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ENVM 5006: Sustainable Energy Policy
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To Mr. Conner Prochaska,

The federal role in promoting Long Duration Energy Storage (LDES) has centered around key programs in the Department of Energy (DOE) and Federal Energy Regulatory Commission (FERC), as well as legislation through the Infrastructure Investment and Jobs Act (IIJA) and the Inflation Reduction Act (IRA). The progress made through these programs, and through the trajectory of clean energy programs more broadly, has made ARPA-E's role in LDES crucial for commercializing emerging technologies, incentivizing innovation and intermarket cooperation, and supporting successful projects that lead to market penetration and adoption.

Background

Historically, policies that support energy storage technologies include The Energy Policy Act of 2005, a piece of federal legislation that targeted advanced vehicles and fuel cells, but also catalyzed broader efforts to research batteries of different compositions.[1] FERC Order 841 and 2222 were critical pieces of legislation for supporting energy storage. Order 841directed RTOs to remove obstacles barring participation in energy storage wholesale markets, establishing guidelines for RTOs to open capacity and ancillary services markets to energy storage, with some preliminary approval for PJM and SPP plans.[2,3] Order 2222 was created to equalize the aggregated Distributed Energy Resource (DER) market and implementation.[4] IIJA became law in November 2021, contributing half a billion dollars to energy storage demonstration projects, three billion for manufacturing and scaling production lines, and 14 billion for resiliency programs.[5] The IRA became law in August 2022 and provided stand-alone ITC for storage with funding programs, a Greenhouse Gas reduction fund with 7 billion in grants to applicants to develop technologies, and 760 million in grants to accelerate siting of transmission projects.[6]

Finally, the One Big Beautiful Bill Act (OBBB) became law in July 2025 and saw the continuation of energy storage tax credits through the next decade, with changes put in place by the new Foreign Entity of Concern (FEOC) for restrictions intended to disincentivize foreign components in domestic projects.[7] Although there are federal policies in place, ARPA-E's role in supporting LDES technologies cannot be understated. They define LDES as energy duration that can discharge for 10 hours or more at their rated power.[8] With the creation of programs like the Duration Addition to Electricity Storage (DAYS) program and Grid-Scale Rampable Intermittent Dispatchable Storage (GRIDS) program, ARPA-E has been leading federal agencies in identifying market challenges, opportunities, research, and players that can advance commercialization.[9,10]

Barriers and Considerations

The barriers to LDES deployment can be broken down into technology constraints, socio-economic trends, and instability of federal support. With many different renewable technologies, supply chains often struggle to address the needs of entire markets and fulfill orders.[11] LDES projects are often brought online with intermittent renewable technologies such as solar and wind to provide consistent on-demand energy, so introducing a multi-stage energy project can change supply and demand for rate payers.[12] To address supply chain constraints, hybrid systems with renewables and storage requests, and energy price volatility, storage projects are fighting against a plethora of challenges to get projects up and running. Studies performed by S&P Global analysts cite “little to no economic incentive” for investors to secure LDES investments in the current market.[13] According to the same source, roughly 88% of LDES projects that have not started operations are using pumped hydro energy storage.[14] Based on

these reports and similar studies produced on financing energy storage projects, it's clear that market viability can benefit from federal programs and incentive stimulus.

Unfortunately, The DOE rescinded over 700 million in energy storage project grants in October.[15] In order to get additional technologies procured and deployed, federal support is needed to catalyze low market grossing R&D. Electrochemical, chemical, mechanical, and thermal energy storage are all technologies that seek to achieve lower Levelized Cost of Storage (LCOS). The National Renewable Energy Laboratory (NREL) performed studies like their Storage Future Study (SFS) through the DOE's Energy Storage Grand Challenge to assess the grid changes we can expect to see with energy storage through 2050.[16] SFS serves as an excellent example in assessing market trends on energy storage, but key learnings in their final reports in April 2022 fall short on a few key points: supply chain, life-cycle constraints, and the newest data available for modeling and projections.[17]

Recommendations

There are three significant focuses that ARPA-E can take to continue supporting LDES: funding pilot demonstrations for bridging grants, creating national standards and testing accessible across research institutions, and investing in socio-economic analyses like supply-chains and battery life-cycles that would otherwise restrict battery projects.

Pilot demonstrations of sustainable energy technologies have proven to successfully disperse knowledge amongst technologists and scientists, facilitate prototyping and scaling, and support policy gains and commercial market development in one fell swoop.[18] These demos can be brought under ARPA-E's umbrella of programs, but intent on combining with other programs at a federal level as a prerequisite. This way, both ARPA-E and federal programs can have combined effects for bringing the projects to completion through funding maximization. These

programs can also benefit from standards and testing that all research institutions have access to. Knowledge sharing is a strong facet of renewable technology success, and standards and testing increase an industry's ability to produce comparable, reproducible, and innovative results.[19,20] Finally, analyses that assess industry wide trends and links in R&D are funded primarily by private industry, then by governmental programs.[21] This is in contrast to basic research expenditures that historically were government funded, only to drop on par with private industry as recently as the past few years.[22] I propose that the funding shortfall in federal programs be proactively filled and supported by ARPA-E to fund studies on supply-chain, life-cycle, and other industry wide subject matter areas that benefit from assessment and feedback gathering.

Conclusion

Since 2009, ARPA-E has provided over 2.93 billion in R&D funding for more than 1,270 potential transformational energy projects.[23] Fiscal Year budget requests for 2025 appropriations would allocate 235 million to eight focused programs, and 65 million to seven exploratory topics.[24] This recommendation is without some granularity for exact figures and values to be calculated by experts at ARPA-E. In its implementation, we can expect to see this program set aside priorities for aligning with a prize like the *Energy Storage Innovations Prize*, strengthening projects ability to adapt their technology to commercial markets.[25] We can then expect to see standards and testing for those projects to be published under newly minted standards released and maintained by ARPA-E. Analysis for how supply chains and other industry barriers are being projected would round out the program to maximize the future of LDES growth and stability in our energy markets.

Notes

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