Intelligent Generation

September 13, 2023

Sherri L. Golden, Secretary of the Board
State of New Jersey Board of Public Utilities
44 South Clinton Ave, 1st Floor
PO Box 305
Trenton NJ 08625

RE: Docket No. QO22080540; In the Matter of the New Jersey Energy Storage Incentive Program

Dear Ms. Golden,

Intelligent Generation (IG) is pleased to provide these responses to the Request for Information regarding the Straw Proposal on the New Jersey Energy Storage Incentive Program (NJ SIP).

IG provides a software platform that maximizes economic returns for solar plus storage projects developed for commercial and industrial customers. IG was founded in Chicago in 2009 and has been a pioneer in behind the meter (BTM) energy storage within PJM since 2014. IG's "firsts" include:

2014: First BTM energy storage project to participate in the PJM frequency regulation (FR) market.
2015: First VPP (BTM aggregated dispatch group) to participate in the PJM FR market.
2016: First municipal BTM project resuling in new rule codification in PJM Manual 14d Appendix A.
2017: First demonstration of the BTM value stack (NITS/capacity charge reduction, FR) in PJM.
2018: First PJM fleet including both BTM and utility-sided energy storage projects.
2022: First BTM energy storage project in Midcontinent ISO (MISO).

Presently, IG manages a fleet of 15 assets either in operation or under construction, all within the commercial and industrial space. IG played a role in drafting sections pertaining to energy storage for Illinois' Climate and Equitable Jobs Act (CEJA), widely regarded as the most progressive state-level climate legislation in the U.S. We have a 10-year history of engaging in the interplay between state and federal incentives, utiltiy and RTO processes (e.g. interconnection), and PUC and FERC jurisdiction.

The responses provided here were drafted by Jay Marhoefer, co-founder and CEO of IG. Mr. Marhoefer is the author of "Re-energizing America," published in 2007, which coined the term "Intelligent Generation" and predicted many of today's energy trends, e.g. autonomous vehicles. He patented the energy storage value stack in 2009 and holds three additional patents. Mr. Marhoefer testified before the Illinois legislature to promote the "smart grid" bill that became law in 2011, and recently provided expert testimony to the Illinois ICC regarding the implementation of CEJA.

Thank you for the opportunity to contribute to the design of this important program.

Sincerely,

Jay Marhoefer
Co-founder & CEO

1.0 Utility Ownership/Dispatch Control

1.1 What are the advantages and disadvantages of utility control versus non-utility control of energy storage systems?

Advantages of Utility Control

Centralized decision-making would likely result in enhanced grid reliability, optimized dispatch control, and better grid management. It may create a more predictable environment for software algorithms, e.g., coincident peak prediction by large C&I customers.

Disadvantages of Utility Control

- Lack of Flexibility: May not always prioritize the economics for end-users and market value of competing wholesale and retail interests (e.g. capacity performance vs. demand charge reduction).
- Economic mismatches between NJ utilities: For example, wide disparity between capacity and transmission prices between PSE&G and JCP could result in zonal imbalances that affect statewide power quality and reliability.
- Potential for monopolistic behavior: Even though EDCs will not be allowed to own ESS's if the Straw is implemented, there may not be limits on their ability to use the fleet of ESS's in suboptimal ways, e.g., as energy resources rather than reserves.
- Potential for less responsiveness to market signals: there may be times when the utility may deem the needs of the zone to be greater than the needs of either the state or RTO despite price signals to the contrary.

Advantages of Non-Utility Control

- Economic Value: Prioritizes responsiveness to market signals for end-users in terms of bill savings and revenues from PJM.
- Innovation: Enables platforms to provide more optimized solutions particularly for aggregated behind the meter assets.
- Increased competition: Examples like PJM's reverse Dutch auction for frequency regulation and the California SCHIP program suggest that market-based storage will provide overall lower pricing to end customers than monopolistic practices.

Disadvantages of Non-Utility Control

Fragmented control might lead to conflicting optimization goals across the grid.

1.2 For Distributed resource Performance-based Incentives, should responding to a utility signal be compulsory or voluntary?

Response should be voluntary in almost all situations to encourage participation while allowing customers to weigh the economic benefits of responding against any potential operational impacts. There may be certain emergency situations such as a PJM maximum generation alert in which participation is compulsory, but these should be exceptions, not the rule. Distributed resources should be eligible for aggregation, which enhances reliability (unlike Grid Supply resources); an aggregation operator can then commit all or a portion of the fleet.

1.3 For Grid Supply resources Performance-based Incentives, should responding to a market signal be compulsory or voluntary?

Generally, a grid supply resource will not have retail economic considerations that would influence a participation decision. Participation should still be voluntary in all but emergency situations, allowing for maintenance, etc., but incentives can be structured to strongly encourage participation.

2.0 Installed Storage Targets, Deployment Timelines, and Capacity Blocks

2.1 How should capacity blocks be structured and proportioned, both within each component of the NJ SIP (Grid Supply and Distributed) and relative to each other?

Based on the comparable experience of the Illinois SREC market, a likely breakout would be:

- 25% utility scale (>10 MW)
- 25% large commercial (500 kW – 10 MW)
- 25% small commercial (25 kW – 500 kW)
- 25% residential (up to 25 kW

It must be noted that there is presently a dearth of price economic “off the shelf” battery projects between the range of a Tesla Powerwall (10 kW) and a starting C&I battery size (500 kW). Incentives may need to be priced appropriately to take into account the higher installed cost per Watt of the below 500 kW market blocks in order to encourage participation for those segments. That said, we recommend emphasizing “behind the meter” batteries for more than a majority of the first allotment given that the PJM interconnection queue for utility-scale batteries is 3 years or more.

2.2 *Should the proposed first-come, first-served application process be changed to a “First Ready, First-Served” process?*

As suggested previously, "First Ready, First-Served" would improve the likelihood of achieving the 2 GW goal in the desired timeframe given the multiyear backlog in the PJM interconnection queue for utility-scale projects. Comparable experience for solar in Illinois suggests that many applications will be submitted just to hold a place in line without funding or in some cases, customer commitment. Thus, a “First Ready, First Served” process would require milestones proving good faith with perhaps a carveout for those projects subject to the PJM interconnection queue.

2.3 *How should the program be designed to avoid or minimize interconnection delays? Should the interconnection process be modified for accommodating energy storage and if so, how?*

Illinois is mandating that all DG projects (including storage) which a pre-application process documents do not exceed a certain percentage of a feeder’s peak load must be granted a Level 2 status (a mandated 60-day interconnection process without supplemental review) vs. a Level 4 status (205-day interconnection process that could be subject to supplemental review).

To avoid delays, establish a clear set of rules upfront and provide redacted information to any potential applicant in a pre-application mode regarding the capacity of existing and proposed DG on a circuit. Then adopt something comparable to Illinois that mandates a 60-day period if certain criteria and thresholds apply.

3.0 Incentive Structure

3.1 *Incentives are meant to cover a portion of the fully installed cost of an energy storage system. What is the fully installed unit cost (in $/kWh) for energy storage systems at present, and estimated to be each year through 2030? How do New Jersey-specific costs vary from these estimates? Please provide links to your references.*

Presently one of the best estimating tools is from PNNL (Pacific Northwest National Laboratory) https://www.pnnl.gov/ESGC-cost-performance They estimate a total installed cost for a 1 MW, 4 hour Li-ion battery today to be between $1.8 -$2.2 million. In 2030, these costs range from $1.3-$1.7 million. Interpolation between these two points will provide costs for each interim year.

Lithium-ion NMC , 1 MW, 4 hr
Costs & Performance Parameters

	2021			2030		
	Low Estimate	Point Estimate	High Estimate	Low Estimate	Point Estimate	High Estimate
DC Storage Block ($/kWh)	$193.99	$215.55	$237.10	$117.46	$141.05	$160.95
DC Storage BOS ($/kWh)	$37.19	$41.32	$45.45	$27.04	$30.85	$35.06
Power Equipment ($/kW)	$76.18	$84.65	$93.11	$63.21	$74.88	$78.04
C&C ($/kW)	$36.01	$40.01	$44.01	$26.18	$29.87	$33.95
Systems Integration ($/kWh)	$50.95	$56.61	$62.27	$44.13	$48.03	$52.18
EPC ($/kWh)	$62.03	$68.93	$75.82	$53.73	$58.48	$63.54
Project Development ($/kWh)	$74.44	$82.71	$90.98	$64.48	$70.18	$76.25
Grid Integration ($/kW)	$27.85	$30.94	$34.04	$24.12	$26.25	$28.53
Total Installed Cost ($/kWh)	$453.61	$504.01	$554.41	$335.22	$381.35	$423.12
Total Installed Cost ($/kW)	$1,814	$2,016	$2,218	$1,341	$1,525	$1,692
Fixed O&M ($/kW-year)	$5.04	$5.60	$6.16	$4.37	$4.75	$5.16
Warranty ($/kWh-yr)	$2.91	$3.23	$3.56	$1.76	$2.12	$2.41

Duration hr
- 2 hr
- 4 hr (selected)
- 6 hr
- 8 hr
- 10 hr
- 24 hr
- 100 hr

Power MW
- 1 MW (selected)
- 10 MW
- 100 MW
- 1,000 MW

New Jersey-specific factors including labor, regulatory and permitting costs, environmental studies and local requirements have the potential to alter these estimates.

3.2 *What are the best public data sets for energy storage costs?*

In addition to PNNL, NREL, EIA and the DOE's Energy Storage database are good public sources. Up to date pricing information should be forthcoming from the RE+ conference that is occurring at the time of this submission.

3.3 *Should Fixed Incentives be assignable to an aggregator? Why or why not?*

Generally, fixed incentives should vest in the owner of the project – the end user or a third party. That said, if assignment to an aggregator can streamline the management and distribution of incentives, then it could be desirable if safeguards are in place to ensure that end users benefit.

3.4 *Should a Distributed energy storage resource that can provide grid services have the ability to opt in to either the Grid Supply or the Distributed storage program, for both the Fixed and Performance-based incentives?*

Fundamentally, an ESS can be behind-the-meter or utility-sided – it cannot be both. Behind the meter storage has been providing grid services like frequency regulation in PJM since 2014. Notably, behind the meter storage can provide both retail benefits (bill savings) and power market revenues for grid services (ancillary services, capacity performance) but Grid Supply can provide only wholesale benefits.

3.5 *The Straw proposes the use of the PJM Marginal Emission Rate ("MER") signal as a basis for Performance-based Incentives for Grid Supply energy storage systems. Is or will the PJM MER be sufficiently developed to use to calculate NJ SIP Performance-based Incentives?*

Realistically, given that it will likely be 3 years before the first utility-sided ESS projects are commissioned (given the PJM interconnection queue), it is likely that the MER will be sufficiently developed by that time.

3.6 *Is there a different methodology that can be used to determine Performance-based Incentives, such as a Peak Demand Reduction program?*

The design of these incentives begins with the determination of what is mandatory versus what is voluntary and the characteristics of performance New Jersey seeks to reward, e.g., reliability, timeliness, capacity.

3.7 *If a Peak Demand Reduction program were to be developed, how should it be structured? What other states have similar programs that New Jersey should use as a benchmark?*

California and New York provide benchmarks for this, including performance tiers and higher incentives for better peak shaving. PJM also informs this process in the evolution of its Capacity Performance program (and its associated plusses and minuses).

3.8 *What degree/percentage of Peak Demand should be targeted for reduction? What effect would such a program have on GHG emissions?*

More data is required to give an informed answer to this question. That said, such an examination begins with the amount of excess capacity and various spinning reserve levels presently performed by CT generation. Properly administered, 2 GW of 4-hour ESS could significantly reduce the need for spinning/synchronous reserve performed by CT generators by providing a window to fire up such plants when needed rather than keeping them running. A good analogy is found in the reduction in GHG that results by ESS substituting for CTs for frequency regulation.

3.9 *The Straw proposed that each EDC establish its own level of Performance-based Incentives. Should EDCs establish EDC-specific performance incentives, or should the incentive be standardized and common to all EDCs?*

Such planning should be integrated and statewide. New Jersey is comparable to Illinois in that there is a predominant utility (ComEd in Illinois, PSEG in NJ) and several smaller utilities (e.g., Ameren, Jersey Central respectively). The Illinois example is further instructive in that it is the only state that has both PJM and MISO EDCs. A review of Illinois' Climate and Equitable Jobs Act (CEJA) illustrates situations where incentives are the same for all utilities, and where they are different.

3.10 *Should energy storage owners be permitted to opt in, or be subject to utility control, in order to be eligible for Distributed performance incentives?*

Opting in and subjection to utility control suggests that energy storage would be similar to load interruption programs, but storage is really quite different it is supply response rather than demand response. Energy storage is generally a multimillion capital investment, and such projects are not approved unless there is some type of certainty related to the delivery of economic value. In major sections of New Jersey, the incentive comes from the effective use of (behind the meter) storage to reduce capacity and transmission charges. Opting into utility control would have to provide economic potential comparable to the retail and wholesale benefits an ESS owner could achieve through voluntary operation.

3.11 *How should incentives be structured for thermal storage systems?*

We do not have an opinion on this topic.

3.12 *Under what circumstances, if any, should Distributed resources be able to opt into Grid Supply Performance-based Incentives?*

As mentioned previously, a distributed C&I resource, especially if aggregated, can by its nature provide grid supply services and thus no prohibition should exist. The one exception would be residential, in which case requiring a minimum aggregation of 100 kW makes sense, as this is the threshold for participation in PJM wholesale markets.

3.13 *Large projects and long duration projects have the potential to qualify for significant incentives. Should incentive caps be applied in this program? If so, how (for example, by customer, project, developer, duration or meter), or other method?*

Our recommendation is to contact the Illinois Power Agency, which has administered the state's bloc grant program since 2017, to discuss with them how to structure the program. An excellent analogy for the "large projects" cited here is community solar in Illinois which was vastly oversubscribed. Long duration storage -defined as anything over 8 hours – provides diminishing returns for anything other than backup and black start. The reality is that an 8-hour battery, given a price point of $1/watt, is the equivalent of a peaker plant for purpose of NITS and capacity reduction in a 5 coincident peak assessment environment.

3.14 14 *Should a cap be set such that the sum of federal and state incentives does not exceed a certain amount? If so, please provide details.*

The answer to this question depends on what you want to incentivize. Large projects generally have large tax appetites, lower capital costs per kWh and lower costs of capital. A residential storage system is likely to be 50%-100% more expensive on a cost per kWh basis than a 20 MW project. With the same incentives regardless of project size, you are more likely to have 20 100 MW projects to fulfill the 2 GW requirement because per unit project costs (all in) are likely to be less. This is obviously not optimal, as you want a diverse mix of storage assets across both the transmission and distribution system.

3.15 *What provisions should be included in the program for monitoring, reporting and evaluation in order for deployed projects to maintain eligibility for incentives that are paid over time?*

Both PJM (for both telemetry-measured services and those without dispatch) and states engaged in SREC compliance (like New Jersey) likely can provide best practices for compliance.

3.16 *How can BPU structure NJ SIP Performance-based Incentives to both promote value stacking and prevent double compensation?*

The value stack primarily applies to behind the meter storage because it can deliver both retail benefits (bill savings) and wholesale benefits (power market revenues). Generally, a BTM ESS will opt for the application that delivers the highest economic value. For example, a 1 MW 4-hour battery will opt to reduce load on a predicted coincident peak day in PSEG rather than participate in frequency regulation given the economic value of the megawatt-year reduction for NITS and capacity.

One thought is that incentives should thus be structured comparable to PJM's "uplift" to compensate storage for providing lower economic value services that might have higher importance to the EDC because of issues like grid reliability. Generally, economics will take care of the rest.

4.0 Overburdened Community Incentives

4.1 *Staff is considering establishing both an adder and a capacity block for OBCs. What size should the capacity blocks be over time as a percentage of the overall Distributed segment? How much should the adder be in 1) $/kWh or 2) as a percentage of the base incentive?*

Using the Illinois CEJA law as a guide, a capacity block of 10-15% of the distributed segment with an adder of 10-20% of the base incentive would be in order.

4.2 *How can BPU assure that the incentive structure chosen will in fact provide benefits to OBCs?*

Again, an analogous measure in Illinois CEJA mandates a commission and at least an annual hearing before the ICC to assess compliance.

5.0 Other Questions

5.1 *What actions, if any, should BPU take to improve access to the energy storage value stack as part of implementing the NJ SIP?*

In our experience, the murkiness between state vs FERC jurisdiction can lead to issues and contention. One example is net metering. A C&I customer should be allowed to install solar plus storage capability that can offset the entirety of peak load on coincident peak days, which means the system is "oversized" for most other days of the year. In these situations, if the solar is allowed to net meter, then the battery must be allowed to net meter as well – even if the owner cannot prove the battery was charged by the solar. The cardinal rule here is that electrons are fungible but not taggable, and reasonableness for value stack purposes should be assessed on a rational basis standard.

5.2 *How will Federal Energy Regulatory Commission ("FERC") Order 2222 affect New Jersey's energy storage market? What changes should the Board make to the NJ SIP to take advantage of PJM's pending implementation of FERC Order 2222?*

As stated above, the first thing to do is to treat grid injection by a BTM battery as a retail event, i.e., net metering, even if the battery is engaging in a wholesale transaction like frequency regulation that may be subject to FERC jurisdiction. In fact, this is one of the first applications contemplated by PJM in its FERC 2222 compliance filing.

5.3 *Are modifications to the NJ SIP needed to maximize the ability of energy storage developers to access federal investment tax credits or other federal incentives?*

Not at this time.

5.4 *What provisions, if any, should be established for interconnection of zero-export energy storage facilities (that is, energy storage facilities that do not inject power back into the grid and only supply power to on-site load)?*

At a minimum, a streamlined interconnection process that could be completed in 30 days would be suitable for this type of situation (assuming approved equipment). Keep in mind that these systems can still engage in frequency regulation even though they don't inject.

5.5 *What specific best practices regarding rates and tariffs from other states should be incorporated?*

We highly recommend reviewing the rebate provisions for Illinois CEJA and ComEd's Rider DG.

5.6 *Should energy storage be utilized and compensated in the Triennium 2 Energy Efficiency /Demand Response proceeding as an allowable Demand Response resource? If so, what changes, if any, should be made to the NJ SIP design to avoid potentially providing double compensation for the same service?*

We do not have an opinion on this question.

5.7 *How should energy storage systems be metered and measured? Can an inverter serve this function? What role should advanced metering infrastructure ("AMI") play in the NJ SIP?*

For any non-residential ESS, a revenue-grade bidirectional meter is required. An inverter alone, particularly for larger batteries, will not be adequate. Most large ESS projects include a site controller, but this should be used to validate data captured by the revenue grade meter. At this point, any revenue grade meter should have AMI capability; because the meter is owned by the utility, the customer should be granted full access to its data, inclusive of interval data, voltage, reactive power, etc.

5.8 *Please provide any other comments on the NJ SIP.*

The impact of electric vehicles on the demands of stationary energy storage is likely to be significant.

Before 2030, EV battery capacity in New Jersey will dwarf the 2 GW/8 GWh energy storage goal. A Tesla has an 80-kWh battery, so 8 GWh = 100,000 EVs. New Jersey has about 3% of the US population and there are 330 million cars in the US. This suggests about 10 million cars in NJ, i.e., if 1% of all NJ cars are EVs in 2030, they will have a combined 8 GWh of storage capacity. What is far more likely is that more than 10% of all cars in New Jersey will be EVs – resulting in 80 GWh of storage (10x). The impact of this is unknown at this point, but certainly warrants analysis in this exercise.