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VIA ELECTRONIC MAIL
Energy.Storage@bpu.nj.gov
Secretary Aida Camacho-Welch
New Jersey Board of Public Utilities
Office of Policy and Planning
44 S. Clinton Avenue
Trenton, NJ 08625

RE: New Jersey Energy Storage Analysis Request for Comments

Dear Secretary Camacho-Welch:

We appreciate the opportunity to provide the following comments to the New Jersey's Board of Public Utilities ("BPU") in consideration of an energy storage analysis required by P.L. 2018, c.17, the Clean Energy Act.

Ingersoll Rand (NYSE:IR) is a global company that advances the quality of life by creating comfortable, sustainable and efficient environments. Our people and our family of brands—including Club Car®, Ingersoll Rand®, Thermo King® and Trane®—work together to increase industrial productivity and efficiency, enhance the quality and comfort of air in homes and buildings, and commercial transport; and to protect food and perishables.

We also manufacture CALMAC® ice storage tanks within our Trane portfolio in Fair Lawn, NJ. The ice tanks work in line with chilled water systems and integrated controls to create thermal energy storage ("TES") systems, a proven energy storage technology. To date, Trane and CALMAC have installed more than 70 MWh of TES throughout New Jersey with more than 1 GW installed globally.

The deployment of TES can help New Jersey achieve its clean energy goals. TES is well suited to “storing” lower cost nighttime energy for daytime use.[1] In some cases, nighttime energy could come from low carbon resources such as wind or nuclear. This enables lower cost, emissions-free energy to be utilized during the day, reducing the need for dirty and expensive peaking fossil fuel plants typically used during the day.

Ingersoll Rand supports efforts to encourage the adoption of energy storage technologies for the benefit of electric customers in New Jersey. We are encouraged that the BPU is soliciting comments addressing implementation that will ultimately facilitate the affordable distribution of energy as the state transitions to 100 percent clean energy by 2050.[2]

Our comments are presented below.

BPU Question 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?*

Energy storage technology can provide multiple benefits to electric customers in New Jersey. Because storage can stack services (i.e. take on onsite generation / demand response, distribution, transmission and generation-like functions depending on need), it reduces the need for single purpose assets on the electric grid. As a result, energy storage technology can be a cost-effective way to improve the efficiency of New Jersey’s grid.

Trane delivers TES through its CALMAC portfolio in Fair Lawn, NJ. TES is best known for peak load reduction, grid services, demand response, and back-up cooling.

[1] https://tc0609.ashraetcs.org/documents/research/TC0609%20ASHRAE%20RP-1607%20Research%20Summary%2020180125.pdf
[2] https://nj.gov/emp/energy/

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

Trane/CALMAC has installed over 50 projects in New Jersey over the last 25 years, accounting for over 70 MWh of load shift. The ice tanks work in line with chilled water systems and integrated controls to create TES systems, a proven, cost-effective energy storage technology. For commercial and industrial use cases, North Carolina State University calculated the system cost of TES to be $310 per kWh, compared to more than $550 per kWh for lithium-ion batteries.[3]

Prominent New Jersey TES projects include the following:

- Perth Amboy School District: Two school installations in 2015 and 2016, with additional sites under consideration. Helps the district save on electricity costs.
- West Long Branch School District: one installation in 2016. Designed for energy cost savings.
- Rutgers Athletic Center: one installation in 2016 to mitigate spiky air-conditioning demands at their basketball arena.
- CALMAC manufacturing facility in Fair Lawn. Thermal storage installation delivers $12,000 in annual energy savings.

Trane is currently working on additional projects in New Jersey that should be in operation by the end of 2019. However, if New Jersey wishes to accelerate the adoption of TES and other energy storage technologies across the state, the most effective means would be to institute a prescriptive incentive for energy storage technologies, on a dollar-per-kW basis. Accelerated

[3] https://energy.ncsu.edu/storage/wp-content/uploads/sites/2/2019/02/NC-Storage-Study-FINAL.pdf, Pages 23 and 25

adoption is necessary for New Jersey to meet its energy storage goals of 600 MW by 2021 and 2,000 MW by 2030.

The most effective incentives are transparent, front-loaded and regularly available. Transparent incentives enable customers to calculate capital costs of efficiency or demand-saving measures as compared to other HVAC options.

Front-loaded incentives are paid following project commissioning, or after one year of monitored and verified operation. Front-loaded incentives are important because customers place a heavy discount on savings earned in subsequent years for large equipment expenditures. Although individuals readily invest in a 7-10% bond, most large customers are reluctant to make investments that yield less than a 25-33% return on investment, which equates to a 3 to 4 year payback. This reluctance often reflects public sector budget constraints and private real estate owner short-term tenancy.

Readily available rebates accelerate demand because customers that have regimented capital planning processes, such as public entities and mission-driven organizations like schools, hospitals, and universities, are able to take advantage of incentives when replacing equipment. They are less well-equipped to participate in lengthy RFP processes that may have uncertain outcomes.

BPU Question 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?*

TES provides commercial and industrial customers with the ability to materially time shift their energy usage during hot summer months. It relies on chillers that make ice typically at night (charging) which is then used to provide air conditioning service during the day (discharging).[4] This process enables building owners to use off-peak energy during peak times. TES is also highly durable and efficient. CALMAC TES tanks have a useful life as long as 30 years with little maintenance cost and achieves round trip efficiencies approaching 97%.[5] Moreover, it can provide cooling service for at least eight hours at a time, and almost all of its components can be recycled at the end of its useful life. Overall, TES lasts 2 to 4 times longer than batteries at a fraction of the cost.[6]

The deployment of TES can help New Jersey achieve its clean energy goals. TES is well suited to "storing" the wind energy it uses at night for daytime use.[7] This enables emission-free energy to be utilized during the day and reduces the need for peaking fossil fuel plants.

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

The definition of Energy Storage should be broad enough to include thermal storage, flywheels, and other technologies, beyond electric batteries. New Jersey should consider the following definition:

> Energy Storage is defined as commercially available technology that is capable of absorbing energy, storing it for a period of time, and thereafter dispatching the energy using mechanical, chemical, or thermal processes.

[4] http://www.trane.com/commercial/north-america/us/en/products-systems/equipment/chillers/ancillary-chiller-equip/ice-making.html.

[5] Batteries by comparison have round trip efficiencies closer to 85% and useful lives of 10 years, according to the 2017 Lazard Levelized Cost of Storage. The report also found that batteries can degrade and must be replaced to maintain capacity. https://www.lazard.com/media/450338/lazard-levelized-cost-of-storage-version-30.pdf

[6] CALMAC analysis as published in Distributed Energy Magazine, January 2018.

[7] https://tc0609.ashraetcs.org/documents/research/TC0609%20ASHRAE%20RP-1607%20Research%20Summary%2020180125.pdf

The New York State legislature has used similar language (see NY S. 1611, 2019) as has Massachusetts (see MA H. 2831, 2019).

BPU Question 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?*

New Jersey policymakers should have a flexible approach to deciding the appropriate energy storage duration based on its state goals of 600 MW by 2021 and 2,000 MW by 2030. Maintaining flexibility is important because the optimal energy storage duration varies by use case. For example, behind-the-meter TES use cases are typically six to eight hours, while other use cases for wholesale services and frequency regulation might be four hours or as little as 30 minutes. By maintaining flexibility on duration, policymakers ensure that the appropriate technology is optimally matched with the grid conditions or symptoms it is being asked to solve.

Please contact me with any questions.

Sincerely,

Nanette Lockwood

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