign work;
6. How the foreign work will benefit the U.S., including manufacturing, contributions to employment in the U.S., and growth in new markets and jobs in the U.S.;
7. How the foreign work will promote manufacturing of products and/or services in the U.S.;
8. A description of the likelihood of IP being created from the foreign work and the treatment of any such IP;
9. The total estimated cost (DOE and recipient cost share) of the proposed foreign work;
10. The countries in which the foreign work is proposed to be performed; and
11. The name of the entity that would perform the foreign work. Information about the entity(ies) involved in the work proposed to be conducted outside the U.S. (i.e., the entity seeking a waiver and the entity(ies) that will conduct the work).

DOE may require additional information before considering the waiver request.

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