



March 20, 2019

Ms. Aida Camacho-Welch
Secretary
New Jersey Board of Public Utilities
Post Office Box 350
Trenton, New Jersey 08625

Re: New Jersey Energy Storage Analysis

Dear Ms. Camacho-Welch:

Thank you for the opportunity to offer comments in response to the request for stakeholder input on the New Jersey Energy Storage Analysis.

New Jersey Resources supports the goals of the Clean Energy Act, including the efforts to become a leader in storage deployment. Incorporating storage into the electric grid can provide a number of benefits, which we have discussed in the attached responses.

We look forward to participating in continued discussion about the implementation of battery storage in New Jersey.

Sincerely,

A handwritten signature in black ink, appearing to read 'Lawrence Barth', with a long, sweeping underline that extends to the right.

Lawrence Barth
Director-Corporate Strategy

CC: Mark Valori, Vice President, NJR Clean Energy Ventures
Chris Savastano, Managing Director – Development, NJR Clean Energy Ventures
Katie Feery, Manager – Corporate Strategy, New Jersey Resources

1. How might the implementation of renewable electric energy storage systems benefit ratepayers by providing emergency back-up power for essential services, offsetting peak loads, providing frequency regulation and stabilizing the electric distribution system?

Storage is a transformative technology that can enable an efficient, resilient, flexible and clean electric grid and change operating and business models in the electric utility industry.

With the ability to shift loads from peak to off-peak periods, storage has the potential to reduce costs and inefficiencies in an electric system designed and sized to meet peak demand. Storage can also be an enabler of a variable resource grid, providing flexibility to balance the output and improve utilization of intermittent renewables.

Reflecting current costs, market prices and market structures, the storage market today is in very early stages, with less than 1 gigawatt (GW) of installations in the United States representing less than 0.01 percent of total generating capacity. To support storage growth and meet its goals of 600 megawatts (MW) by 2021 and 2 GW by 2030, New Jersey will need to provide financial incentives to encourage market development.

2. How might the implementation of renewable electric energy storage systems promote the use of electric vehicles in New Jersey, and what might be the potential impact on renewable energy production in New Jersey?

Both stationary and mobile batteries in electric vehicles (EVs) can complement a variable resource grid with a high penetration of intermittent renewables. If properly integrated into the grid, mobile batteries have the potential to augment and even displace the need for some stationary storage. Early trials in the U.S. and Europe demonstrate that mobile storage has the potential to be recycled and reused as stationary storage devices. Stationary storage also has the potential to provide mobile storage devices with more flexibility and options. These synergistic effects can be better understood once the penetration rates of these technologies, along with renewables, increase from the relatively insignificant levels of today. Vehicle-to-Grid (V-to-G) and Vehicle-to-Home (V-to-H) protocols have been line tested in several U.S. trials thus far and should be part of the BPU's early policy and planning endeavors with respect to battery storage.

3. What types of energy storage technologies are currently being implemented in New Jersey and elsewhere?

Over the past five years, energy storage installations in the U.S. have been dominated by battery storage technologies. The following battery storage market data is sourced from the U.S. Energy Information Administration (EIA) and IHS-Markit.

- In total, the U.S. has approximately 1 GW of battery storage installed.
 - Nearly 450 MW were installed in the U.S. in 2018
 - 85 percent of all global battery installations in 2018 were lithium-ion technology

- 60 percent of projects have less than one hour of storage duration, only six percent support more than three hours
 - 88 percent of systems participate in frequency regulation markets, with PJM as largest market
 - Approximately half the systems are co-located with renewables, primarily solar
 - There is a relatively even distribution between transmission, distribution and behind-the-meter projects
- New Jersey has 7.3 MW installed, with 40 MW in late-stage planning or construction.

In addition to battery storage, there are other emerging storage technologies in development. Trials of Power-to-Gas (P-to-G) technologies and protocol development are ongoing in California and Western Europe to determine the effectiveness and costs for seasonal storage. The expected advantage of P-to-G storage is to gain resiliency through diversity of distribution utilizing existing infrastructure while maintaining a low/no carbon outcome.

4. What might be the benefits and costs to ratepayers, local governments, and electric public utilities associated with the development and implementation of additional energy storage technologies?

The transformative potential for storage was discussed in question 1. State incentives will be necessary to encourage storage development for the foreseeable future. Total costs can be determined after program targets and incentive levels are determined.

5. What might be the optimal amount of energy storage to be added in New Jersey over the next five years in order to provide the maximum benefit to ratepayers?

Until storage markets can function without incentives, the optimal amount of storage will need to be determined by policy, reflecting on the Clean Energy Act targets of 600 MW by 2021 and 2 GW by 2030. These policies must also consider the funding necessary to support storage incentives. In the absence of these incentives and program drivers, storage installations will be limited. The cost involved to incent stationary storage in New Jersey should be weighed against other alternatives that also provide or enhance flexibility and resiliency to the grid. These include fast response generation, additional energy exports, curtailment of renewables or load, peer-to-peer energy transactions or electric vehicles.

6. What might be the optimum points of entry into the electric distribution system for distributed energy resources (DER)?

The state should prioritize those segments of the market with high strategic relevance, low incentive requirements, ratepayer impacts and low barriers to entry. Based on the analysis of New Jersey Resources (NJR), the most promising segments for storage today include:

- Behind-the-meter commercial sites with predictable peak loads (for example hotels and hospitals), which can use storage to reduce monthly demand and allocated generation charges. Supplemental benefits may include demand response revenues and energy arbitrage in response to time-of-use rates. If paired with new solar to provide resiliency, storage projects are eligible for a 30 percent ITC (at declining rates after 2020), which can reduce the need for state incentives.
- Utilities can leverage storage as a “non-wires” alternative to defray the cost of transmission and distribution upgrades. Storage, when deployed to reduce congested or closed circuits constraining solar development, can be important in contributing to the state’s clean energy goals. Utilities can effectively direct storage resources to locations with have the greatest need, and leverage storage for supplemental revenue streams. A mix of utility and third-party-owned storage models should be considered to support utility needs.

In contrast, wholesale market economics for storage resources in PJM are more challenging:

- The daily spreads between on-peak and off-peak locational marginal prices (LMPs) are insufficient to support project economics on a standalone basis. Increased wholesale price volatility is possible with greater penetration of intermittent renewables; however, this is not likely to be the case in New Jersey until the 3,500 MW of offshore wind is installed.
- While storage could be a viable long-term alternative to meet system peak-capacity needs, in PJM, capacity market prices are well below the levels needed to support projects at today’s costs - even with cost declines expected over the next several years. PJM’s revised capacity market rules are also less favorable for batteries, requiring 10 hours of storage capacity to participate. This is beyond the economically-feasible range of four hours for storage projects today. Most storage projects could still participate in the market; however, capacity payments would be de-rated.
- The PJM frequency regulation market has supported storage project development to date. According to EIA, there were nearly 300 MW of batteries providing regulation service to PJM in 2018. According to the PJM interconnection queue, there are over 1.3 GW of solar plus storage projects that have applied for interconnection in New Jersey, reflecting developers’ desire to take advantage of the 30 percent ITC available for storage systems paired with solar.

It is questionable if much of this will be built given the oversupply in the regulation market, depressed prices, market risks and the limited potential for supplemental revenues from energy and capacity markets. While issues over local grid stability are possible with increased penetration of intermittent renewables, this does not necessarily translate to the need for more regulation services. The regulation market does not require

additional state incentives to support activity, nor is the need to stabilize PJM's grid frequency strategic for New Jersey.

The retail residential market poses its own economic challenges for several reasons:

- As a resiliency resource, solar paired with storage is more expensive and less reliable than other forms of backup generation.
- The spread between off-peak and on-peak time-of-use rates provides little incentive for load shifting under current time-of-use tariffs in the state. Price differentials need to be greater, with shorter peak time periods, to be a better match with battery costs and performance capabilities.
- Current net metering policy, which has been essential to supporting the growth of behind-the-meter solar, does not facilitate the need for storage. Any changes to net metering policy need to be comprehensively considered in context of clean energy goals, approaches to better value solar generation and the impact of new technologies including storage.

The Federal Energy Regulatory Commission's (FERC) recent Order 841 may create new opportunities for retail storage to participate in wholesale markets. Despite the challenges with these markets, the state may want to encourage the participation of residential storage systems to demonstrate the potential for DER markets. It might be necessary for utilities to play an intermediary role between retail participants and wholesale markets.

7. What might be the calculated cost to New Jersey's ratepayers of adding the optimal amount of energy storage?

As indicated in question 5, until storage markets can function without state incentives, the optimal amount of storage will need to be determined by policy, reflecting on the Clean Energy Act targets of 600 MW by 2021 and 2 GW by 2030. These policies should consider the funding necessary to support storage incentives relative to the competing uses for those funds.

In California, which is currently a national leader in the installation of energy storage systems, the state defined a total goal of 2 GW of storage by 2020 and established clear procurement megawatt goals for every two-year period through 2020. The state's utilities are responsible for achieving these goals, with a mix of utility-owned projects (capped at 50 percent of total) and procurements from third-party providers. To date, the state is on track to meet or exceed their goals. It will have taken 12 years since the initial passage of California's energy storage legislation to reach the targets, which is consistent with the timeline in New Jersey.

8. What might be the need for integration of DER into the electric distribution system?

Incorporating DER into the electric distribution system can provide clean, resilient, cost-effective alternatives to new supply. As the penetration of intermittent renewables increases, DER resources can play an important role in balancing supply and demand.

9. How might DER be incorporated into the electric distribution system in the most efficient and cost-effective manner?

The response to question 6 indicated opportunities by market segment, including leveraging storage in commercial buildings to reduce demand charges and as a non-wires alternative for utilities to defer transmission and distribution investments. Incentives will be needed to support project economics and private and utility ownership models should be considered.

10. In the context of the ESA, what might be the definition of Energy Storage?

We agree with the definition in FERC Order No. 841, which defined storage as “a resource capable of receiving electric energy from the grid and storing it for later injection of electricity back to the grid.” The FERC interpretation accommodates resources located on transmission, distribution system, or behind-the-meter systems, and is technology neutral.

11. What discharge time duration could be applied to the State goals of 600 MW of energy storage by 2021 and 2,000 MW of energy storage by 2030? Four hours? Ten hours? Other?

The appropriate discharge time will vary based on the application of the energy storage system. Other than large-scale pumped storage systems, most batteries are designed to support up to four hours of storage and should be sufficient for most applications. A sliding scale incentive value, based on the duration of the battery, could be considered.

12. What storage systems should be counted towards the achievement of the State’s goal? Existing systems? Those systems placed into operation after the May 23, 2018 enactment date of the statute?

While technology neutral, we would recommend that New Jersey focus its efforts on developing a program and designing incentives to support battery storage applications. Thereafter, the program can be broadened to accommodate other types of storage technologies. Incentives should be limited to new systems. Given only 7.5 MW installed, this should be a minor issue.

13. How might Federal Energy Regulatory Commission’s (FERC) Order 841 and the associated PJM compliance filing affect the foregoing?

The order specifically outlines that electric storage resources cannot be discriminated against in providing all types of capacity, energy and ancillary services. Battery energy storage resources as small as 100 kilowatts will be permitted to participate, be able to set prices as generation and

load, and be allowed to resell power into markets at the LMP. A formal challenge is pending, as to whether the order applies to distribution-connected storage resources, which are largely beyond FERC's jurisdiction.

A current limitation of PJM's compliance filing for Order 841 is that resources must have a 10-hour minimum to bid into capacity markets, which will limit the revenue potential for most battery technologies today. PJM's requirements are well above those of ISO New England (2-hour), New York ISO (4-hour), and Midcontinent ISO (4-hour).

Thank you for the opportunity to share our insights with you on this important issue. NJR welcomes further discussion or questions on any of the items above and looks forward to the release of the draft storage analysis.