SUNPOWER®

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Board of Public Utilities
44 South Clinton Avenue, 3rd Floor, Suite 314
Trenton, NJ 08625

BPU Energy Storage Policy Staff:

SunPower Corporation respectfully submits written comments in response to the Board of Public Utility's request for comments to help inform the Board's Energy Storage Analysis.

SunPower is a global technology company and the largest US solar panel manufacturer. We employ over 7,000 employees worldwide, and produce the world's highest efficiency solar photovoltaic panel technology that is commercially available. In addition to directly developing commercial solar for Fortune 100/500 businesses, SunPower brings solar panels to market through an extensive national dealer network consisting of over 500 small businesses. In NJ, SunPower has a regional office in Hamilton, and 24 local companies in our dealer network, who develop and install residential and commercial projects, representing several hundred full-time workers in the state.

SunPower is part of the growing trend of developing solar projects paired with energy storage. We have experience bringing solar plus storage projects to market across the US. We offer answers to the questions, below. Please reach out to us for further comment and discussion. SunPower would welcome the opportunity to be more involved in the public Energy Storage Analysis process.

Sincerely,

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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?**

   Emergency Back-up Power for Essential Services
   Energy storage systems can be used in place of, or as a supplement to, traditional backup generators (diesel, natural gas, etc.), and have the added benefits of zero on-site greenhouse gas (GHG) emissions with virtually instantaneous dispatch. However, as energy-finite resources, energy storage systems cannot be relied upon solely to provide back-up power for extended periods of time (e.g., 12+ hours). Additionally, it is not possible to "stack" the benefits of energy storage backup power with other use cases for individual energy storage systems. Energy capacity reserved for back-up power cannot be used, for instance, to provide grid services or peak load shaving, in that an emergency event may occur immediately after an energy dispatch event for another use case, at which time a storage system may be too depleted to perform its emergency power obligation.

   For these reasons, emergency back-up power should not be a blanket requirement of all energy storage systems participating in a state-sponsored energy storage program. Owing to the opportunity cost of performing back-up power services, a separate funding source should be established to enable energy storage back-up power systems to be deployed cost-effectively. Developers of energy storage systems should also be given the opportunity to provide emergency back-up power during specific windows of time, rather than all hours, in exchange for a prorated share of emergency back-up power funding. For instance, a developer may choose to provide back-up power for an essential services facility during the months of January – June, or during the hours of 8 p.m. – 8 a.m., and in exchange would receive half the emergency back-up power funding as an energy storage system providing back-up services during all hours of the year. This will enable developers to make informed business decisions about the provision of emergency back-up power without entirely foregoing other storage use cases.

   Offsetting Peak Loads
   Energy storage systems can be very effective in offsetting peak loads for specific pre-determined durations. Energy storage systems have unique advantages regarding response time and the ability to closely match power dispatch to variations in load, and so are particularly useful in accommodating dramatic swings in load and covering absolute load peaks (e.g., candidate hours for the PJM 5 coincident peak hours). However, the energy-finite nature of energy storage systems makes them less well suited to coverage of peak events that are protracted or subject to great variations in length of time.

   Any state program framed around energy storage systems providing peak load offset should take advantage of energy storage devices' intrinsic dispatch speed and operational flexibility while mitigating their relative shortcomings as energy-finite resources. Program designers should also keep in mind that the very highest peak hours (e.g., PJM 5 CP hours) are extremely costly to ratepayers relative to other hours of the year, and so peak load coverage via energy storage is subject to diminishing returns. For that reason, we recommend that a storage peak load offset program have a short runtime requirement (e.g., 2 – 4 hours), or otherwise conform funding to an approximation of peak load offset value relative to maximum power and energy capacities. We would refer program designers to methodology used to calculate the Energy Storage Adder as part of the Solar Massachusetts Renewable Target (SMART) program.

Similar to the compensation structure for energy resources participating in capacity markets in PJM and other ISO/RTO's, peak load-offsetting energy storage systems should be paid for their availability to perform during peak periods, rather than on a $/MWh energy dispatch basis. This is because peak loads are variable within reasonably predictable hours, and so resources should be held back until they are determined to be necessary to mitigate actual peak events, while project developers and investors rely on predictable revenue streams when making business decisions about where to locate resources. In order to accommodate both interests, program designers could establish certain peak windows (e.g., 2 – 6 p.m.), during which resources would be available to dispatch up to their nameplate energy capacity at the direction of program administrators.

Providing Frequency Regulation and Stabilizing the Electric Distribution System

Frequency regulation was one of the first and most successful use cases for energy storage systems in the United States, particularly in PJM. However, because of the relatively small size of the frequency regulation market (1% of the annual cost of the PJM capacity market) and the very high compensation rates of FR market participation for a period of time, the market proved unreliable as a sustainable core revenue stream for ongoing storage project development. Any state-level program designed to support the enrollment of energy storage systems in PJM's regulation market should seek to mitigate the volatility of participation in that program.

Because PJM's Frequency Regulation program is geared toward supporting grid stability at the transmission level, program designers may consider a separate program design specific to frequency regulation the distribution level. Distribution grid conditions can vary substantially from substation to substation and even circuit to circuit, so program designers may consider implementing specific non-wire alternative (NWA) solicitations for areas of the grid in which storage may prove a viable and cost-competitive alternative to traditional grid upgrades, similar to the programs implemented in New York State. However, for these NWA solicitations to be effective, they would need to be well-scoped (specifically defined energy capacity, power capacity, and point of injection requirements) and long-term, with a cost-to-compare in excess of 10 years, as traditional solutions are generally evaluated on a 20+ year life cycle. Prospective bidders should also be given information on the cost of a traditional upgrade to address grid stability, so they can make informed business decisions about the scope and types of energy storage solutions to offer on a competitive basis.

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?**

   In the next 10+ years, New Jersey and the rest of the region and nation are likely to see substantial changes in system load behavior due to the electrification of the vehicle fleet. New Jersey has the opportunity to plan for this change through the programmatic support of the development of renewable energy resources paired with energy storage systems to meet the additional demand for electricity caused by EV charging.

   Changes in load patterns will be one of the largest impacts of increased EV deployment. We do not yet know how those load patterns will change, since EV charging infrastructure has largely not been deployed. EV charging stations at commercial locations (i.e., offices, shopping malls) could lead to an increase in daytime load. EV charging stations at residential locations (single- and multi-family homes) would lead to increases in late afternoon, evening and overnight load. Energy storage deployment, whether paired with renewable generation or not, could be co-located with EV charging infrastructure to help off-set the increased load from charging. For increases in daytime load, renewables such as solar paired with storage could help charge EVs in order to lessen grid energy demand. At night, energy storage will be essential to any effort to minimize load curve increases, and consumers can be benefited from owning or hosting solar plus storage systems that help charge their EV.

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

   In NJ and elsewhere, the majority of new energy storage resources in implementation or development are based on lithium ion cell technology. Exact chemistries vary by manufacturer (e.g., Li-cobalt, lithium manganese oxide, lithium iron phosphate, etc.), each with a different set of operational characteristics and ancillary system designs (e.g., containers, cooling systems, controls, etc.), but the core technology is the same in most commercially deployed systems. We look forward to more nascent storage technologies (e.g., flow batteries) are achieving commercial availability and economic viability in the coming years.

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?**

   As discussed above, energy storage systems offer benefits to the grid – and so to ratepayers, local governments, and utilities – the form of very fast dispatch and operational flexibility. Programmatic investments made in energy storage systems have the potential to offset investments in higher-cost, more GHG-intensive traditional generation resources and grid infrastructure. We encourage program designers to develop evaluation frameworks in which energy storage resources can be compared to traditional grid resources on an “apples-to-apples” basis with traditional resources, including specific performance requirements (e.g., historical dispatch events, duration, and timing) and project life-cycles.

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?

We believe the State goal of 600 MW of energy storage by 2021 in year is an ambitious and achievable goal that will drive storage project deployments at speed and scale, progressively reducing development costs to the benefit of ratepayers. By contrast, the goal of 2,000 MW by 2030 would equate to a slowing of deployments on an annualized basis relative to the 2021 goal (~133 MW/year), which would create incentive for storage project developers to focus on deployments in NJ after 2021, reducing competition and raising cost to ratepayers on a per-MW unit basis. For that reason, we believe the 2,000 MW goal should be pulled in to 2025, accelerating the rate of deployment and reducing ratepayer cost.

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

Certain points of interconnection with the electric distribution offer specific advantages, such as co-location with intermittent renewable resources to smooth generation and take advantage of tax benefits to reduce ratepayer cost, or location within load pockets with acute energy import congestion during specific timeframes that could be lessened with load-shaving storage. We encourage program designers to investigate specific areas of the distribution system to determine locations where storage might offer the most value through the supporting the local grid via NWA projects. Program designers might also choose to allocate a greater share of funding to areas where ratepayers bear a greater-than-average cost of service from both generation and delivery.

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

The answer to this question is contingent upon the specific size of individual storage deployments and the use cases they serve. We look forward to further discussions with program designers regarding ratepayer impact in the context of specific program structures, timeframes, and capacities.

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

Integration of DERs into the electric distribution system can create benefits for the grid that cannot be realized through the deployment of resources at the transmission level. For instance, the transmission system operator (PJM) is responsible for procuring adequate energy and capacity to serve load aggregated at the zonal level, but it does not have direct control over the distribution system used to deliver that generation and capacity to individual end users. DERs can be used to "fine-tune" generation, capacity, power quality, and other essential grid products at the distribution level, and in doing so defer the cost of traditional distribution grid upgrades and/or additional transmission service to support load pockets.

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

We encourage program designers to remain neutral to the specifics of DER deployments (size, location, behind-the-meter or stand-alone, renewables colocation, etc.), and instead assign funding based on the value created by specific use cases, allowing developers to make business decisions resulting in the most efficient and cost-effective deployment of individual assets and portfolios of resources.

The Board should ensure that this incorporation process is as clear and streamlined as possible. Utility interconnection applications and reviews should not discriminate against renewable projects paired with energy storage. Unnecessary delays and indefinite discussions with an electric company in the absence of clear rules and standards drives up costs to the end customer, and can also discourage private sector engagement in the state.

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

"Energy Storage" should be defined as any device capable of absorbing energy from the grid or a collocated generation resource, storing that energy for a sustained period of time (e.g., 24+ hours) at with a high level of efficiency (e.g., 80%), and dispatching that energy back to the grid in an active and controlled fashion. Beyond these common operation requirements, the ESA should be technology-agnostic.

Resources intrinsically capable of independent energy generation should not be categorized as Energy Storage; however, Energy Storage systems located behind the same point of common coupling with the distribution system as generation resources should not be prevented from participation in the ESA. Energy Storage devices co-located with generation resources should be allowed to have either AC-coupled or DC-coupled configurations and have equal treatment by the ESA for all programs for which they can demonstrate compliance with operational requirements.

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?**

As discussed in our response to Question #1 above, the value streams available to an energy storage device diminish as a function of duration. In this way, a 10-hour storage system offers less value to the grid than a 2-hour storage system on a per-MWh basis. If program designers established a 10-hour minimum duration for energy storage systems, the resulting program would very likely either fail to meet MW deployment goals or over-compensate the resources used to meet those goals.

For this reason, we recommend either establishing a relatively short minimum duration requirement (e.g., 2 hours) and establishing calculations for additional funding as a function of longer runtimes, as in the SMART program implemented by the Commonwealth of Massachusetts.

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?**

We recommend that only those storage systems placed in operation after enactment of the statute be counted toward the achievement of the State's goal.

13. **How might Federal Energy Regulatory Commission's (FERC) Order 841[2] and the associated PJM compliance filing affect the foregoing?**

Implementation of FERC Order 841 may create opportunities to co-optimize performance of energy storage systems in PJM wholesale markets with performance under State-sponsored programs. In order to facilitate this co-optimization, program designers should tailor programs to complement PJM requirements (e.g., implement programs with shorter duration requirements than PJM's 10-hour requirement for capacity market participation), rather than simply duplicating PJM's requirements for specific programs.