



# Recommendations for Implementing Energy Storage Demonstration Programs

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CLEARPATH

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## Purpose

This memo provides recommendations for implementing energy storage demonstration programs within the U.S. Department of Energy (DOE).

## Background

Energy storage is a promising suite of technologies to reduce emissions and modernize the U.S. electric grid. Advanced energy storage technologies strengthen grid reliability and resilience by helping grid operators manage supply and demand, defer transmission upgrades, recover from grid disruptions, and integrate variable renewables. In recent years, the U.S. Department of Energy (DOE) has prioritized energy storage with cross-cutting initiatives, including the Energy Storage Grand Challenge (ESGC) and Long-Duration Storage Shot. As part of these programs, DOE has set a goal to reduce the cost of grid-scale energy storage by 90% by 2030 for systems that deliver 10+ hours of duration. These initiatives represent DOE's comprehensive strategy to accelerate the demonstration and deployment of next-generation energy storage technologies.

The bipartisan Energy Act of 2020 established new programs that support DOE's ESGC and Storage Shot initiatives. In the Energy Act, Congress directed DOE to establish a focused energy storage research, development, and demonstration (RD&D) program, including the large-scale demonstration of technologies capable of storing energy for a wide range of durations. The bipartisan Infrastructure Investment and Jobs Act (IIJA) included \$505 million for energy storage demonstration projects that were authorized by the Energy Act.<sup>1</sup> Specifically, the IIJA funded two programs: 1) the Energy Storage Demonstration Projects and Pilot Grant Program, and 2) the Long Duration Demonstration Initiative and Joint Program. The IIJA established both programs within the Office of Clean Energy Demonstrations (OCED), as described below:

- **Energy Storage Demonstration Projects and Pilot Grant Program**  
\$355M total (\$88.75M for FY22, FY23, FY24, and FY25.)
  - DOE is directed to fund three energy storage demonstration projects by September 30, 2023 and establish a separate pilot grant program.
- **Long Duration Demonstration Initiative and Joint Program**  
\$150M total (\$37.5M for FY22, FY23, FY24, and FY25.)
  - This is a joint program between DOE and the U.S. Department of Defense (DoD) to demonstrate long-duration storage technologies at DoD facilities and installations.<sup>2</sup>

Both of the energy storage demonstration programs in the IIJA provide an unprecedented opportunity to advance the goals of DOE's ESGC and Storage Shot, particularly when combined with other resources in the IIJA. With this infusion of funding, DOE can support innovators to dramatically reduce the cost of long-duration, grid-scale energy storage, enabling its widespread deployment at home and abroad.

## Recommendations

The recommendations below are focused on establishing demonstration programs that 1) prioritize a diverse portfolio of long-duration, grid-scale energy storage technologies capable of achieving DOE's performance goals; 2) develop energy storage technologies that can be manufactured in the U.S. and exported globally; 3) advance technologies that strengthen U.S. energy security and do not depend on supply chains controlled by foreign adversaries; and 4) leverage synergies with other IIJA demonstration programs.

### *Goal-Oriented Technology Portfolio*

In developing the demonstration programs, DOE should prioritize a portfolio of energy storage technologies that are capable of achieving DOE's cost reduction goal and serve multiple use cases reflected in the ESGC Roadmap and congressional direction. The ESGC and Storage Shot established the goal to reduce the cost of 10+ hour, grid-scale storage by 90% by 2030. This goal is DOE's first comprehensive performance target for long-duration, grid-scale energy storage. Demonstrating this performance goal would enable mass deployment of energy storage across multiple use cases.

The ESGC Roadmap identified six primary use cases for energy storage: 1) facilitating an evolving grid, 2) serving remote communities, 3) electrified mobility, 4) interdependent network infrastructure, 5) critical services, and 6) facility flexibility in the residential, commercial, and industrial sectors. These use cases are consistent with congressional direction in the Energy Act. Under the \$355 million Energy Storage Demonstration Projects and Pilot Grant Program, Congress directed DOE to fund three energy storage demonstration projects to advance multiple eligible uses, including:

1. To improve the security of critical infrastructure and emergency response systems.
2. To improve the reliability of transmission and distribution systems, particularly in rural areas, including high-energy cost rural areas.
3. To optimize transmission or distribution system operation and power quality to defer or avoid costs of replacing or upgrading electric grid infrastructure, including transformers and substations.
4. To supply energy at peak periods of demand on the electric grid or during periods of significant variation of electric grid supply.
5. To reduce peak loads of homes and businesses.
6. To improve and advance power conversion systems.
7. To provide ancillary services for grid stability and management.
8. To integrate renewable energy resource production.
9. To increase the feasibility of microgrids (grid-connected or islanded mode).
10. To enable the use of stored energy in forms other than electricity to support the natural gas system and other industrial processes.
11. To integrate fast charging of electric vehicles.
12. To improve energy efficiency.

The use cases of the ESGC/Storage Shot largely align with the requirements of the Energy Act, as funded by the IIJA. The ESGC Roadmap matches its use cases with a portfolio of energy storage technologies, including electrochemical, mechanical, thermal, and chemical.<sup>3</sup> In developing the IIJA demonstration

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programs, DOE should support a diverse portfolio of energy storage technologies with a pathway to achieve the 90% cost reduction goal and meet the needs of multiple use cases reflected in the ESGC Roadmap and the Energy Act.

In addition to the \$355 million for energy storage demonstrations and pilots, the IIJA provided \$150 million for the Long Duration Demonstration Initiative and Joint Program. The joint program between DOE and DoD is a unique opportunity to demonstrate the value of long-duration energy storage for defense critical infrastructure. Multiple forms of energy storage hold promise for long-duration applications, including advanced batteries, mechanical, and thermal storage (such as geothermal or molten salt). DOE should work with DoD to match technology options with DoD’s mission needs and technical requirements.

## Make Here, Deploy Everywhere

In the ESGC Roadmap, DOE identifies an overarching goal “to develop and domestically manufacture energy storage technologies that can meet all marketplace demands by 2030.”<sup>4</sup> To achieve this goal, DOE includes three guiding objectives: innovate here, make here, and deploy everywhere. As the Roadmap explains, technology innovation is necessary but not sufficient for the U.S. to lead the world in the deployment of energy storage. Beyond innovation, the U.S. must also establish a domestic manufacturing capacity to ensure that technologies developed in the U.S. can be built domestically and exported around the world.

As such, DOE should establish an energy storage technology pipeline that is developed, demonstrated, and manufactured in the U.S. DOE’s Grid Storage Launchpad (GSL), which was announced in 2020, will be a world-class facility to test and scale emerging storage technologies to prepare them to compete for funding under OCED’s demonstration programs. The GSL’s construction timeline may not align with the statutory requirement to fund three demonstration projects by the end of Fiscal Year 2023, but GSL-supported technology developers can potentially compete for the separate pilot projects and the DOE-DoD joint program. Regardless, the GSL will be an important capability to advance DOE’s long-term innovation, demonstration, and manufacturing goals.

In addition to leveraging capabilities like the GSL, DOE should incorporate domestic manufacturing metrics from the ESGC Roadmap into the Funding Opportunity Announcements (FOA) for demonstration projects. Demonstrating one version of a new technology does not prove the technology can be mass-produced at scale. As shown below, the Roadmap identified four specific metrics to measure the manufacturability of energy storage technologies, each of which should be incorporated into demonstration program FOAs.<sup>5</sup>

Perspective	Goal	Metrics
Technology	Maturation of new technologies	Manufacturing Readiness Level (MRL)
Cost	Lower manufacturing costs to meet price targets	\$/kW, \$/kWh, LCOS, etc.
Production	Meet global demand (i.e., U.S. production capacity and production output)	MW/month
U.S. Supply Chain	Strengthen U.S. supply chain	% of U.S. presence in energy storage supply chain ecosystems

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As the Roadmap explains, the Manufacturing Readiness Level (MRL) “provides a high-level, technology agnostic way to track the progress of the manufacturability of technical innovations from the experimental proof-of-concept stage—the ability to make one, to the industry standard stage—the ability to reliably and cost-competitively make enough to meet market demand (usually in the thousands or millions per year).” As part of the FOA process, DOE should ask applicants to demonstrate their capacity to reliably and cost-competitively manufacture their technology to meet market demand at commercial scale and prioritize demonstration projects with high MRLs.

## Secure Supply Chains

DOE should prioritize energy storage technologies that strengthen U.S. energy security and avoid funding projects that depend on supply chains controlled by foreign adversaries, including China and Russia. Promising technologies that do not rely on critical minerals include advanced batteries (redox flow, iron-air, etc.), pumped storage, mechanical, and thermal storage—all of which are included in the ESGC Roadmap. While OCED works to fund a diverse portfolio of demonstration projects, DOE should support the build-out of facilities to meet the future manufacturing needs of successful demonstration projects. The private sector is unlikely to invest in new facilities to manufacture emerging technologies that have not yet been demonstrated. At the same time, if a domestic manufacturing capability is not established rapidly, DOE risks losing successful demonstration projects to other countries, especially foreign adversaries keen to undercut the U.S. on price with low quality and poor environmental standards.

DOE can help de-risk investment in domestic manufacturing by leveraging the \$6 billion in IIJA for battery supply chain projects.<sup>6</sup> Under those programs, DOE is directed to fund large-scale battery material processing, component manufacturing, and recycling, including at least one demonstration project and one commercial-scale facility. While DOE’s recent Notice of Intent focuses on lithium-ion batteries,<sup>7</sup> the congressional direction does not exclude advanced, non-lithium battery chemistries, such as those that would compete for funding under the energy storage demonstration programs. Moreover, Congress directed DOE to provide “priority consideration” to projects that “will not use battery material supplied by or originating from a foreign entity of concern.”<sup>8</sup> As a result, DOE should clarify its eligibility requirements to include a broad range of battery chemistries, as reflected in congressional direction.

To support a domestic supply chain, DOE should leverage its IIJA battery resources to facilitate partnerships between advanced battery developers and domestic manufacturers. This way, successful demonstrations can be quickly scaled to meet market demand. While it would not address the manufacturing and supply chain needs of other technologies beyond batteries, this strategic partnership could provide a template for a successful technology pipeline *to innovate here, make here, and deploy everywhere*.

## Synergy with Other IIJA Programs

In addition to the programs discussed above, the IIJA provided funding for multiple demonstration programs related to energy storage, including:

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- Program Upgrading Our Electric Grid and Ensuring Reliability and Resiliency (\$5 billion)
- Clean Energy Demonstration Program on Current and Former Mine Land (\$500 million)
- Industrial Emission Demonstration Projects (\$500 million)

To the greatest extent possible, DOE should seek to leverage synergies across programs, as energy storage is eligible to compete under each. For example, the electric grid reliability and resilience program is designed to “demonstrate innovative approaches to transmission, storage, and distribution infrastructure to harden and enhance resilience and reliability.”<sup>9</sup> Therefore, OCED should seek to fund promising energy storage projects through this program. Similarly, DOE could fund an energy storage demonstration project on current or former mine land, as energy storage is explicitly included in the definition of “clean energy project.” DOE could also potentially fund certain demonstration projects, such as thermal storage, at industrial facilities under the industrial emission demonstration program. As the ESGC Roadmap points out, energy storage could be “integrated into industrial processes to decrease unexpected downtime from outages, decrease fuel price risk, decrease waste heat, and assure power quality.”<sup>10</sup>

By utilizing resources across multiple IIJA programs to fund energy storage projects across diverse economic sectors and geographic regions, DOE can strengthen the value proposition for energy storage and maximize the impact of taxpayer resources.

## Conclusion

The IIJA energy storage demonstration programs will advance DOE’s goals under the ESGC and Storage Shot. By prioritizing the aforementioned recommendations, DOE can help innovators reduce the cost of long-duration, grid-scale storage by 90 percent within the decade, while positioning the U.S. to lead the world in the manufacture and export of next-generation energy storage technologies. For energy storage, now is the time *to innovate here, make here, and deploy everywhere.*

## Sources

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