Notice of Intent No.: DE-FOA-0003398

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This is a Notice of Intent to Issue:
Notice of Funding Opportunity No.: DE-FOA-0003399

Energy Storage Pilot Demonstrations

The Office of Clean Energy Demonstrations (OCED) intends to issue a Notice of Funding Opportunity (NOFO) entitled “Energy Storage Pilot Demonstrations”. The goal of this new investment area is to support pilot-scale demonstrations for non-lithium, long-duration energy storage solutions that advance technical maturity, reduce uncertainty in cost and performance characteristics, generate operational datasets, and increase investor and end-user confidence in technical and commercial maturation pathways and timelines.

ANTICIPATED PROGRAM SCOPE AND CHARACTERISTICS	
Total DOE Funding	Up to $100M
Project Funding	$5M - $20M DOE share, 50% minimum required non-Federal cost share
Project Count	3 – 15 projects
Key Objectives	• Advance a diverse set of non-lithium long-duration energy storage technologies towards commercial viability and utility-scale deployment. • Generate high-quality operational datasets and techno-economic models. • Build investor, utility, and other end user confidence in the real performance and adoptability of the proposed solutions.
Requirements and Priorities	• OCED will define a minimum system capacity by technology area (i.e., electrochemical, thermal, and mechanical) and a minimum discharge duration. • OCED will require teams to include a technology provider as a prime or sub-recipient and encourages inclusion of utilities, facility owner/operators, developers, financiers and others that support a clear path to commercial adoption. • OCED will expect projects to share operational datasets and techno-economic information with DOE and potentially National Laboratory programs to improve system performance modeling capabilities and validate performance. DOE will share information publicly only if it is possible to aggregate and anonymize the data.

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OCED anticipates that funding will support technology maturation activities including design for manufacturability, pilot system development, fabrication and installation, operational testing and validation, and commercial scale system design and supply chain maturation.

This Notice of Intent (NOI or Notice) describes a preliminary plan that will evolve during the NOFO development process.

It is anticipated that this NOFO will be executed in coordination with the planned Office of Electricity program DE-FOA-003384 Critical Facility Energy Resilience (CiFER).[1]

Statutory Authority

The Infrastructure Investment and Jobs Act (IIJA, Public Law 117-58), also known as the Bipartisan Infrastructure Law (BIL) authorized the Office of Clean Energy Demonstrations (OCED).[2] This NOFO is supported under the Energy Storage Pilot Grant Program.[3]

Background

OCED was established to build on DOE's expertise in clean energy research and development and expand DOE's scope to fill a critical gap in demonstration of first of a kind technologies. OCED's mission is to deliver clean energy demonstration projects at scale in partnership with the private sector to accelerate deployment, market adoption and the equitable transition to a decarbonized energy system. OCED has over 100 projects under award or selected and in negotiations, representing nearly $20 billion in federal investment.

Variable renewable solar and wind are expected to grow significantly in the coming years and comprise the majority of new capacity additions.[4] In addition, electricity demand is expected to continue to increase through 2050, driven by electrification of various sectors and loads[5,6] and growth of information processing demands.

Short duration (<4 hours) energy storage is already supporting resource adequacy, reliability, and flexibility needs of the grid.[7] Continued deployment of variable generation may push utility-scale storage duration requirements above 4 hours[8] and beyond the commercially viable discharge duration of currently commercially deployed Li-ion systems. The Long Duration Energy Storage (LDES) Pathways to Commercial Liftoff report estimates that "the U.S. grid may need 225-460 GW of LDES capacity for power market application".[9] Energy storage at this scale requires materials that are lower cost and less environmentally impactful than lithium. Lithium batteries also experience significant supply chain competition from the electric vehicle market.[10] Multiple

[1] https://www.energy.gov/oe/articles/energy-department-announces-15m-potential-funding-innovative-storage-technology
[2] IIJA Section 41201 (42 U.S.C. § 18861).
[3] IIJA section 41001(a) authorizes appropriations for Section 3201(c) of the Energy Act of 2020 (42 USC 17232(c)).
[4] https://www.eia.gov/todayinenergy/detail.php?id=56160
[5] NREL Electrification Futures Study, https://www.nrel.gov/docs/fy21osti/79094.pdf
[6] Energy Information Administration, Annual Energy Outlook 2023, https://www.eia.gov/outlooks/aeo/
[7] https://www.eia.gov/analysis/studies/electricity/batterystorage/pdf/battery_storage_2021.pdf
[8] https://www.nrel.gov/docs/fy23osti/85878.pdf
[9] https://liftoff.energy.gov/wp-content/uploads/2023/10/Pathways-to-Commercial-Liftoff-LDES-May-5_UPDATED-v10.pdf
[10] https://www.energy.gov/policy/articles/americas-strategy-secure-supply-chain-robust-clean-energy-transition

technologies (mechanical, thermal, electrochemical and chemical) are under development across the research, development and demonstration (RD&D) community, each technology with a unique set of challenges and opportunities.[11] Regardless of technology class, there are remaining challenges for long-duration energy storage solutions from both technology and commercial adoption readiness perspectives.

Technology Readiness Level (TRL)[12] varies across energy storage technologies.[13] Depending on the technology area, challenges may be at the minimum viable module scale or involve complex systems integration:

- Electrochemical solutions may need to establish confidence in performance characteristics at the module or subsystem level (up to the direct current (DC) module capacity). Aggregation of DC modules to align with commercial-scale inverter capacities is fairly well established.
- Mechanical and thermal solutions often have well established technical performance at the subsystem level but have not yet demonstrated a fully integrated system.

Commercial Adoption Readiness Level (ARL)[14] challenges for long- duration energy storage include:

- Delivered cost – There is high uncertainty in many cases for Nth of a Kind (NOAK) costs given the relatively small scale of demonstrated systems to date.
- Functional performance – Asset owners and utilities lack confidence in long-duration energy storage system performance (closely linked to TRL above).
- Demand maturity/market openness – In many regions there is a lack of clear valuation methods and market mechanisms for long-duration energy storage.
- Capital flow – There may be reluctance to invest in these technologies due to uncertainty in cost and performance characteristics and monetization of services.
- Manufacturing and supply chain – For some energy storage technologies, supply chains are underdeveloped, and serial production methods and facilities have not yet been established. Some energy storage technologies rely on raw materials that do not have reliable and resilient supply chains.
- Regulatory environment – There is a lack of clear rules or a multi-year horizon for market participation of energy storage and distributed energy assets in many cases. There is a lack of clear path for updating codes, standards, and permitting regulations developed for lithium-ion batteries to accommodate a range of non-lithium technologies.
- Safety – Li-ion battery safety incidents may influence perception of safety of other energy storage systems and limit siting opportunities.

With this program, OCED intends to directly address challenges in both TRL and ARL, primarily through increasing confidence in performance and cost characteristics, planning for manufacturability and supply chain maturation, and engagement with investors and end users.

OCED intends to complement and build on prior and existing DOE programming to target remaining technical and commercial adoption challenges. DOE has a broad range of related programming, including the OCED Long-Duration Energy Storage Demonstrations Program[15];

[11] https://www.energy.gov/oe/storage-innovations-2030
[12] https://www.directives.doe.gov/directives-documents/400-series/0413.3-EGuide-04/@@images/file
[13] https://liftoff.energy.gov/wp-content/uploads/2023/10/Pathways-to-Commercial-Liftoff-LDES-May-5_UPDATED-v10.pdf, p 13
[14] https://www.energy.gov/technologytransitions/adoption-readiness-levels-arl-complement-trl
[15] https://www.energy.gov/oced/long-duration-energy-storage-demonstrations-0

OCED Liftoff Enabling Programs[16], thermal energy storage through the OCED Industrial Demonstrations Program[17] and Industrial Efficiency and Decarbonization Office (IEDO) Programs[18]; multiple Office of Electricity programs[19], the Duration Addition to electricitY Storage (DAYS) program through ARPA-E[20] and Grid Resilience and Innovation Partnerships (GRIP)[21] programs, among others.

This investment will allow the U.S. to develop more cost-effective, investable long-duration energy storage technologies and solutions while supporting climate action and providing benefits to communities and workers. It will also support the Biden Administration's decarbonization goals of a 50-52% reduction in GHG emissions from 2005 levels by 2030, a carbon-pollution-free power sector by 2035, and a net-zero GHG emissions economy by 2050.[22,23]

Technical and Commercial Program Priorities

In this NOFO, OCED intends to fund technology demonstrations for energy storage solutions at the pilot-scale. The program will focus on non-lithium technologies with long-duration (10+ hour) discharge in stationary storage applications. Priority will be given to proposals that include utility, developer, and/or end user members, a plan to demonstrate the storage technology in an operational environment, and a plan to build investor confidence to secure support for follow-on projects.

Applications should clearly describe the proposed demonstration site, which could be an industrial facility, grid-connected utility site, a utility testbed or laboratory testbed, and explain the rationale for their selection and approach to apply project results to commercialization efforts. If not proposing to utilize an existing site, applicants must explain their approach to manage increased execution and schedule risks as well as their understanding of any required environmental reviews.

Projects will be expected to share operational datasets with DOE and potentially National Laboratory programs to improve system performance modeling capabilities and validate performance; findings will be supplied to projects and may be used to support performance claims to investors and/or end users. DOE may share information publicly, but only if it is possible to aggregate and anonymize the data.

Applications must show a clear path to technology commercialization and follow-on investment, including a clear articulation of potential cost reduction mechanisms, an investor engagement

[16] https://www.energy.gov/oced/liftoff-enabling-programs
[17] https://www.energy.gov/oced/industrial-demonstrations-program-0
[18] https://www.energy.gov/eere/iedo/iedo-fy23-multi-topic-funding-opportunity-announcement
[19] https://www.energy.gov/oe/office-electricity
[20] https://arpa-e.energy.gov/technologies/programs/days
[21] https://www.energy.gov/gdo/grid-resilience-and-innovation-partnerships-grip-program
[22] Executive Order 14057, Catalyzing Clean Energy Industries and Jobs Through Federal Sustainability, https://www.federalregister.gov/documents/2021/12/13/2021-27114/catalyzing-clean-energy-industries-and-jobs-through-federal-sustainability
[23] FACT SHEET: President Biden sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies

strategy, a business plan to scale and enter markets, an assessment of the competitive landscape, a monetization approach for services provided, and similar relevant commercialization plans.

OCED will consider proposals that include (non-exhaustive):

- Electrochemical solutions, including flow and non-flow batteries.
- Mechanical solutions, including both pressure and gravity based.
- Thermal solutions, including sensible, latent and thermochemical heat storage mechanisms configured for electrical to electrical, electrical to thermal, and thermal to thermal input-output configurations.

OCED does not intend to consider:

- Proposals that use lithium-based energy storage technologies or other technologies that are deployed currently at >100MW capacity.
- Proposals that intend to produce a bulk chemical as a storage medium, such as hydrogen or ammonia.
- Proposals with technologies that cannot achieve a 10-hour continuous discharge duration.

Projects should:

- Demonstrate reliable, repeatable technology performance at pilot scale.
- Generate high-fidelity operational data sets.
- Produce high-confidence techno-economic models and cost-down projections from First of a Kind to Nth of a Kind.
- Refine and optimize system designs for commercial deployments.
- Establish robust and resilient supply chains.
- Establish partnerships with end-users and financiers for future projects.

In addition to these priorities, selection criteria will include **technical approach and impact, financial and market viability, management and organization, workplan, and community benefits plan**.

To support the goals of building a clean and equitable energy economy, DOE anticipates supporting projects that define a robust Community Benefits Plan, including:

- Supporting meaningful community and labor engagement;
- Investing in America's workforce and supporting good jobs;
- Advancing diversity, equity, inclusion, and accessibility; and
- Contributing to the President's goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities (the Justice40 Initiative).[24]

[24] The Justice40 Initiative, established by EO 14008, "Tackling the Climate Crisis at Home and Abroad," January 27, 2021, sets a goal that 40% of the overall benefits of certain federal investments flow to disadvantaged communities. Pursuant to EO 14008 and the Office of Management and Budget's Interim Implementation Guidance M-21-28 and Addendum M-23-09 guidance, DOE recognizes disadvantaged communities as the census tracts defined and identified as disadvantaged by the White House Council on Environmental Quality's Climate and Economic Justice Screening Tool (CEJST), located at https://screeningtool.geoplatform.gov/, as well as all Federally Recognized Tribes (whether or not they have land). See https://www.whitehouse.gov/wp-content/uploads/2023/01/M-23-09_Signed_CEQ_CPO.pdf. DOE's Justice40 Implementation Guidance is located at https://www.energy.gov/sites/default/files/2022-07/Final%20DOE%20Justice40%20General%20Guidance%20072522.pdf.

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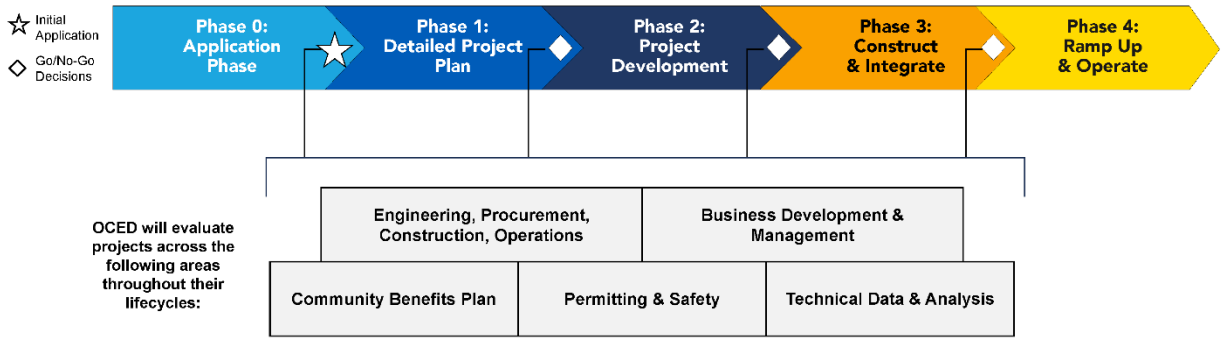
DOE anticipates providing awards to teams that are led by a single entity. All applicants are encouraged to partner with experts in technical engineering support or analysis, lifecycle analysis, commercialization, financing, and/or community benefits, if none exist within the applicant's team.

Guidance on specific application and reporting requirements will be included in the NOFO, but examples are also available on OCED Exchange.[25] Additional details on selection criteria will be provided in the NOFO.

Implementation Approach

This NOFO is expected to make available up to $100 million of federal funds through financial assistance for competitively selected, cost-shared demonstration projects. DOE anticipates project costs to generally range from approximately $5M to $20M DOE share for each award, with a minimum of 50% non-federal cost share (at least 50% of the total project cost, including both DOE share and recipient cost share).[26] Funds are anticipated to support technology maturation activities including design for manufacturability, pilot system development, fabrication and installation, operational testing and validation, and commercial scale system design and supply chain maturation.

OCED anticipates that projects awarded through a subsequent NOFO will follow a phased structure similar to that shown in the following image.



To facilitate long-term project planning, such as securing potential strategic partners or commercial third-party financing, DOE envisions that the NOFO will solicit applications that cover all four Phases of the project. While only Phase 1 of selected projects will be funded initially, additional funding for subsequent Phases will be released based on successful completion of Go/No-Go decisions. DOE will review and evaluate progress and deliverables against expected milestones. Projects may be discontinued during or at the end of any Phase at the sole discretion of DOE if the Go/No-Go criteria, project, or program requirements are not met.

More details on activities and deliverables likely expected to be completed in each Phase will be provided in the NOFO or during pre-award and pre-Phase negotiations. Phase lengths may be

[25] See for example Community Benefits Plan Guidance for DE-FOA-0002779, DE-FOA-0002970 or DE-FOA-0003009 (under Application Forms and Templates); available for download at https://oced-exchange.energy.gov
[26] Section 988(c) of the Energy Policy Act of 2005 (42 U.S.C. § 16352).

adjusted or consolidated based on the readiness and status of the proposed project and applicant team.

If funded through all four Phases, DOE envisions that the demonstrations will reach technical viability under the NOFO and demonstrate a plan for commercial viability. Though DOE's goal will be to support projects that will maintain operation after the period of performance, pilot projects may include disposition and decommissioning plans as part of future scale-up efforts.

Achieving OCED's and DOE's broad end goals will necessitate review and evaluation of proposed project characteristics that include cost, schedule, and scope; technology; business; market; financial; management; community support; or other factors. Each subsequent Phase will be structured to ensure that each project meets a standard level of maturity, employs a robust execution approach, delivers meaningful community benefits while minimizing negative impacts, and that technical and non-technical project risk is adequately and appropriately managed throughout DOE's engagement.

Submission and Registration Requirements for Full Applications

OCED envisions awarding multiple financial assistance awards in the form of cooperative agreements. The NOFO will be released on or about August 2024 and may require concept papers. If OCED requires concept papers, OCED would issue encourage or discourage notifications to applicants based upon the concept papers and applicants would be required to submit an eligible concept paper to be eligible to submit a full application, which will be requested following the concept paper notifications. OCED intends to announce selections in mid-2025.

This Notice is issued so that interested parties are aware of OCED's intention to issue this NOFO in the near term. All the information contained in this Notice is subject to change. **OCED will not accept questions at this time regarding issuance of the potential NOFO. Details on how to submit questions and comments will be provided in the NOFO, when issued.**

OCED plans to issue the NOFO via the OCED eXCHANGE website https://oced-eXCHANGE.energy.gov/. If applicants wish to receive official notifications and information from OCED regarding this NOFO, they should register in OCED eXCHANGE. When the NOFO is released, applications will be accepted only through OCED eXCHANGE.

In anticipation of the NOFO being released, applicants are advised to complete the following steps, which are required for application submission:

- Register and create an account in OCED eXCHANGE at https://oced-eXCHANGE.energy.gov. This account will allow the user to apply to any open OCED NOFOs that are currently in OCED eXCHANGE. Please note that potential applicants must create an account in OCED eXCHANGE even if the organization has already registered for an EERE eXCHANGE account. It is recommended that each organization or business unit, whether acting as a team or a single entity, use only one account as the contact point for each submission.

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

- Register with the System for Award Management (SAM) at https://www.sam.gov. Designating an Electronic Business Point of Contact (EBiz POC) and obtaining a special password called a Marketing Partner Identification Number (MPIN) are important steps in SAM registration. Please update your SAM registration annually. Upon registration, SAM will automatically assign a Unique Entity Identifier (UEI).

- Register in FedConnect at https://www.fedconnect.net/. To create an organization account, your organization's SAM MPIN is required. For more information about the SAM MPIN or other registration requirements, review the FedConnect Ready, Set, Go! Guide at https://www.fedconnect.net/FedConnect/Marketing/Documents/FedConnect_Ready_Set_Go.pdf

- Register in Grants.gov to receive automatic updates when Amendments to a NOFO are posted. However, please note that applications will not be accepted through Grants.gov. http://www.grants.gov/. All applications must be submitted through OCED eXCHANGE.

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