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VIA ELECTRONIC MAIL
EMP.Comments@bpu.nj.gov

President Joseph Fiordaliso
New Jersey Board of Public Utilities
Office of Policy and Planning
44 S. Clinton Avenue
Trenton, NJ 08625

RE: New Jersey 2019 Energy Master Plan

Dear President Fiordaliso:

We appreciate the opportunity to provide the following comments to the New Jersey's Board of Public Utilities ("BPU") in consideration of achieving the energy storage deployment goals as outlined by Governor Murphy. Energy storage will be critical to achieving 100% clean energy by 2050.

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 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 systems. To date, more than 120 MWh has been installed throughout New York City with more than 1 GW installed globally.

We appreciate the opportunity to provide the following comments to the New Jersey Energy Master Plan and applaud the BPU for its work to ensure New Jersey has a clean energy future.

Please contact me directly for questions.

Respectfully Submitted,

Nanette Lockwood

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INGERSOLL RAND COMMENTS

Ingersoll Rand ("IR") submits these comments in response to the New Jersey's Board of Public Utilities' ("BPU") solicitation for comments regarding the development of a 2019 Energy Master Plan ("EMP"). We support Governor Murphy's ambitious vision of a clean, resilient, flexible and affordable grid for the State of New Jersey. Specifically, the key pillars have been set by several policy goals, including a 100% clean energy goal by 2050 and a storage deployment goal of 600 megawatts (MW) by 2021 and 2,000 MW by 2030.

In these comments, IR supports efforts to encourage the adoption of energy storage for the benefit of electric customers in New Jersey. Thermal energy storage ("TES") is a proven technology with more than 120 MWh deployed in New York City alone.[1,2] We are encouraged that the EMP will address current barriers to new and enhanced infrastructure, facilitate the utilization of new and developing technologies, and ultimately identify a path to provide affordable distribution of energy as the state transitions to 100 percent clean energy by 2050.[3] Our comments are presented below.

TECHNOLOGY OVERVIEW

TES provides C&I 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.

[1] https://der.nyserda.ny.gov/map/.
[2] http://www.calmac.com/energy-storage-installation11-madison-ave.
[3] https://nj.gov/emp/energy/
[4] http://www.trane.com/commercial/north-america/us/en/products-systems/equipment/chillers/ancillary-chiller-equip/ice-making.html.

TES is also highly durable, efficient and safe, with no flammable or hazardous materials. CALMAC® tanks have a useful life of 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 most components can be recycled. Overall, TES lasts 2 to 4 times longer than batteries at one-third the cost.[6]

The deployment of TES can also 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.

Reducing Energy Consumption

IR supports reducing energy consumption and emissions while maintaining efficiency and affordability and is encouraged that it will be a priority of the EMP.

A strong energy efficiency goal can help curb demand and increase overall operational efficiency. In addition, peak reduction programs such as energy storage, including TES and building management system implementation can be cost effective for both the utility and the commercial customers.

Implementation of the EPA Portfolio Manager program can be supplemented with use of EPA's Energy Star Building program, which can help benchmark building energy use but, more importantly, quantify improvements with targeted goals.

TES should be an eligible technology for utility energy efficiency incentive programs because it will assist in helping keep energy affordable for all customer classes. TES cost effectively

[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. http://www.trane.com/commercial/north-america/us/en/about-us/newsroom/blogs/thermal-storage-and-batteries-working-together.html

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

reduces consumer demand charges and enables consumers to respond appropriately to utility price signals by reducing energy usage during times of high demand, which is a key tool in improving load factors of electric systems.

Technology

Integrating advanced data solutions in systems such as heating, ventilation and air conditioning ("HVAC") can deliver new information to customers allowing for more frequent adjustments of building operations levers to help avoid wasted energy. In fact, systems that are connected from the appliance to the Building Management Systems can even deliver guaranteed demand response solutions in support of utility RFQs.

Data analytics complements and advances energy management in buildings. Trane® is the leader in connected buildings, with over 12,000 buildings connected to our cloud, continually providing building performance data. We use this data to help customers make their buildings perform better. As more energy managed buildings become connected, the more demand can be managed on a larger scale.

We encourage the BPU to design markets on a technology-neutral basis with a focus on specific symptoms in order to let manufacturers and developers compete for the best solutions. Carve outs for specific technologies ultimately disadvantage customers because they act as subsidies to technologies that may not be cost effective. This means that utility demand response RFQs should focus on a guaranteed dispatchable energy amount instead of defining "batteries" as the technology. Each customer application can differ, and a portfolio of multiple technologies is needed to apply the most cost-effective solutions in each case.

State Policy

State policy can be helpful when targets and incentives are used to drive behavior. This drives the right investment to achieve specific targets but while also creating local jobs. For example, energy efficiency improvement goals for state buildings can drive investments that can deliver operating cost savings. States can also drive investment through flexible financing methods such

as Energy Saving Performance Contracting for their state-owned buildings. This delivers immediate cashflow benefits with no State capital expenditure. Additionally, the State is protected if savings do not materialize as payment is only required when the guaranteed performance is met.

Codes and Standards

We encourage New Jersey to adopt the latest version of the International Energy Conservation Code or ASHRAE 90.1 to help drive cost-effective energy consumption reduction in both residential and commercial buildings.

Economic Growth and Workforce Development

We have recently increased our Fair Lawn, NJ, CALMAC® manufacturing plant employee base by over forty percent to meet the growing demand of TES. We anticipate increasing that base further within the next six months. Our only CALMAC® manufacturing site is in Fair Lawn, so it will expand in response to the global energy efficiency and demand management in buildings markets.

We have been manufacturing in New Jersey for over 60 years and serve as one of the cornerstones of the state's manufacturing sector. CALMAC® has had a great deal of success manufacturing out of Northern NJ, first at a facility in Englewood and now for over ten years in Fair Lawn. New Jersey has a skilled labor pool, along with access to international markets through the port of NY/NJ in Elizabeth. Additionally, our local presence in the tri-state metropolitan area has been critical to our growth in strong commercial markets like New York City.

Building a Modern Grid

Building a modern grid is important to ensure New Jersey meets its future clean energy goals. Regulated rate design and tariff structures can help ensure the development of a modern grid.

Price signals are important because they differentiate between embedded and future / avoided costs.

Energy storage, which may inject energy into the grid when needed or provide network relief via demand response, should be appropriately compensated for the value it provides.

IR supports Rider Q-like rate designs like those in New York where utilities apply optional, more granular daily as-used demand charges as a pilot tariff for demand-metered customers. ConEd has developed a similar pilot for New York City under "Rider Q." We support implementation of Rider Q-like pilot tariffs for demand metered customers across the state and recommend that TES be made an eligible technology for the program. ConEdison's Rider Q, for example, is currently limited to inverter-based technologies and combined heat and power. TES is functionally similar to batteries in its ability to reduce end-user demand over an extended period of time and should therefore be included in any pilots that New Jersey utilities implement.

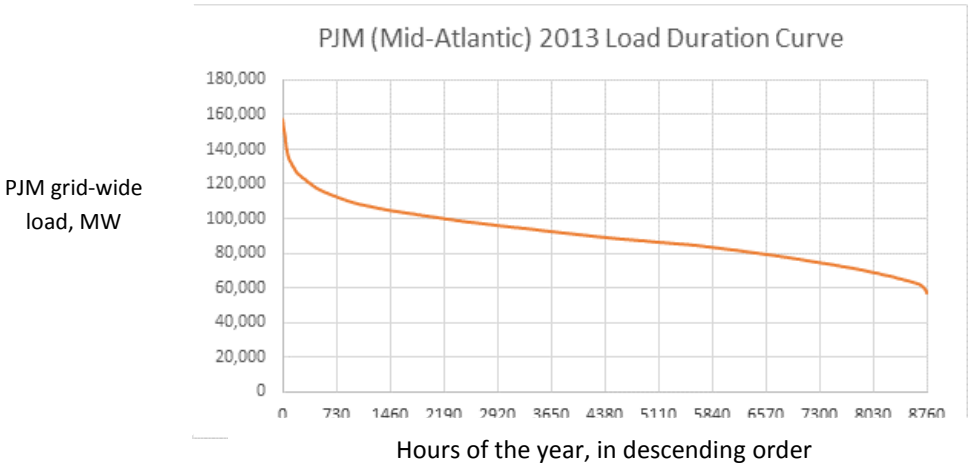
In a modernized grid, the interface between the energy distribution systems and the energy transmission systems should incorporate more investment options like non-wires alternatives to manage grid constraints while allowing for a level playing field that fairly and accurately values the costs and benefits of all resources. For example, behind the meter resources should be allowed to access market mechanisms/programs and be valued for the temporal and locational values they can offer to the grid.

Technology

TES is a key asset to help make the energy distribution systems more efficient by reducing peak load. New Jersey's electric grid, like that of PJM as a whole, is summer-peaking,[8] and the largest component of NJ's electrical consumption is the commercial sector.[9] According to the U.S. Department of Energy, space cooling, refrigeration, and ventilation accounted for 37% of the electricity purchased by U.S. commercial entities in 2016,[10] which is higher during the peak

[8] https://www.pjm.com/-/media/library/reports-notices/load-forecast/2018-load-forecast-report.ashx?la=en
[9] https://www.eia.gov/state/?sid=NJ#tabs-4
[10] https://www.eia.gov/outlooks/aeo/data/browser/#/?id=5-AEO2018&cases=ref2018&sourcekey=0

demand hours of the summer, when high temperatures drive up air-conditioning use and sets the grid peak. TES is designed to reduce the commercial sector's power consumption during the summer weekdays, when its load is at its highest.



PJM Interconnection's Load Duration Curve in 2013. The Mid-Atlantic grid peaked out at 157,508 MW on July 18th from 4-5pm; the average load for the year was 90,320 MW, a load factor of 57.3%. *Source: PJM hourly aggregated load data.*

TES thus reduces the need for high-emitting peaker plants, while also reducing costs for consumers by lowering the need to build new transmission and distribution lines to meet those daytime peaks. TES accomplishes this at one-third the cost of battery storage, and thus should be a large part of New Jersey's plan to build a modern grid and meet its energy storage mandate.

Proper valuation of TES will result in more accurate incentives and help evaluate capacity contracts. A 10-day average baseline method for determining the value of TES under predicts its impact on the electric grid by as much as seventy seven percent.[11] The value thermal energy storage systems are more accurately quantified when based on one-in-ten heat-event (hottest hour in ten years) – which is how many other utility investments are evaluated.

[11] https://www.trane.com/content/dam/Trane/Commercial/global/about-us/Thermal%20Energy%20Storage%20Case%20Study.pdf

Advanced meter infrastructure, IoT, and data analytics are a necessity for a modern grid to ensure two-way communication, trouble shooting and overall grid management. Data analytics complements and advances energy management in buildings. Trane® is the leader in connected buildings, with over 12,000 buildings connected to our cloud, continually providing building performance data. We use this data to help customers make their buildings perform better. As more buildings with TES become connected, the more potential to manage demand on a larger scale.

Security

New or existing industries in the grid modernization field could be brought to the State if grid modernization is done on a broad scale that incentivizes technologies equally. Our CALMAC facility is located in Fair Lawn and our current rate of growth relies on how TES is treated within the energy storage market. If grid modernization includes energy storage with incentives that are technology neutral, then TES and thus CALMAC would grow, bringing additional suppliers and skilled installers to the region.

Clean and Reliable Power

Shifting New Jersey's energy production profile away from reliance on outdated technologies that contribute to global climate change and toward clean energy sources through innovation in energy policy is key to attaining clean and reliable power.

Transition and Technology

The State should invest in and encourage innovative technologies for renewable energy and energy efficiency that favor in-state technologies and development where practical. Investments should also include economic development, workforce improvement and education.

State Policy

The State should address the baseload needs as well as intermittent elements of clean energy generation in order to ensure that adequate, quality power is supply is available. Energy storage

plays an important role in the conversion to 100% clean energy because it offers flexibility to shift demand to periods of heavy generation. It is important to plan for storage that can shift demand for long periods of time to accommodate technologies with lower periods of generation. For example, TES time shifts nighttime wind for day-time use.

Planning and Zoning

An energy storage study would help determine the portfolio mixture the State can utilize over time in achieving its 100% clean energy goal.

The scope of the study should include the value of short and long term storage for behind the meter as well as in front of the meter use. In addition, the state should ensure that analytics supporting the study are performed on a sub-hourly basis and that it is carried out in a technology-neutral manner. Policymakers should look to the Massachusetts State of Charge report as a benchmark and New Jersey could follow.[12]

Clean and Reliable Transportation

We support reducing the State's carbon footprint and advancing electric and alternative fuel vehicles. Clean transportation technologies are advancing at a rapid pace with many solutions ranging from electric scooters to electric low speed vehicles and light duty passenger vehicles to clean commercial transportation. Therefore, multiple technologies and uses of this type should be a part of the State's overall policy approach to the transportation sector.

Electric low speed vehicles used in master planned communities (consumer vehicles) and campus-like applications (utility vehicles) can make use of the existing charging infrastructure as their daily range is limited. These vehicles have an attractive price point for consumers and institutions. Two policy actions that can cost-effectively enable expansion of this clean transportation technology are as follows:

[12] Please see http://files.masscec.com/uploads/attachments/2016StateofChargeReport.pdf

1. Local ordinances that enable electric low speed vehicles on public roadways with speed limits of 35 mph or 25 mph (based on specific low speed vehicle type). This does not require government funds and can be a source of incremental licensing fees for the state or municipalities.

2. An incentive program for consumers or businesses who purchase electric low speed vehicles for use in master planned communities or for light duty utility applications. Given the lower price point of this class of vehicles, a much lower rebate level (i.e., $800) can shift consumer decisions relative to the rebate needed to drive light duty passenger vehicle consumer decisions.

The lack of electric vehicle charging infrastructure for commercial vehicles is a major barrier to broader deployment of electric solutions. Additionally, diesel-idling to power hotel-load needs for drivers or transportation refrigeration units is still broadly used due to lack of an acceptable charging and plug-in infrastructure. The state can, through legislation, appropriate funds for direct investment in a commercial charging and plug-in infrastructure. In addition, the BPU can support utility investment in charging or plug-in infrastructure which can deliver returns for the utility through a new revenue source. The BPU should be cognizant of, and directly address, the issue of fuel source switching across utilities and allow this type of investment in support of the greater good of the state.

Sustainable and Resilient Infrastructure

We applaud New Jersey for all its recent infrastructure investments and hope that future investments include a focus on resiliency. However, the applicable definition of resilient is unclear. We support a definition of infrastructure resiliency that includes designing for the long term (more than 50 years) impacts of climate change. This definition would require demand anticipation related to climate related population shifting, changing weather (hotter, more frequent peaks), and a hardened system.

TES improves the reliability of the grid by reducing peak demand reducing customer electric bills and can also be deployed as a demand response asset controlled by the utility or grid

operator to stave off power shortages. TES is a flexible and cost-effective asset that enables a smaller transmission and distribution grid that also helps to integrate intermittent renewable resources. Overall, TES contributes to a more reliable power network that is rendered more resilient and sustainable through a greater diversity of energy sources.

Additionally, CALMAC® tanks have shown resilience following storms. For example, during superstorm Sandy, basements were flooded in two New York City locations with TES units. In both circumstances, the tanks were able to be flushed and 80% recovered for reuse.

State Policy

Incentives are an important mechanism to drive wanted behavior. Decoupling helps utilities support reduced energy consumption.

Workforce Development

CALMAC® has been a job creator in New Jersey's smart grid industry for decades. The policies that have been outlined in New Jersey will, if implemented effectively, help CALMAC® and Trane® provide more local smart-grid manufacturing and administrative jobs.

Please contact me with any questions.

Sincerely,

Nanette Lockwood

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