Comments of Fourth Power in Response to Massachusetts Department of Energy Resources ("DOER") 83E Stakeholder Questions

Introduction

Fourth Power appreciates DOER soliciting stakeholder feedback on the Section 83E energy storage procurement. Fourth Power is a Massachusetts-based company. Our thermal energy storage technology offers a groundbreaking solution by storing energy as heat in inexpensive carbon blocks at extremely high temperatures (up to 2400°C) and converting it back to electricity using thermophotovoltaic (TPV) cells. This allows for grid-scale energy storage that is several times cheaper than lithium-ion batteries, with durations from 5 to over 500 hours, depending on the needs of the local grid.

The key innovations enabling this approach are (1) a modular design that decouples energy and power, enabled by an all-graphite piping network circulating high-temperature liquid tin and (2) a patented approach to protecting TPV cells during extended exposure to extreme temperatures. Fourth Power's low cost, abundant materials, and flexible durations make it uniquely suited to providing the energy storage needed to deliver affordable, firm, clean power.

We are in the middle of our 100 kW-e/1MWh-e demonstration phase and have an agreement with one of the largest Investor-Owned Utilities in the US to build a 1 MW-e/10MWh-e pilot in 2027. We expect to build our first utility-scale 100 MW-e/1GWh-e project by 2029.

We are eager to grow our business in the Commonwealth and are encouraged by the expected procurement of 750 MW of 10-24 hour long-duration storage and 750 MW of 24-hour plus multi-day storage ("LDES/multi-day procurements").

Fourth Power Recommendations

Fourth Power recognizes that the stakeholder questions are focused on mid-duration storage (4-10 hr) applications. Therefore, our recommendations focus on the procedural steps that DOER can take to ensure the LDES/multi-day procurements deliver maximum value, and the use cases that DOER should consider when designing an LDES/multi-day procurement. DOER should decide the durations to procure based on the use cases that will deliver the greatest reliability, affordability, and decarbonization benefit and avoid letting the durations of different technologies dictate the use cases and the procurement.

Fourth Power recommends that DOER convene a series of workshops to identify and detail these use cases. At a minimum, we recommend inviting stakeholders from ISO-NE, Federal and Regional Energy Affairs "FREA" within MA EEA, the Attorney General's Office, the Clean Energy

Center ("CEC"), the Office of Energy Transformation, Department of Environmental Protection ("DEP"), Eversource, National Grid, LDES providers, and existing generation owners.

Here are just three of the services that Fourth Power envisions the Commonwealth procuring from LDES/multi-day storage:

1. **Peaker power plant replacement**: According to PSE Healthy Energy, who recently completed analysis titled "Replacing Peaker Plants with Energy Storage in Massachusetts," there are currently 21 oil- and gas-fired peaker power plants and peaking units at larger plants.[1] PSE states: "Just under half of Massachusetts peaker plants primarily burn oil, and most are over 30 years old—resulting in numerous inefficient plants with high rates of greenhouse gas and health-damaging pollutant emissions for every unit of electricity generated. Moreover, many of these plants are located disproportionately in urban, low-income and communities of color, where vulnerable populations already experience high levels of health and environmental burdens." According to PSE, these plants combine to emit over 800,000 tons of CO2 per year. Despite being peakers, 10 of the 21 plants run more than 40 times per year.

   Of these 21 plants, 19 of them have average run times of under 50 hours. There are several LDES technologies, including Fourth Power, which are expected to be capable for running this duration. A well-designed procurement, combined with regulations from DEP that governed emissions from peaking power plants, could lead to LDES reliably and cost-effectively replacing these peaking power plants.

   During workshops, stakeholders could discuss the attributes and generation profile of LDES that would be required to displace existing peaker plants.

2. **Winter reliability**. Winter reliability has been and will continue to be a concern in the New England region, with great costs for ratepayers. From 2023 through February 2025, ISO-NE has had an Inventoried Energy Program to provide incremental compensation to certain fossil fuel resources that maintain inventoried energy during cold periods. This program cost approximately $78M during the winter of 2023-24, with a similar cost expected for 2024-25.[2] ISO-NE also had a "Mystic Cost of Service" program, which cost approximately $750 million from June 2022-May 2024, that ensured the region would have access to sufficient LNG.[3] ISO-NE is also in the midst of their "Regional Energy Shortfall Threshold"

[1] The analysis can be found here: PSE Healthy Energy - Replacing Peaker Plants with Energy Storage in Massachusetts
[2] a09_mc_2024_07_09-10_2024_winter_qmr_imm_presentation.pdf
[3] mystic_cos_prelim_03_2024.pdf

initiative, which would reflect the region's level of risk tolerance with respect to energy shortfalls during extreme weather.

The region has depended on incremental investments in fossil fuel to maintain reliability, despite plans to decarbonize. Multi-Day LDES could help address winter reliability concerns by charging during shoulder periods of lower prices and system stress (e.g. November or early December) and storing energy that could be dispatched during an extended cold snap. Our understanding is that modeling to date has focused on a limited time period for when the LDES would charge. If the LDES were to charge in the middle of the winter, it could deplete gas supplies and fail to address the winter reliability challenges.

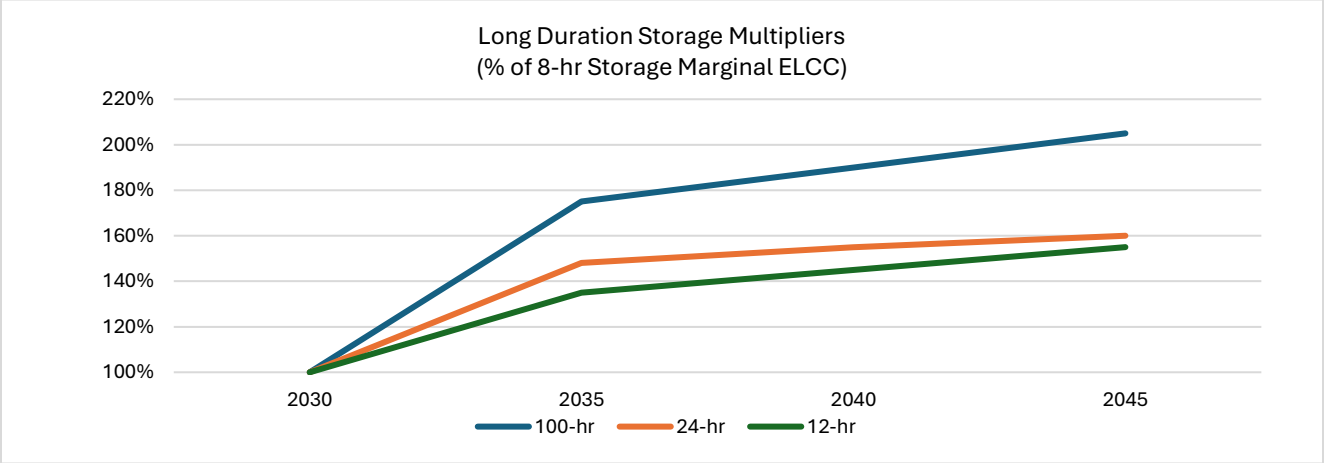
During a workshop, stakeholders could discuss how LDES could provide winter reliability, when it would need to charge, and the attributes and dispatch profile necessary for avoiding fossil investments.

3. **"Perfect Capacity**:" ISO-NE will soon be implementing "Effective Load Carrying Capability" ("ELCC") which could significantly de-rate the capacity value of 4-hr energy storage, perhaps by as much as 50% in 2028.[4] Under this de-rate, a 100 MW nameplate battery would only be able to sell 50 MW into the Forward Capacity Market. With electrification contributing to forecasted increases in peak demand, and expected retirements from generating resources, there will be a strong need for new capacity at affordable prices. LDES, which will have a high ELCC by virtue of its duration, could help fill this need. When cost-effective, Massachusetts could procure LDES that is able to add duration in response to changes in ELCC, such that it is always able to sell its full nameplate capacity into the market.

   The following graphic from a recent California PUC presentation illustrates the value of adding duration over the lifetime of a project.[5] Here, an 8-hr, 12-hr, 24-hr, and 100-hr battery start with similar ELCC value. Therefore, whether a battery is 8 hours or 100 hours, it provides a similar amount of capacity in 2030. If an 8-hour battery is the lowest cost, at that time, it will be the best investment for capacity purposes. However, by 2035, the 100-hour battery provides 180% of the capacity value of the 8-hour battery, and by 2045, is over 200%. While California and Massachusetts are likely to have different ELCC values, an LDES procurement in MA could include an option to add duration in response to changes in ELCC so that consumers avoid overpaying for capacity. Assuming the lifetime capacity

[4] Markets Committee Presentation from May 2024
[5] 2025 Draft I&A MAG. Slide 131

savings exceed the cost of adding duration, consumers would benefit from such a procurement.



Other potential LDES/multi-day use cases include but are not limited to:

a. Transmission deferral or avoidance. For example, to avoid curtailments of renewable energy, LDES could absorb excess renewable energy in parts of the grid that are export constrained and discharge the energy during periods where there is no constraint. LDES located on the distribution grid could also reduce demand during system peak hours and defer or avoid new transmission. For every 1 GW of peak demand reduction, ISO-NE has estimated this could lead to $750M-$1.5 B in savings.[6]
b. 24/7 carbon-free energy, where LDES charges during periods of higher renewable output and discharges during periods of lower renewable output
c. Resilience in areas of the grid that are prone to power outages

Conclusion

Fourth Power thanks DOER for the opportunity to comment and looks forward to collaborating with DOER and stakeholders on an effective LDES procurement. Please contact me if you have any questions.

Sincerely,

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[6] 2024_02_14_pac_2050_transmission_study_final.pdf (iso-ne.com). P. 16-17