

U.S. Department of Energy
Office of Electricity

Long Duration Energy Storage Demonstration Program
NATIONAL LABORATORY CALL FOR PROPOSALS

Rapid Operational Validation Initiative (ROVI) Flow Battery Lab Call

This Lab Call is being issued by the U.S. Department of Energy's Office of Electricity (OE)

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I. Overview and Purpose

A. Executive Summary

As a part of the Bipartisan Infrastructure Law (BIL) signed by President Biden on November 15th, 2021, \$505 million was appropriated for the 4-year period encompassing fiscal years (FYs) 2022 through 2025 for the development of grid-scale long-duration energy storage demonstrations to validate new technologies and enhance the capabilities of customers and communities to integrate grid storage more effectively. This will support the Biden Administration’s goal to achieve a carbon-free electric grid by 2035 and a net zero emissions economy by 2050.

DOE is issuing a lab call to develop the Rapid Operational Validation Initiative (ROVI) which will address critical gaps in data needs for energy storage such as lack of access to large and uniform sets of performance data that are necessary to accelerate the pace at which technology development can occur¹. ROVI will create a data collection and analysis framework to identify what the fundamental data needs are for different LDES technologies and then develop protocols to ensure that this data can be collected and stored in a standardized format. In addition, ROVI will provide an opportunity for project performers to collect this data from real systems and leverage data science methods such as artificial intelligence (AI) and machine learning (ML) to extract valuable insights about the performance of these LDES technologies. The ultimate goal of ROVI will be to use these data-driven insights to develop new accelerated testing and validation (T&V) methods for new technologies that will yield 15+ years of investment grade performance projections with only 1 year or less of data required.

Through achieving these objectives, ROVI will fulfill the statutorily required performance reporting requirements of the BIL programs² and implement the “Testing and Validation” requirements in the Energy Storage System Research, Development, and Deployment Program of the Energy Act of 2020³. These requirements specifically require:

“develop[ment of] testing and evaluation methodologies for

- (A) storage technologies, controls, and power electronics for energy storage systems under a variety of operating conditions;
- (B) standardized and grid performance testing for energy storage systems, materials, and technologies during each stage of development;
- (C) reliability, safety, degradation, and durability testing under standard and evolving duty cycles; and
- (D) accelerated life testing protocols to predict estimated lifetime metrics with accuracy.”

This specific lab call will be an initial effort to develop the overall ROVI roadmap and to specifically address **flow battery technologies**⁴. The intent of this opportunity is to understand, in sufficient detail, what the ROVI concept will look like when applied to flow batteries and, if carried out successfully, it will serve as a model framework for the larger ROVI program that can be replicated for other LDES technologies.

¹ [Principles of the Battery Data Genome](#)

² U.S. Code § 17232 (c)(4)

³ U.S. Code § 17232 (b)(3)

⁴ [DOE ESHB Chapter 6 Redox Flow Batteries \(sandia.gov\)](#)

This opportunity is open to National Labs only, but the awarded lab applicant or applicant group may incorporate external partners such as those from industry and academia to ensure necessary expertise and capabilities are available. In order to facilitate partnerships, non-lab entities that are that are interested in ROVI may provide contact information, details on their area of expertise, and a brief description of capabilities to a partnering list that will be viewable by applying national labs.

This opportunity will require a letter of intent (LOI) submission and each lab will be allowed a maximum of one submission. In the cases that labs want to partner with other labs they must jointly submit a LOI which must list each of the labs that will be involved in the proposal. The LOI must acknowledge that the lab call has been read and understood in its entirety and provide a brief description, no longer than a paragraph, of the anticipated approach for this lab call.

B. Timeline and Process Logistics

Lab Call Announced:	8/31/2022
Lab Call Q&A Session:	9/29/2022
LOI Submission Deadline:	10/12/2022
Partnering List Submission Deadline:	10/14/2022
Proposal Submission Deadline:	12/14/2022
Reviews Completed and Selections Announced:	2/8/2023
Award Issued by:	3/1/2023
Phase 1 Completed by:	9/29/2023
All Deliverables Completed by:	6/2/2024

- **PROPOSAL SUBMISSIONS:** LOIs and completed proposals should be submitted to vinod.siberry@hq.doe.gov. DOE strongly encourages all applicants to submit the required information at least 24 hours in advance of the submission deadline.
- **PARTNERING LIST:** Non-lab organizations that are interested in sharing their information for potential partnering opportunities must email their information to esgc@hq.doe.gov in the format shown by the below excel spreadsheet categories. The partnering list will be sent to lab POCs after the submission deadline.

Name	Organization	Email	Area of Expertise	Description of Relevant Capabilities

- **QUESTIONS DURING THE OPEN LAB CALL PERIOD:** Specific questions about this lab call will be addressed during a virtual Q&A session tentatively planned for Wednesday 9/29/2022 at 10:30-11:30 am ET, please provide your name and email to vinod.siberry@hq.doe.gov to receive a meeting invite. Only national lab participants may attend this session.

C. Key Considerations

- **AVAILABLE FUNDING:** There is approximately **\$2 million in total funding** made available by the Office of Electricity, to fund a single proposal by a lab or group of labs responding to this lab call.
- **CRADAS AND FOA AWARDS:** The call for proposals below should NOT be construed as requiring the renegotiation of an existing Cooperative Research and Development Agreement (CRADA) or

previously competed FOA award in which the lab is a prime or sub-recipient. Labs with CRADAs or FOA awards addressing any of the topic areas below may incorporate that work in proposals they submit in response to the Lab Call to demonstrate existing capability and leverage existing partnerships with industry and other partners. If the proposal is not selected for funding under this Lab Call, the work under the CRADA or FOA award will continue—there is no additional risk to the provision of DOE funding.

II. Technical Requirements

A. Objectives for ROVI

The overall ROVI will be split up into five phases:

Phase 1 – Data Requirements Framework: Development of a data requirements framework that will outline specific data points that need to be collected to fulfill data needs required to carry out ROVI. This framework will be used to ensure that quality data collection and management processes can be properly developed in future phases as well as inform a comprehensive list of technical requirements needed for monitoring LDES materials, components, or systems.

Phase 2 – Collection and Monitoring Protocols: Development of data collection & monitoring protocols that will collect the data described in the phase 1 framework specifically for LDES technologies that are deployed in applications that may involve resilience⁵ and diurnal energy shifting use case profiles. The performing lab(s) will provide more details and justification on the methods that will be implemented for aspects such as communication protocols, data collection architecture, cybersecurity, and data access measures.

Phase 3 – Protocol Implementation and Refinement: Deployment of the protocols described in phase 2 with implementation on one or multiple of the Energy Storage for Everyone, Everywhere (ESEE) resilience/BIL Joint Program⁶ demonstrations and use the protocol to collect at least 3 years' worth of relevant data and complete a report to congress. The performing lab(s) will use this as an opportunity to refine and improve aspects of the protocol that will be necessary to expand it for use on more systems.

Phase 4 - Data Collection: Development and deployment of data management systems and processes that can store large amounts and have robust cybersecurity and proprietary data protection practices in place that are sufficient enough to the point at that outside partners are willing to use the collection and monitoring protocol and contribute data to this effort. The performing lab(s) will implement the finalized collection and monitoring protocols into selected BIL and industry field deployments through partnerships and agreements with technology developers, end users, and other relevant organizations.

Phase 5 – Testing and Validation Method Development: Storage community engagement to develop a set of comprehensive T&V methods by applying AI/ML or similar data science/analytical methods on data collected in phase 4. The set of T&V methods will allow new technologies to have 15+ years of lifetime performance projections with 1-year or less of data. The performing lab(s) are encouraged to utilize innovative methods (e.g. prizes) that facilitate participation and adoption by industry and technology developers.

⁵ [Battery Storage for Resilience \(nrel.gov\)](https://www.nrel.gov/battery-storage-for-resilience)

⁶ 42 USC § 17232(d)

This lab call is soliciting proposals that will carry out work only for the phase 1 data requirements framework specifically for flow battery technologies, but the awarded lab(s) will describe their planned approach in a detailed roadmap for phases 2-5 to explain their overall strategy to carry out the rest of ROVI for flow batteries. The goal is that completion of phase 1 and a roadmap, for a single LDES technology, can serve as a model for the ROVI concept being developed for other LDES technologies in the future.

B. Lab Call Outcome Requirements

The following two deliverables will be required to be completed for this lab call:

Phase 1: Data Requirements Framework: A framework that will outline what specific data needs to be collected from a flow battery system to provide required information that is needed to carry out the entire ROVI program. This framework will inform the development of generic (non-flow battery specific) data collection and monitoring protocols that will be used for future phases and should, to the maximum extent possible, show how it will gather data that is necessary to gain an understanding of implications regarding lifetime, failure modes, reliability, and other behavior that is important to predict. The types of data can include the following:

- Data from materials, systems, subsystems, components, and devices
- Data from field deployments or pilot systems
- Data from characterization and measurement techniques such as spectroscopy and microscopy
- Data from simulations or theoretical calculations

The awarded lab(s) should examine existing literature, datasets, and past efforts such as national lab guidelines for collecting quality data on energy storage systems including flow batteries⁷ to leverage and build upon relevant work that has already been done in this area.

A successful framework will provide justification for why certain data points are needed, the necessary amount of certain data that will be needed, and how this data must be sampled and stored. This framework must indicate how heterogeneous data that may cover different scales and time domains⁸ can be properly integrated and formatted in a way that will facilitate extraction of innovative insights from the overall ROVI database that will ultimately come out of the initiative. The framework should be extensible to other battery chemistries and storage technologies, in particular lithium-ion batteries, in a future phase. The awarded lab(s) must complete this phase 1 deliverable no later than September 2023.

Roadmap for Future Phases: The awarded lab(s) will be responsible for developing a strategic roadmap for phases 2-5 of the ROVI program described in Section II-A of this lab call, specifically for flow batteries. It is encouraged for the awarded lab(s) to form an advisory board composed of members including flow battery technology developers, lab experts, investors, and potential end users that will provide input on how future phases can be effectively carried out. The strategic roadmap should include any anticipated or proposed deliverables, collaborations, required capabilities/expertise, or other necessary activities to achieve the described phases 2-5 objectives. The awarded lab(s) will also indicate

⁷ [Electrical Energy Storage Data Submission Guidelines, Version 2 \(sandia.gov\)](#)

⁸ [Principles of the Battery Data Genome](#)

the expected budget, level of effort, potential risks, and other critical aspects that will be important to understand when these phases are carried out in the future.

C. Project Budget

To carry out all of the deliverables described in the project outcome requirements for phase 1 and the strategic roadmap, a total of \$2 million will be made available to a single lab awardee or one group of multiple labs. Partnerships among labs are strongly encouraged, it is DOE's view that including more than one lab on a single proposal will allow for more expertise and laboratory capabilities to be engaged in this opportunity. Portions of this funding may be allocated to other non-lab partners or subcontractors as long as it is justified why their involvement in the project is required to achieve specific deliverables. If the award is made to a group of multiple labs, the funding will be evenly split among the recipient labs unless an alternative distribution of funds is agreed to by all participating labs. Labs are allowed and encouraged to include external partners in this effort such as those from industry and academia and may provide a portion of awarded funding from this lab call to these organizations. It is the responsibility of the awarded lab(s) to negotiate any cost-sharing, sub-contracts, or other required agreements with these partners and the specific amount of awarded funding will go to each of these partners. It is also the responsibility of the winning lab(s) to factor in project costs for all aspects of this project including but not limited to costs for staffing & labor, facility/testbed usage, necessary infrastructure upgrades, testing equipment/systems, modeling tools and software, developing physics-based models, and data collection & management infrastructure/systems. The awarded lab(s) may contribute their own additional funding and/or resources to this project as they deem necessary and may leverage resources or funding contributions from project partners.

III. Application Submission

A. Proposal Requirements

To be considered for this lab call, applicant labs must complete a full proposal that will be no longer than 30 pages and must contain the following sections:

Technology Characterization: Technical description of flow battery technologies that the proposed framework will address and a description of associated information such as design considerations, performance parameters, key components and subsystems, and other any other information required to demonstrate that the applicant has a sufficient level of understanding about the design, performance, and operation of the technology. The identified flow battery technology or technologies must be considered bidirectional electrical systems meaning the input energy for charging must be electricity and output energy from discharging must also be electricity.

Innovation Pathways: The applicant must also describe pathways for future innovation of the flow battery technologies being discussed which may include things such as using new types of materials/components/systems, incorporating new control/operational methods, or other proposed research, design, and development (RD&D) that has the goal of improving cost, performance, manufacturability, and safety for the storage technology. This section will demonstrate the applicant has sufficient understanding of the technology development activities around certain storage technologies

that require either present or future testing and validation efforts that ROVI should be complementing or building on.

Use-Case Characterization: In-depth characterization of different use cases including a diurnal storage pattern that is associated with energy time shifting for variable renewable energy (VRE) which requires energy storage capabilities up to 12 hours⁹ and a use case for energy resiliency that can require storage durations of 24+ hours. Awardees may also identify other important use cases that represent key end uses for LDES. The applicant lab(s) must demonstrate knowledge of performance measures and other system information that will be required to understand how a system, or its materials/components/systems will perform under a given operational profile intended to represent a specific use case or set of use cases that may be used in the testing, validation, or pilot demonstration phases of the technology development cycle. The applicant lab(s) can include an analysis of already existing testing protocols such as those developed and used by national labs in the past¹⁰.

Data Framework Proposed Tasks and Approach: The applicant lab(s) will outline the approach, methods, and existing or previous related activities they will use to develop the data framework and indicate how this will tie into a future collection & monitoring protocol. The proposal should indicate how the project team will conduct activities to gain a strong understanding what type of data will be necessary to collect for this initiative and how they will achieve the specific objectives outlined in the “Lab Call Outcome Requirements” section of this document. This section should include descriptions of milestones, proposed tasks, budget, project management information, and any other information that will indicate the applicant team will be successful in achieving phase 1 objectives.

Roadmap and Future Work: In the proposal, the applicant lab(s) will acknowledge that they agree to develop a roadmap for carrying out phases 2-5 of ROVI and include descriptions and justification for planned activities in these future phases as they build on work planned for the phase 1 data requirements framework deliverable. Any initial insights or proposed approaches on how the applicant would plan to carry these tasks out is strongly encouraged.

The applicant lab(s) must indicate a timeline in the proposal for each of the major milestones or deliverables that must all be completed June 2nd, 2024. The phase 1 data requirements framework deliverable should be completed no later than September 2023. Lab(s) will indicate in the proposal when they will hold project updates with DOE staff to demonstrate progress.

At DOE’s option, implementation of all or selected future phases may be funded as an extension of this lab call or pursued as a separate lab call.

B. Review Process

The review process will first consist of a review of the LOIs by DOE-HQ staff, these will only be reviewed to check to ensure that they are responsive and to notify applicants if their LOIs have been deemed not responsive with provided feedback. A full merit review coordinated by DOE staff that are managing this lab call will determine which applicant lab or group of labs will be awarded the requested amount of funding to carry out the proposed work for this opportunity. The merit review process will consist of

⁹ [Storage Futures Study: Economic Potential of Diurnal Storage in the U.S. Power Sector \(nrel.gov\)](https://www.nrel.gov/storage/futures-study)

¹⁰ [Washington Clean Energy Fund: Energy Storage System Performance Test Plans and Data Requirements \(osti.gov\)](https://www.osti.gov/energy/clean-energy-fund/energy-storage-system-performance-test-plans-and-data-requirements)

selected reviewers evaluating the full proposals based on the selection criteria outlined in the next section.

C. Selection Criteria

The selection committee will consider the follow factors when evaluating proposals:

1. Technical Approach (40%)
 - a. Technology Characterization: Proposal demonstrates that the applicant has an in depth understanding of the design, operation, and other relevant characteristics for long duration energy storage technologies and are focused on high impact and innovative technologies that are promising candidates for achieving widespread industry deployment.
 - b. Innovation Pathways: Proposal demonstrates that the applicant has an in-depth understanding of the RD&D process and areas of innovation for specific LDES technologies to show that they have sufficient knowledge of what relevant technology development activities ROVI should consider.
 - c. Use Case Characterization: Proposal demonstrates that the applicant has a sufficient understanding of important use-cases for LDES specifically including diurnal storage and resiliency applications.
 - d. Approach and Innovation: Overall, the proposal demonstrates that the applicant is proposing a robust and innovative approach that will lead to the most impactful set of deliverables under this opportunity.
2. Collaboration and Partnerships (30%)
 - a. Expertise and experience: Proposal describes in adequate detail the knowledge, skills, and experience of the key team members and partners that will lead to a successful project. Proposals that include a diverse set of expertise from multiple labs or partners from industry should be considered a strength under this criterion.
 - b. External Engagement and perspectives: The applicant indicates in the proposal that they have or will conduct activities, form partnerships, or engage in collaborations that will strengthen the likelihood that this project achieves the objectives of this lab call.
3. Execution (30%)
 - a. Project management: Proposal indicates that the team is capable of managing the project and involved partners, timelines, ensuring quality deliverables, and communicating information to lab call staff at DOE.
 - b. Costs: Proposal indicates an appropriate anticipated budget that provides a sufficient level of detail including a breakdown for costs for key staff, labor, use of facilities/testbeds, and other subcontracts or resources.
 - c. Likelihood of success: Overall, the applicant shows that they have laid out a convincing path forward to both achieve their specificized deliverables and have adequately explained how their deliverables will meet the objectives of this lab call.