Bloomenergy™

October 12, 2018

The Energy Master Plan Committee
New Jersey Board of Public Utilities
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Aida Camacho-Welch, Secretary of the Board
Board of Public Utilities
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Re: <u>State Energy Master Plan Comments</u>

Dear Master Plan Committee and Secretary Camacho-Welch:

Please accept the following comments of Bloom Energy Corporation ("Bloom Energy") regarding the 2019 New Jersey State Energy Master Plan (EMP). Bloom Energy is a manufacturer of solid oxide fuel cell systems that produce on-site power for many of the world's most demanding customers. The Bloom "Energy Server" fuel cell generates electricity through an electrochemical process without combustion and therefore does not produce the local forms of "criteria" air pollutants associated with combustion technologies or consume or discharge water. Bloom Energy Servers are designed in a modular fault-tolerant format that provides mission critical reliability with no downtime for maintenance. Bloom Energy systems have been proven resilient through disruptive events including hurricanes, earthquakes, utility outages, physical damage and fire damage. As a result, Bloom Energy servers are used by many of the world's leading companies to secure their critical business processes from the risk of utility outages.

Bloom Energy has installed over 300MW of its solid oxide fuel cell systems for customers in eleven U.S. states as well as in Japan, South Korea, and India. A growing percentage of Bloom Energy's business is focused on grid-islanding and micro-grid projects that are designed to operate indefinitely in the event of an outage of the electric grid.

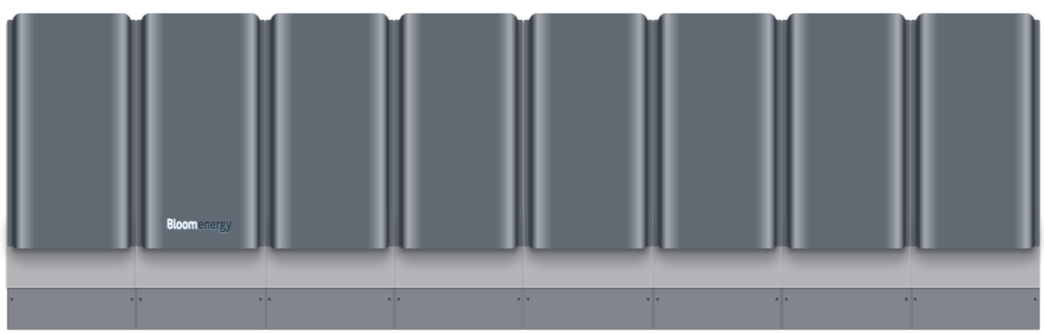


Figure 1- Bloom Energy Server

Bloom Energy's comments at this stage of the EMP process are focused on; (1) timing of implementation, (2) customer sited distributed generation, and (3) utility directed and/or utility owned distributed generation. These comments also include responses to some of the questions posed during the public hearing process.

I. Timing of Implementation

Bloom Energy strongly supports the EMP objectives of achieving at least 50% clean energy by 2030 and 100% clean energy by 2050. However, these long term objectives should not divert attention from the need to achieve immediate emission reductions while also ensuring resiliency for critical customers and the electric grid. The urgency of our changing climate requires that GHG reducing technologies be deployed as quickly as possible and that policy actions focus on proven emission reduction and resiliency capabilities rather than technology selection. Driven in part by climate change, weather related outages of the electric grid are up eighty percent over the last fifteen years. Over ninety percent of the electric outages in the United States are a function of failures of the distribution system.

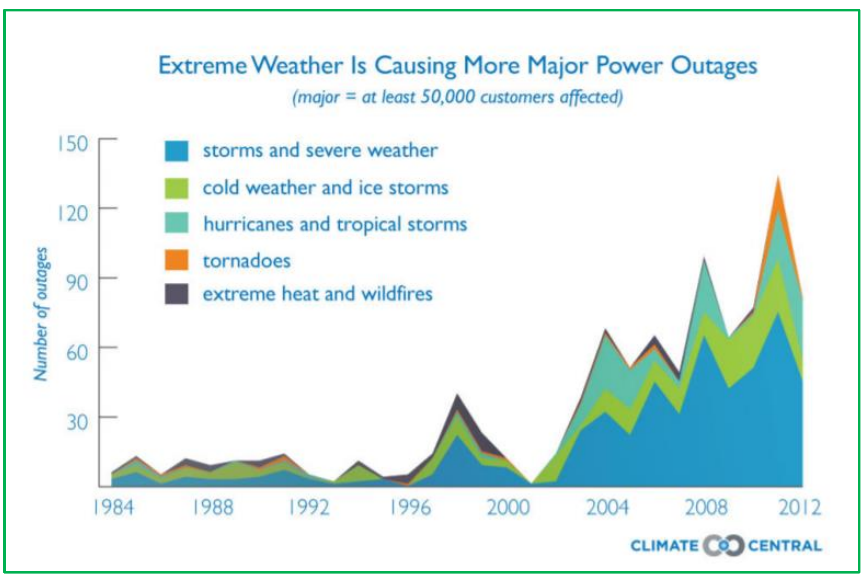


Figure 2 - Weather Related Power Outages
http://assets.climatecentral.org/pdfs/PowerOutages.pdf

The climate crisis is happening faster than even the most aggressive projections had predicted it would. According to the National Oceanic and Atmospheric Administration the four warmest years on record were the last four years.[1] In light of these facts New Jersey cannot afford to pursue only longer term plans to reduce emissions and increase resiliency. Instead, the EMP should include an "Immediate Phase" focused on measures that can achieve a combination of rapid emission reductions and increased energy security in anticipation of increasingly severe weather. The Immediate Phase should be comprised of those measures that science and data say can most effectively and rapidly reduce emissions and increase resiliency during the near term time frame while large scale renewables are being built out.

One of the most effective ways to achieve immediate term emission reductions is through increased efficiency, including efficiency of power generation that supplies the grid with electricity. The desire to reduce dependence upon fossil fuels should not impede the use of the most efficient generators to displace less efficient marginal fossil fueled generation. To the contrary, displacing less efficient marginal generation with more efficient distributed generation is one of the most effective ways to reduce fossil fuel use and achieve a combination of near term emission reductions and increased resiliency. A high efficiency natural gas powered fuel cell reduces greenhouse gases and other forms of air pollution in the same way that a wind or solar renewable generator does – by displacing dirtier power plants – and it can do so around the clock while simultaneously isolating customers from outages of the electric grid. The EMP conversation should not be

[1] https://www.ncdc.noaa.gov/sotc/global/201713

about renewables *versus* smarter and more efficient fossil fuel use, it should be about maximizing renewables *plus* smarter and more efficient fossil fuel use.

In fashioning Immediate Phase measures care should be taken to avoid those measures that would lock in less advanced fossil fuel uses over the long term. For instance, there is a fundamental difference between a large fossil fueled combustion power plant and a distributed non-combustion solid oxide fuel cell. The combustion plant locks in its initial technology for the duration of the project, likely 30 or 50 years. On the other hand, a solid oxide fuel cell can be constantly upgraded over time to incorporate higher efficiencies and new capabilities during the life of the project. The fuel cell can deliver its electricity to an end-user during outages of the distribution system *and* avoid the need for diesel back-up generators.[2] The distributed fuel cell will avoid line losses and essentially eliminate emissions of criteria air pollutants. The fuel cell can very efficiently charge electric vehicles with its native DC output. The fuel cell can be re-located if the needs of a customer or the distribution system change over time. Finally, a fuel cell installed *today* can, with minor modications, accommodate new fuels in the future - including both renewable gas ("biogas") and renewable-derived hydrogen.

There is great value in a platform that can accommodate future technological advances. Fifteen years ago, the iPhone did not exist. Thirty years ago the world wide web did not exist. Technological change is happening faster every day and in this environment it is especially important not to pick specific winners and losers

[2] It is an underappreciated fact that grid dependent strategies, including 100% large scale renewables, almost always involve the use of diesel back-up generators. Diesel back-up generators operate not only during blackouts, but are also tested regularly throughout the year.

and to instead set objectives and allow new technologies to evolve to achieve those objectives.

Unfortunately, the recent history of energy policy in New Jersey is a history of technology selection and de-selection. Rather than setting objectives and allowing existing and emerging technologies to compete to achieve those objectives, policymakers in New Jersey have chosen specific technologies while excluding other technologies. This is particularly the case in the area of distributed generation, one of the most rapidly evolving areas of energy technology and policy. The EMP process presents an opportunity for New Jersey to change course and stake out a leadership role on the use of distributed generation as a means to achieve immediate term reductions of greenhouse gases and other pollutants while simultaneously increasing resiliency for customers and the grid itself.

II. Customer Sited Distributed Generation

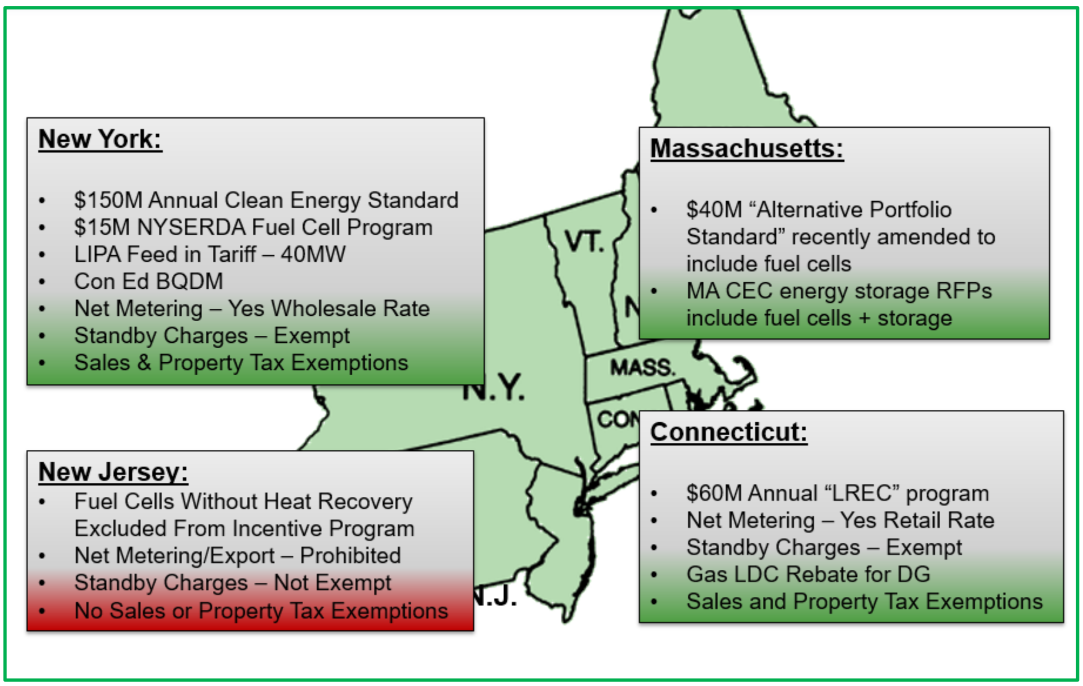
A perfect example of technology selection limiting options to combat climate change in New Jersey has occurred in the customer sited distributed generation program. Previous administrations have made an explicit technology selection in favor of one type of distributed generation technology, combined heat and power (CHP). This technology selection came in the form of a stated goal in the last EMP of 1500 MW of CHP by 2020 that was initially established in 2005 and then renewed in the 2011 EMP. At the present rate of progress, the 2020 objective is unlikely to be achieved.

This shortfall is likely due to the fact that, while a well designed CHP plant can achieve high overall efficiencies, the universe of customers that the have matching electric and thermal loads necessary to implement a well designed CHP plant is quite limited – some estimates indicate fewer than five percent of New Jersey customers. At the same time, technological advancements in all-electric distributed generation are resulting in higher and higher demonstrated efficiencies without the limitations imposed by the need to find a matching thermal load.

Importantly, the presence of a matching thermal load does not necessarily correlate with the significance of a given facility from a public security or resiliency perspective. For instance, an emergency telecommunications center might not have a matching thermal load but a laundry facility might. Because of the technology selections made in previous EMPs and, more recently, in BPU decisions, current New Jersey policy would direct incentive funding and preferred interconnection treatment to the laundry simply because it is an application of CHP technology. This is true even if the emergency call center proposed to install the single most efficient form of distributed generation for that facility that is available on the market today.

The forms of combustion CHP favored by current New Jersey policy also tend to exhibit much higher emissions of local air pollution than non-combustion DERs like fuel cells. This issue is increasingly important as the desire to produce locational benefits from distributed energy resources has the effect of driving distributed generation into heavily populated urban areas. A recent study by the New York University Institute for Policy Integrity examined this dynamic and concluded that distributed energy resources can be "particularly valuable if they avoid local air pollution imposed on populations that are especially vulnerable to this pollution."[3] As an immediate term measure the distributed generation programs administered by the BPU should recognize these impacts and take into account the relative emissions of local air pollutants like NOx, SO2, and PM.

The programs and policies in New Jersey differ markedly from fuel cell programs and policies in other leading northeast states. The following graphic provides an overview of these differences as they apply to non-CHP fuel cell projects in four northeast states.



Importantly, the programs and policies in other jurisdictions are having their intended effect – driving investments into clean and resilient distributed energy

[3] Institute for Policy Integrity, New York University School of Law, "*How States Can Value Pollution Reductions from Distributed Energy Resources*" July 2018, available at: https://policyintegrity.org/files/publications/E_Value_Brief_-_v2.pdf

projects that are immediately reducing emissions and isolating customers from outages of the electric grid. For instance, over the last year Bloom Energy has leveraged state programs to begin the installation of twenty-four “mini micro-grid” projects at Home Depot Stores across upstate New York and eastern Massachusetts. The projects each involve a 200kW non-combustion fuel cell that is designed to isolate those stores from future outages of the local electric grid. Before, during, and after an extreme weather event a Home Depot Store can be an important community asset allowing customers to access supplies to prepare for and recover from a storm.

In New Jersey, however, these projects were prohibited from competing in the CHP/Fuel Cell program due to a June 2016 Board Order that eliminated that specific technology – fuel cells without heat recovery – from the incentive program. The prohibition applies irrespective of the fact that the projects represented the single most efficient way for a Home Depot Store (a facility without a matching thermal load) to generate resilient on-site power. As a result, a portfolio of twelve identical projects in New Jersey were mothballed. These projects are only some of many opportunities to achieve immediate emission reductions and increased energy resiliency from the customer sited distributed generation sector that could result from relatively simple adjustments to existing programs and policies.

Issue or Policy	**Current Status**	**Recommended Change**
Interconnection	Fuel cells are unable to co-locate with solar in NJ due to policies that appear to prohibit the deployment of a net metering	Clarify that EDCs are allowed to use a net generator output meter that differentiates

	technology and a non-net metering technology behind a single customer meter.	between the electricity generated by each technology. This approach is used in other states including NY and CA.
Export	A 45% LHV efficient combustion CHP project is allowed to export to the NJ EDCs for compensation but a 60% LHV efficient non-combustion fuel cell is prohibited from exporting to the NJ EDCs, even for free.	Reform state level Qualifying Facility (QF) and/or Net Metering regulations to allow non-QF projects with higher efficiencies to export at LMP rate. This is not a federal issue as it is not the case in NY, CT, or CA.
Incentive Eligibility	Fuel Cells without heat recovery are prohibited as a technology category from competing in the BPU's CHP/FC incentive program. Since this June 2016 program revision virtually every approved project utilizes a gas reciprocating engine, essentially eliminating the diversity of technologies that previously existing in the program.	Allow fuel cells without heat recovery to compete either within the existing CHP/Fuel Cell program or in a stand alone fuel cell incentive.
Incentive Performance Verification	Incentives paid mainly up front on a $/per kW installed basis and actual performance of projects often not verified.	Incentives should be paid $/ton avoided or other performance based metric and only upon the basis of verified performance.
Incentive Transparency	Actual performance of funded projects is maintained by	Actual project performance should be

	consultants to Board and not publicly available.	publicly available in an on-line data base.

III. Utility Directed Distributed Generation

The EMP process should take into account and seek to replicate innovative new policies that have proven successful in other jurisdictions. One of the most prominent of these is the Brooklyn Queens Demand Management (BQDM) Initiative recently undertaken by Consolidated Edison of New York (Con Ed). In 2014, as the economy rebounded in Brooklyn and Queens, the electrical load was surging and would soon surpass the capabilities of the local distribution network. Con Ed estimated that its network would be overloaded by 52 megawatts by 2018 and that the cost of upgrading the network using the traditional "poles and wires" utility model would exceed $1.2 billion dollars.

Both the utility and the New York PSC agreed that there was a less expensive way to serve Con Ed's customers. Instead of asking ratepayers to cover the $1.2 billion cost for traditional utility infrastructure, Con Ed provided targeted incentives for 52 megawatts of energy efficiency and distributed energy resources and successfully avoided the system capacity upgrades - for a cost of just $200 million.

Con Ed partnered with the advanced energy industry to identify a suite of technologies that could meet the utility's load reduction needs. In the first solicitation of its kind, suppliers brought a range of technologies, solutions, and projects to Con Ed. The character of the neighborhood proved paramount – a dense urban environment with a minimal number of commercial and industrial customers, where space is at a premium and energy resources are unavoidably located in close proximity to residents. After a thorough review, Con Ed selected fuel cells without heat recorvery as a feasible solution due to their small footprint, high capacity factor, lack of local air pollution, and innocuous siting characteristics. Con Ed agreed to provide incentives to suitable customers and was permitted to rate base the expense associated with those incentives. Con Ed then identified customers within the BQDM area, including six (6) separate customer locations suitable for fuel cell installations. The sites included a low income housing development, several large retail stores, a state government facility, and two large healthcare facilities. In total, Bloom Energy successfully installed 6.2MW of capacity across the six locations within the BQDM targeted load relief area.

In addition to the value of avoiding distribution system investment, these projects will also benefit the local community with improved local air quality and GHG reductions. They are expected to avoid 16,437,266 lbs of CO2, 25,053 lbs of NOx, and 1,276 lbs of SO2 each year by offsetting less efficient, dirtier generation in the New York City area. Due to transmission constraints, many of these plants are old peaker plants that were installed before the passage of the Clean Air Act and emit very significant amounts of criteria air pollutants like SO2, NOx, and PM in neighborhoods that face environmental justice challenges[4].

The BQDM program demonstrates that ratepayer, utility shareholder, public safety, customer, and community interests can all be unified in a way that benefits every stakeholder. Absent the forward thinking BQDM program, Con Ed ratepayers would have been required to foot the bill for a $1.2B traditional utility solution. Instead, ratepayers were protected from unnecessary expense while utility shareholders and executives were comfortable with the "rate base and

[4] https://www.strategen.com/reports-1/09-20-2017/new-york-best

regulated return on investment" business model to which they are accustomed. The citizens of Brooklyn and Queens did not experience the brownouts and blackouts that had been predicted and emissions and other environmental impacts were reduced as compared to the traditional utility solution. Importantly, the program turned the assumption that emission reductions have to *cost* money on its head – instead emission reductions were achieved at a *savings* of nearly $1 billion.

The low income housing development project referenced above is known as "the Marcus Garvey Houses." The BQDM project installed at the housing development is a combination of solar, energy storage, and a 400kW Bloom Energy fuel cell configured in a micro-grid format that Con Edison can isolate from the remainder of its distribution system. The project has been successful in every respect, but it could not be replicated in New Jersey. Instead, the fuel cell would be excluded from the state fuel cell incentive program and the interconnection of the solar and fuel cell together behind a single customer meter would apparently be prohibited.

The EMP process should include a review of the Con Edison BQDM program and an exploration of whether similar emission reductions can be achieved at negative cost to ratepayers in New Jersey. This could involve utility-directed customer side deployments similar to the BQDM approach or it could involve a limited application of utility-owned projects where those projects are used for a distribution system purpose and can be shown to reduce costs for all ratepayers and/or the projects increase resiliency for important community assets.

IV. Specific Questions and Responses

Clean and Reliable Power

1. *For the purposes of the Energy Master Plan (EMP) and reaching Governor Murphy's goal of 100% clean energy usage in New Jersey by 2050, how should clean energy be defined?*

The term clean energy should be defined to include those measures that effectively reduce greenhouse gases, criteria pollutant emissions, and water use associated with energy consumption as verified by demonstrated performance data. Additionally, consideration should be given to traditionally excluded considerations include the displacement of diesel back-up generators and the ability to evolve in the future to accommodate non-fossil fuel alternatives like hydrogen once those alternatives are available.

5. How should the state analyze the construction of additional fossil fuel infrastructure during the transition? How can the state plan to accommodate this infrastructure in both its short-term and long-term clean energy goals? What statutory or regulatory changes will be needed for the state to make and implement these determinations?

The term "fossil fuel infrastructure" should not be viewed as a monolithic sector. There are wide variations in efficiency, emission rates, flexibility, and capabilities. The EMP should focus future fossil fuel infrastructure efforts on the lowest emitting "soft" infrastructure options that are capable of evolving to incorporate new capabilities and/or moving to different locations instead of "hard" infrastructure options that commit for the long term to a present location and set of capabilities that may be outdated within the project life. There are no statutory changes necessary for the state to make and implement these determinations.[5]

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[5] N.J.S.A. 48:3-51

7. How can state policies support a modern grid to increase resiliency and reliability and fight climate change?

New Jersey should observe the trends in other jurisdictions and focus to a greater extent on distributed generation, either customer-owned or utility-owned. A fundamental distinction between grid connected clean energy projects and distributed behind the meter clean energy projects involves the fact that grid connected projects are required to disconnect or cease operating during an outage of the electric grid. Therefore, an energy policy that is focused *exclusively* on grid connected projects is an energy policy that *requires projects developed pursuant to that policy to be unavailable in the event of a widespread grid outage*, irrespective of whether that outage is due to a cyber-attack, extreme weather, or some other unforeseen event. The state's behind the meter distributed generation programs are currently limited to an extremely small subset of customers but are capable of being expanded via some very simple fixes to the current policies and programs.

17. How will the State consider and integrate overburdened communities into clean energy advancements?

The State should include avoided criteria air pollutants as a principal consideration in its Clean Energy Programs. As it stands these forms of air pollution are not considered for purposes of funding or project selection. This has resulted in a predictable bias in favor of higher emitting technologies. In light of the increased penetration of distributed generation, especially in urban areas, it is especially important to begin taking criteria pollutants into account.

The State should also formally recognize that grid-connected strategies, included 100% renewable strategies, almost always involve the use of diesel back-up generation. Diesel back up generation operates more often than commonly believed and can contribute to higher NOx emissions and Particulate Matter "hotspots" in urban environments. Those technologies or configurations that are capable of obviating the need for diesel back-up generation should be credited for that displacement during both program development and project reviews.

Clean and Reliable Transportation

What is the effect of increasing alternative fuel vehicle adoption on energy generation and the utility distribution system? What role should utilities play?

Solid oxide fuel cells produce DC power as their native output and are capable of deployment in either AC, DC, or combined AC and DC project modes. The ability to generate reliable (i.e. non-intermittment) non-combustion DC power at distributed locations creates unique benefits as compared to any form of electric grid supplied EV charging, including;

- Avoid new EV related investments in electric transmission and distribution systems
- Avoid "time of charge" (i.e. peak demand) concerns associated with EVs.
- Avoid significant inefficiencies associated with AC/DC and DC/AC inversions
- Avoid increased electric system operation and maintenance costs
- Avoid line losses due to the transmission and distribution of grid-supplied electricity.
- Avoid compounding the public security and economic disruptions involved in outages of the electric grid by placing the transportation sector onto the electric grid.

Distributed solid oxide fuel cells are capable of supporting extremely fast charging systems and are often located at facilities where large numbers of vehicles park for periods of time that are well matched with charge periods including; shopping malls, large retail stores, office buildings, government buildings, hospitals, and educational institutions.

It is not appropriate to assume that the electricity for EV charging equipment must be supplied exclusively by the electric grid. That assumption could be inefficient, fail to capture opportunities to reduce emissions, and create a significant public security risk. Placing the transportation sector onto the electric grid would expose the transportation sector to electric grid outages at a time when severe weather patterns and cyber risks to the electric grid are growing.

Distributed fuel cell deployments may be particularly effective at avoiding this risk as well as the distribution system investments involved with large volume charging of transportation fleets such as public transportation, school buses, local government service vehicles, transit bus depots, and airport vehicles.

Sustainable and Resilient Infrastructure

2*. What are pathways forward to ensure New Jersey has secure, modern, and resilient infrastructure by 2030? By 2050?*

New Jersey should be immediately changing policies that are effectively blocking private investment that would otherwise be occurring in secure, modern, and resilient infrastructure in New Jersey. There is not time to wait until 2030 or 2050. These include incentive programs that are technology selective and exclude the most advanced and reliable forms of distributed generation, interconnection policies that do not clearly allow the deployment of multiple technologies behind a single customer meter, and policies that allow less efficient, less reliable, and higher polluting technologies to export energy while preventing more efficient, more reliable, and lower polluting technologies from exporting energy.

6. What steps are needed for to preserve the integrity of our energy systems in the face of future acts of nature (storms, hurricanes, wind, etc.)?

Increased deployment of distributed generation that is capable of isolating critical facilities – both public and private – from the effects of the rapidly increasing number of weather related outages. These should include not only traditional critical facilities such as shelters and government buildings, but also private facilities that serve an important public service like telecommunications hubs, supermarkets, large retail stores, and data centers.

Use of targeted DERs, including both energy efficiency and reliable distributed generation, as an aspect of utility distribution operations. In New York Con Edison’s Brooklyn Queens Demand Management Initiative has proven that the targeted use of DERs in utility load pockets can avoid transmission and distribution investments and increase both customer reliability and the resiliency of the distribution system – while saving ratepayers nearly $1 Billion. This same approach could be used in New Jersey.

12. What level of coordination is required between state and national standards (i.e. RGGI, California Car, etc.) to meet the EMP's goal? What steps could be taken to coordinate standards?

Increased awareness of the interplay between federal Qualifying Facility (QF) standards and New Jersey Net Metering and QF Regulations. Federal QF standards allow 42.5% LHV efficient combustion distributed generation with higher emissions of local air pollutants (NOx, SO2, PM) to export power to the NJ EDCs at the LMP rate. At the same time 60% LHV efficient non-combustion distributed generation with no emissions of criteria pollutants are not permitted to export power to the NJ EDCs at the LMP rate, *or even for free*. This creates a "no man's land" for high efficiency non-combustion distributed generation in New Jersey. Other jurisdictions have solved this issue by permitting non-combustion distributed generation to export to local utilities at the avoided cost rate rather than at the retail rate. This approach avoids the cost shift to other ratepayers that is associated with retail net metering.

Workforce Development

17. Is New Jersey at a competitive advantage or disadvantage to recruit these workers?

New Jersey is at a competitive disadvantage because its technology-selective approach to incentive, interconnection, and export policies is having the effect of limiting the market for component parts that are currently manufactured in New Jersey for export worldwide. New Jersey should be encouraging, not limiting, the manufacturing of clean energy technologies in the state. On this topic and in explicit reference to fuel cells, a June 2018 BPU Order specifically indicated that job creation and retention is "not one of NJCEP's primary or secondary objectives."[6] The Master Plan should specifically change this and, consistent with adjoining states, make economic development, job creation and the development of the State's clean energy economy a stated objective of the EMP.

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[6] I/M/O The Clean Energy Programs and Budgets for Fiscal Year 2019, BPU Docket No. QO18040393, Order dated June 22, 2019, p. 19

20. How can infrastructure be responsibly and effectively sited while taking into consideration of environmental justice concerns?

The NJ BPU programs do not currently take into account emissions of local air pollutants like NOx and PM. This has the effect of favoring combustion DER technologies that emit these pollutants over non-combustion DER technologies that do not emit these pollutants. This is especially important at a time when the desire to value locational benefits and avoided transmission and distribution expenses will have the effect of driving DERs into highly populated urban neighborhoods. Recent studies on this topic indicate that the health and environmental impacts of NOx and PM are directly attributable to combustion DERS, are readily quantifiable, and that the economic and health benefits associated with reducing NOx and PM exceeds the economic and health benefits of reducing CO_2 emissions. The desire to reduce CO_2 is appropriately the first and most important emissions reduction objective but it does not follow that local air pollution does not matter at all. The NJ BPU should work with the NJ DEP to reform its programs so that avoided emissions of local air pollution like NOX and PM are valued in the BPUs programs.

Bloom Energy appreciates the opportunity to provide these comments as the 2019 EMP is developed and stands ready to provide additional information wherever that information will be helpful to the process.

Very truly yours,

/S/

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