Energy Storage For a Better World

March 27, 2025

SUBMITTED VIA EMAIL
Board.Secretary@BPU.NJ.Gov

Sherri L. Golden, Secretary of the Board
State of New Jersey
Board of Public Utilities
44 South Clinton Ave., 1 st Floor
PO Box 350
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RE: Docket Number QO24020126 – New Jersey Energy Master Plan

Dear Ms. Golden:

Form Energy, Inc. ("Form Energy") appreciates the opportunity to comment on the State of New Jersey's 2024 Energy Master Plan ("2024 EMP"). Form Energy supports the conclusion in the March 13, 2025 presentation on the Executive Summary Draft that investment in energy storage in New Jersey is a "no-regrets" action that can be taken to support the State's clean energy, economic development, affordability, and reliability goals. Longer duration storage technologies are also identified as a key need for the State to maintain reliability in the face of rapidly increasing electricity demand. These innovative storage technologies can dispatch energy for many hours and even days at a time without needing to be recharged. For the reasons detailed in these comments, Form Energy recommends that the 2024 Energy Master Plan establish new energy storage targets for long duration energy storage ("LDES") and multi-day storage ("MDS") technologies to be installed in New Jersey.

About Form Energy

Form Energy is a U.S. energy storage technology and manufacturing company that is commercializing a new class of multi-day energy storage systems that will enable a reliable and fully renewable electric grid year-round. Our first commercial product is an iron-air battery capable of continuously discharging electricity for 100 hours at rated capacity at a total installed cost per unit of energy that is less than 1/10th of today's lithium-ion battery technology. Form's battery can achieve these low costs by using iron, one of the most abundant and cheapest minerals. Our iron-air battery is modular, safe, and can be sited anywhere on the grid.

Different Energy Storage Resource Segments and their Attributes[1]

Energy storage is a broad resource type with three distinct and complementary segments. A least-cost, reliable power system requires a balanced portfolio of each separate class:

- Short-duration storage (<10-hr duration): provides short bursts of power to shift energy across a few minutes to a few hours within a day to enhance grid reliability
- Long-duration storage (≥10-hr duration): shifts long periods of excess energy produced at one point in a day to another point within the same or next day (diurnal energy shifting); also supports sub-hourly flexibility
- Multi-day storage (>24-hr duration): supports reliability during extended shortfalls of power (e.g. extreme weather, low renewables, or fuel constraints) by shifting energy across days to weeks; also supports sub-hourly and diurnal flexibility

Different technologies compete within each segment, and each segment has a different balance of power-capacity cost, energy-capacity cost, duration, and efficiency. Short-duration storage is primarily lithium-ion batteries and pumped hydro. Long-duration storage (LDES) includes electrochemical storage (batteries), mechanical, and thermal storage. Multi-day storage (MDS) includes different types of batteries, thermal storage, and fuel-based technologies.

Short-duration storage has relatively low installed cost per MW of rated power capacity, while multi-day storage has relatively low installed cost per MWh of rated energy capacity, and long-duration storage falls in the middle.[2] Because of this dynamic, storage programs that seem "technology neutral" may, in fact, favor one storage segment over others based solely on the valuation metric chosen. This is why it is important to separate storage technologies by duration class.

Benefits of LDES and MDS: Reduced Capacity Costs, Lower System Costs, Improved Reliability

- Reduced Capacity Costs: Form Energy recently conducted a case study analysis for a utility that found a multi-day storage system contributes to robust (1:1) peak demand reduction in all months of the year, thereby insulating the utility against high capacity costs; this is in contrast to a 4 hour li-ion system, which in some months could only reduce the monthly peak by 0.5 MW for every 1 MW deployed. This kind of peak demand reduction is especially valuable under volatile capacity market conditions such as those currently being experienced in PJM
- Lower system costs: long-duration and multi-day storage have high potential to lower total electric system costs by avoiding resource needs. This benefit occurs because

[1] *See* U.S. Department of Energy, Pathways to Commercial Liftoff: Long Duration Energy Storage, 2023
[2] *Id*. at p. 58, and also Li et al, The Influence of Regional Geophysical Resource Variability on the Value of Single- and Multistorage Technology Portfolios, Environmental Science & Technology, 2024, Figure 1, at https://pubs.acs.org/doi/10.1021/acs.est.3c10188

these resources maximize total useful renewable energy generation, which reduces total needs for new generating capacity and avoids the operating costs of expensive fossil fuel generators. Nationally, the U.S. The Department of Energy found that more one third of US storage needs will be from long-duration and multi-day storage as soon as 2030, and can cumulatively save $10-$20B annually in avoided costs by 2050.[3]

- Improved reliability: long-duration and multi-day storage strengthen grid reliability by providing *firm* capacity: they can discharge continuously during extended periods of grid stress when other resources are scarce and energy prices are high, such as multi-day heat waves and cold spells, fuel shortages, and renewable energy lulls.

Evidence of Minimum Initial Needs for LDES and MDS and Specific Procurement Targets

The DOE found that multi-day storage will comprise 28-35% of total U.S. storage needs between 2030-2050, and that both multi-day storage and long-duration storage combined will comprise 34-92% of total storage needs as part of a least-cost electric system, depending on forecast li-ion costs. This indicates that a no-regrets approach to designing storage procurement programs is to dedicate *at least* 30% of capacity for long-duration and multi-day energy storage *combined*, with flexibility to adjust that target based on improved future modeling.

Long-duration and multi-day energy storage must reach both commercial economies of scale and complete market saturation in less than 20 years to support states in achieving their clean energy, reliability, and energy affordability goals. Literature about the historic commercialization of new energy technologies found that policy support is needed for the first 10% to 20% of long-term market needs to help new resources achieve initial economies of scale.[4]

Several states have taken action to address this opportunity and need:

- California: Required state procurement of 1 GW of 12+ hour non-lithium-ion storage, and 1 GW of multi-day storage to lower system costs and market barriers[5]
- Massachusetts: Required utilities to contract for 5 GW of energy storage, including 750 MW of long-duration storage and 750 MW of multi-day energy storage[6]
- New York: Required that 600MW of the state's additional 3 GW of bulk energy storage procurement by 2030 be dedicated to long-duration storage (defined as 8+ hr duration)[7]

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[3] *Id.* at p. 1

[4] Gross, et al, 2018. *How long does innovation and commercialisation in the energy sectors take?* Energy Policy 123, 682-699, https://doi.org/10.1016/j.enpol.2018.08.061

[5] *See* California Public Utilities Commission (CPUC) Decision 24-08-064, Issued Aug 28, 2024 (Press release). California set this goal after a previous 1 GW goal for 8+ hr LDES resulted almost entirely in li-ion storage, and in recognition of multiple modeling and market barriers to LDEs.

[6] *See* S.2967, Act Promoting a Clean Energy Grid (signed Nov 20, 2024)

[7] *See* New York Public Service Commission Order Establishing Updated Energy Storage Goal and Deployment Policy, June 20, 2024, and August 29, 2024 Erratum Notice

- Virginia: Legislature passed a law requiring utilities to procure 2 GW of long-duration storage, 2 GW of multi-day energy storage, 6 GW of short-duration storage by end 2045, and 3,000 MWh of LDES pilots by 2030[8]
- Michigan: Found that 2.5 GW of long-duration and multi-day storage could replace 2.5 GW of existing fossil-fueled power plants, and utilities should make numerous modeling improvements to include these resources in the state's 2.5 GW storage target[9]

Barriers to LDES and MDS in PJM that Procurement Should Address

Long-duration and multi-day storage are at a different stages of commercial maturity than short-duration storage, and they face different market barriers than short-duration storage, chiefly that existing wholesale market services and state programs do not yet fully value the reliability benefits of long-duration and multi-day storage and their ability to lower system costs over the long-run.

- Capacity markets do not yet fully value LDES and MDS: PJM does not specify the incremental reliability value of LDES or MDS in capacity markets compared to short-duration storage, nor do they have market services that pay for firm capacity that can guarantee output during periods of grid stress. This undervalues LDES and MDS.
- Storage targets tend to seek only power in MW, not energy in MWh: Most states with energy storage targets (including NJ) establish goals and procurement programs in terms of MW, rather than MWh, without consideration for various storage duration classes.
- Renewable Portfolio Standards do not encourage *firm* renewables: Existing renewable energy programs usually value the lowest cost renewable energy credits (in $/MWh) regardless of when that energy is produced or if it's available at times when reliability risks and energy costs are highest. As a result, these programs *discourage* developers from proposing higher capital cost firm renewable resources (renewables paired with storage) that can provide higher availability, higher value energy to the system overall.

These barriers have discouraged developers from investing to bring long-duration and multi-day storage resources in New Jersey or the greater PJM region. With clear policy signals, developers could quickly deploy these resources, even prior to 2030 if using existing queue positions and surplus interconnection capacity.

Recommendations to Ensure LDES and MDS Are Fully Valued in New Jersey

Establishing three separate and complementary procurement targets will allow for competition within each energy storage resource class, while ensuring that each class develops at sufficient scale by 2035 to put New Jersey on a path to achieving its longer-term clean energy goals.

[8] *See* HB2537 / SB1394, adopted Feb 20, 2025, awaiting Governor signature
[9] Michigan Public Service Commission, Study of Long-Duration and Multi-day Energy Storage, 2025

Need For Separate Targets: Separate storage targets and procurement programs are essential because it is not possible for different storage segments to compete against each other based on a single, simplified price metric, whether $/MW or $/MWh, other than total portfolio value. Unfortunately, accurately calculating portfolio value would require more robust grid optimization capabilities than most states and utilities currently have.

The easiest solution is therefore to establish three separate and complementary procurement targets for the short-duration, long-duration and multi-day storage segments based on no-regrets estimated levels of future resource needs. Form Energy recommends that New Jersey set new LDES and MDS targets of installing 1,000 MW each by 2035. This will ensure that like storage resources compete against like resources, while promoting technology competition within each storage resource segment and ensuring that each segment develops at sufficient scale to put New Jersey on a path to achieving its clean energy goals while reducing impacts on ratepayers.

Conclusion

Thank you again for the opportunity to provide these comments. Form Energy is happy to work with the BPU on the development of the 2024 Energy Master Plan, and we welcome any questions or concerns.

Sincerely,

Sarah Jackson

Sarah Jackson
Senior Policy Manager
Form Energy