NATIONAL FUEL CELL RESEARCH CENTER

University of California, Irvine
Irvine, California 92697-3550
(949) 824-1999
(949) 824-7423 Fax
http://www.nfcrc.uci.edu

New Jersey Energy Master Plan
Comments of the National Fuel Cell Research Center
October 12, 2018

The National Fuel Cell Research Center (NFCRC) appreciates the opportunity to respond to various topics on New Jersey's 2019 Energy Master Plan (EMP), solicited by the Board of Public Utilities (BPU) in September and October of 2018.

The NFCRC facilitates and accelerates the development and deployment of fuel cell technology and fuel cell systems; promotes strategic alliances to address the market challenges associated with the installation and integration of fuel cell systems; and educates and develops resources for the various stakeholders in the fuel cell community. The NFCRC was established at the University of California, Irvine by the U.S. Department of Energy (DOE) and the California Energy Commission (CEC) with the goal of both developing and transitioning to a form of power generation that is both energy efficient and environmentally sensitive. The DOE has recognized the significance of the NFCRC efforts in bringing government agencies, business, and academia together to facilitate effective public-private alliances, with the goal to develop advanced sources of power generation, transportation and fuels.

As the BPU and other agencies develop the draft EMP, the NFCRC would like to underscore the importance of a systematic transition, rather than an immediate transition, to achieve the goal of 100% clean energy usage by 2050. Throughout these comments, the NFCRC emphasizes that 1) a diverse portfolio of energy solutions and technologies is needed to achieve the maximum positive impacts on grid reliability, efficiency, resiliency, environmental, and community impacts, and 2) consideration of air quality, in addition to reducing the carbon footprint and greenhouse gas (GHG) emissions, is imperative to ensure the greatest benefits to all communities in the State of New Jersey.

CLEAN AND RENEWABLE POWER

General

1. How Should New Jersey Define Clean Energy?

New Jersey's definition of clean energy should be technology neutral and focus on attributes required to achieve state energy requirements and economic and environmental objectives. Clean energy should be defined as fuels, heat, and power generation sources that provide grid services; reduce greenhouse gases, criteria pollutant emissions, water and land usage and waste; and improve resiliency, efficiency, and air quality.

Fuel cell systems exhibit all of these clean energy attributes. They are highly efficient power generation sources that can, in addition, produce heat, cooling, and hydrogen with highly-valued resiliency. Fuel cell systems maintain operation during grid outages, providing significant economic and community benefits. Additionally, because fuel cells generate power electrochemically rather than by combustion, they produce virtually zero criteria pollutant emissions.

Transition and Technology

4. How can the State immediately begin to transition to clean energy production and distribution? What intervening steps should be considered to clean existing technology?

-and-

State Policy

9. How should the state address the baseload needs v. intermittent elements of clean energy generation? What is the role of energy storage in the conversion to 100% clean energy?

To ensure a transition to a sustainable energy system, New Jersey should invest in technologies that provide resilient power, decrease emissions, and improve air quality. On the customer side of the meter, fuel cells provide continuous clean, reliable, and load-following power and can be configured to provide seamless transition to meet critical loads in the case of a utility grid outage, eliminating thereby the need for backup diesel generators. Fuel cells can also support combined cooling, heating, and power (CCHP) operations for further reductions in carbon emissions. Additionally, tri-generation fuel cell systems produce electricity, heat, and hydrogen, providing not only the expected high-quality electricity and heat, but also hydrogen for fueling of zero emission fuel cell electric vehicles (e.g., light, medium, and heavy-duty vehicles, and cargo and materials handling equipment). On the utility side of the meter, fuel cells today provide clean generation and grid support at the distribution level and can provide 24/7, dispatchable, renewable power generation to complement a high penetration of intermittent, diurnal and seasonal varying wind and solar.

New Jersey should recognize that states, such as California, with a substantial deployment of intermittent and diurnal varying renewables with low capacity factors are experiencing challenging grid stability issues and gaps in power generation. The use of short-duration energy storage technologies (mostly lithium ion battery systems) to address these gaps has resulted in increased emissions on the California grid.[1] Reversible fuel cells or electrolyzers can also serve as a controllable load that correspondingly helps the grid manage instances of overproduction from renewable resources to produce a renewable hydrogen fuel for storage and later electricity production or for fuel cell vehicles. While battery energy storage is necessary, the inclusion of clean, 24/7 load-following generation is also required for a successful conversion to 100% clean energy.[2] Fuel cells are perfectly suited to serve this role.

Benefits of fuel cell systems include the provision of 24/7, clean, load-following power at close to 100% capacity factors. Importantly, this high capacity factor corresponds to the production of clean, renewable electric energy (MWh) per unit of power capacity (MW) that is on the order of

[1] Itron, Energy + Environmental Economics (E3), 2017 SGIP Advanced Energy Storage Impact Evaluation, available on-line at: http://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/Customer_Gen_and_Storage/2017_SGIP_AES_Impact_Evaluation.pdf

[2] Davis, *et. al., Net-Zero Emissions Energy Systems,* Science **360**, 1419 (2018) 29 June 2018

six (6) times that of solar power systems (assuming a 15% capacity factor for solar) and on the order of three (3) times that of wind power systems (assuming a capacity factor of 30% for wind). Thus, investments in fuel cell capacity produce vastly more renewable energy than wind or solar power systems per unit of capacity installed. Unlike investments in solar and wind power systems, installations of fuel cell systems can be used by the utility to (1) support local capacity and spinning reserve requirements that are used for grid reliability, and (2) serve as an alternative to costly utility system transmission and distribution upgrades to this system. In addition to mitigating carbon emissions when utilizing natural gas and biogas, and eliminating carbon emissions when operating on renewable hydrogen, fuel cells generate and emit zero criteria pollutants in contrast to traditional combustion-based power generation options. In addition, the energy density of fuel cell systems significantly reduces the land footprint required for onsite generation, allowing for deployment in high density areas and increased acreage available for habitat restoration and preservation.

7. Evaluate existing clean energy policies and programs: where are they most/least effective, and are they aligned with the 100% clean energy by 2050 goal? If not, what modifications can be made, if any?

For reference, California's Self-Generation Incentive Program and Fuel Cell Net Energy Metering tariff have supported approximately 250 MW of stationary fuel cell installations in California. With a reverse auction, net metering and utility procurement, Connecticut has over 150 MW of systems operating and in development today. By contrast, there are only about 10MW of stationary fuel cell systems installed in New Jersey.

New Jersey has taken steps to develop a Clean Energy Program to encourage the use of new generation, efficiency measures, and storage technologies. The next generation of this program should incorporate market mechanisms such as a reverse auction to allow clean energy projects to compete based upon desired attributes and cost-effectiveness in the short-term. Future incentives should be paid based upon the operation and actual amount of energy produced (accounting for capacity factor) by the generation systems, rather than an up-front capacity incentive. By paying for the actual energy and actual benefits (including air quality) delivered by clean energy systems, the State can guarantee the best use of program and ratepayer funds. As examples, Connecticut[3] and New York[4] have implemented performance-based clean energy incentives to ensure continued operation and payback from state and ratepayer clean energy investments. This could include consideration of fuel cell systems as a Class 1 resource, or expanding the existing net metering program to include fuel cell systems.

Environmental Justice

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

To ensure direct, positive impact on overburdened communities, local DER must be clean in order to be located in these urban areas. While more granular locational pricing can drive DER

[3] Connecticut Department of Environmental Protection Low and Zero Emissions Renewable Energy Credit Program (LREC/ZREC) available at: https://www.ct.gov/deep/cwp/view.asp?a=2715&q=553942&deepNav_GID=1626

[4] New York State Energy Research and Development Authority, *Stationary Fuel Cell Program Opportunity Notice 3841* available at: https://portal.nyserda.ny.gov/CORE_Solicitation_Detail_Page?SolicitationId=a0rt000000FmWFdAAN

into these communities, New Jersey should ensure that this does not drive high NOx, SO_2, particulate matter (PM), and air toxics emitting resources into those areas. According to the New York University Institute for Policy Integrity:

> "Because DER use often displaces the use of traditional, fossil-fuel-fired generators, the substitution reduces emissions of many air pollutants, including greenhouse gases and local pollutants such as particulate matter, SO_2, and NOx, which can contribute to climate change, worsen human health, impair ecosystems, harm crops, and make it harder for workers to be productive. Furthermore, DERs can be particularly valuable if they avoid local air pollution imposed on populations that are especially vulnerable to this pollution, such as low-income communities and communities of color."[5]

By also valuing the reduction of air pollutants and air toxics, the New Jersey Clean Energy Programs can also improve the air quality of the most overburdened areas. Fuel cells are most often located in urban areas, where power is needed most, providing not only local clean energy, but needed tax revenues to urban communities.

19. How can the state play a role in ensuring that disproportionately impacted communities receive opportunities and benefits connected to the clean energy economy?

In 2017, the State of California passed landmark legislation to monitor and address air quality in Assembly Bill No. 617.[6] The Community Air Protection Program "requires new community-focused and community-driven action to reduce air pollution and improve public health in communities that experience disproportionate burdens from exposure to air pollutants."[7] This legislation calls for implementation through the California Air Resources Board and the local air districts. An equivalent policy does not currently exist in New Jersey. The concept of identifying the most impacted communities and identifying and supporting the implementation of control measures and deployment of new, clean, stationary generation in these communities, can be identified in the EMP as a direct method to address disproportionately impacted communities, placing New Jersey at the leading edge of such initiatives.

Technologies that increase local air pollution in disproportionately impacted communities, or any community, should be explicitly excluded from programs. All combustion-based technologies have emissions of criteria pollutants, such as NOx, SO_2, and PM. In addition, many of these combustion-based technologies deploy post-combustion clean-up technologies such as selective catalytic reduction (SCR) to reduce nitrogen oxide emissions. However, these technologies must be maintained to be effective and can emit ammonia which is a PM precursor leading to an additional air quality burden; often in disproportionately impacted communities. The full lifecycle benefits of fuel cell systems also reduce community impacts; over 90% of fuel cell systems can be recycled at end of life and do not end up in landfills.

---

[5] 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

[6] Assembly Bill 617, Garcia, C., Chapter 136, Statutes of 2017, modified the California Health and Safety Code, amending § 40920.6, § 42400, and § 42402, and adding § 39607.1, § 40920.8, § 42411, § 42705.5, and § 44391.2.

[7] California Air Resources Board, Community Air Protection Program available at: https://ww2.arb.ca.gov/our-work/programs/community-air-protection-program

REDUCING ENERGY CONSUMPTION

Technology

6. What advances in technology should be considered as part of a strategy to reduce energy consumption? What technologies could complement and advance existing energy efficiency efforts?

From a power generation perspective, technologies that can provide load-following and ramping, and enhance both onsite generation and assist utilities in managing a high penetration of renewable generation, should be preferred.[8]

In addition to generating electrical power, the CCHP capability of stationary fuel cells to capture and utilize heat produced by the fuel cell for the provision of cooling, heating, hot water, or steam results in overall fuel cell system efficiencies (electrical power generation and use of the captured thermal energy) ranging from 55% to 80%[9] and, with a superior design and well-matched loads, exceeding 90%.[10] This attribute also displaces the fuel and emissions that would otherwise be associated with (1) boilers when using the thermal energy as heat, and (2) the electricity to drive chillers when using the thermal energy for cooling. The resultant effect is to dramatically reduce CO_2 emissions, criteria pollutant emissions, and the demand on fuel reserves. In contrast to combustion heat engines, fuel cells are unique in providing high fuel-to-electricity efficiency and high quality (i.e., high temperature) heat, as well as producing virtually zero emission of criteria pollutants.[11]

State Policy

11. Which strategies should be state-led, and which ones should be advanced by the private sector? What other players are important leaders in energy efficiency?

The private sector plays an important leadership role in advancing distributed energy resources (DER) to meet both efficiency and environmental goals. While New Jersey can lead by providing information and education on technology alternatives, the private sector is often a first-mover in technology adoption. The private sector also owns much of the critical infrastructure in New Jersey with the associated need for resiliency to maintain essential services such as banking, communications, hospitals, data centers, and food and water resources. The state should employ policies that facilitate the adoption and use of clean power technologies such as fuel cells by the private sector, by state facilities, and by utilities that can own such assets and avert otherwise costly upgrades to their transmission and distribution systems.

---

[8] Advanced Power and Energy Program at the University of California Irvine, "*Managing the Dynamics of a 100 Percent Renewable Electric Grid*" March 2018 available at: http://www.apep.uci.edu/Research/whitePapers/pdf/APEP_Grid_Management_3-Page_031518.pdf

[9] Darrow, K., et al., Catalog of CHP Technologies 2015: Available at: https://www.epa.gov/chp/catalog-chp-technologies (Accessed January 12, 2015).

[10] Ellis, M.W., M.R. Von Spakovsky, and D.J. Nelson, *Fuel cell systems: efficient, flexible energy conversion for the 21st century.* Proceedings of the IEEE, 2001. 89(12): at 1808-1818.

[11] *Supplemental Report: The Science of Fuel Cells; Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, April 31, 2016.

12. Should the state require energy efficiency in particular projects receiving state incentives?

The State should recognize that simply meeting an efficiency threshold does not signify that a DER is clean or good for consumers. Projects receiving state incentives should value broader impacts beyond electrical efficiency that include, for example, reasonably high capacity factors and product utilization (both heat and power), resiliency, grid benefits, and air quality and environmental benefits. A crosscutting protocol for evaluating projects would be appropriate, as recommended by the National Renewable Energy Laboratory to:

> "…examine the energy impacts at the source of the energy supply (beyond the customer boundary) or the environmental impacts (e.g., greenhouse gas emissions or criteria air pollutant emissions) resulting from CHP systems. Similarly, although CHP systems are a valuable component of the electricity system, it is also beyond the scope of this protocol to provide a means for calculating net electricity system efficiencies or examining the system-wide benefits such as improved reliability or resiliency that CHP may provide to the grid. Because environmental and systemwide electricity impacts can result from a wide variety of energy measures and not only CHP systems, it is appropriate to treat these impacts through a crosscutting protocol.[12]

BUILDING A MODERN GRID

General

3. How does a modern grid address, adapt, or respond to climate change and its impacts on New Jersey?

A modern grid that includes DER to reduce or eliminate combustion, can adapt and respond with resiliency to the impacts of climate change (e.g., extreme weather events) if appropriately designed. However, the most immediate, direct, and daily impacts on New Jersey and its citizens are not associated with climate change but rather with air quality. Power generation produced through natural gas combined cycle (NGCC) power plants today meets the majority of electricity demand, but with the concomitant emission of criteria pollutants (e.g., NOx), low efficiencies limited by heat engine constraints, inability to capture heat, and losses due to long distance transmission and distribution of the electricity. When using natural gas, fuel cells reduce GHG compared to generation from the current grid and generate virtually zero criteria pollutant emissions. When operated on biogas (or other renewable fuel), fuel cells generate electricity and heat with zero net carbon emitted. Fuel cells are also capable of operation on renewable hydrogen with a zero emission of both carbon and criteria pollutants.

The EMP should consider utility-scale procurements in New Jersey with non-combustion, efficient, load-following resources such as fuel cell systems. As a fundamental element of large-scale procurements, fuel cells can provide unique co-benefits.[13] Fuel cell systems are deployed today on the utility-side of the meter to create grid support solutions where transmission or

[12] National Renewable Energy Laboratory, Chapter 23: *Combined Heat and Power Evaluation Protocol, The Uniform Methods Project: Methods for Determining Energy Efficiency Savings for Specific Measures, Section 1.2, Topics Not Covered by This Proposal*, at 2. Available at: www.nrel.gov/publications

[13] Shaffer, Brendan, Tarroja, Brian, Samuelsen, Scott, *Dispatch of fuel cells as Transmission Integrated Grid Energy Resources to support renewables and reduce emissions*, Applied Energy, Volume 148, 15 June 2015, at 178-186.

distribution is constrained or where increased reliability is sought. These resources are providing clean, 24/7, load-following power generation to complement the increasing deployment of intermittent solar and wind resources, and to support grid reliability in locations where it is most needed – including in disadvantaged communities. Examples range from a 15MW system in Connecticut, to a 30MW system in Delaware, to a 59MW system in Seoul, Korea.

Korea is using hundreds of MW of fuel cell systems to modernize their grid.[14] Fuel cell attributes more effectively meet the Korean renewable portfolio standard (RPS) goals than intermittent wind and solar resources. Also, in densely populated areas, land constraints limit large-scale implementation of some renewable resources such as wind and solar, whereas fuel cells can be installed within a very small footprint. These fuel cell systems function like substations providing primary power and heat, even when the grid goes down. For example, in Korea, Doosan has installed 30.8 MW of fuel cells for district heating and electricity for 71,500 homes in the City of Busan. This system can also operate when the grid goes down and is configured in a tiered structure and sited on only one acre of land; an equivalent 30 MW solar farm could require more than 75 acres and would produce as little as 1/6th the amount of electric energy and zero heat.

Another example is a 59 MW FuelCell Energy power plant located at Gyeonggi Green Energy south of Seoul, Korea. This system produces 440 million kilowatt-hours of electricity per year and supplies district heating, all on just 5.2 acres of land.

Doosan is also currently installing a 50 MW fuel cell system in Korea that will be fueled solely by hydrogen. The hydrogen is a by-product of a chemical plant that will be used to operate the fuel cell system with the utility utilizing the electricity produced.

Bloom Energy has installed multiple projects as part of the Con Edison Brooklyn Queens Demand Management Demand Response Program.[15] The program ultimately avoided nearly $1 billion in ratepayer costs through the use of targeted DER installations. The Program projects included one using solar, storage, and fuel cell technologies together at a low-income housing development, to optimize the efficiency, reliability, and affordability of the project. Current New Jersey regulation that prohibits multiple clean energy technologies from being used behind one customer meter should be updated to allow for these multi-technology projects that create broad benefit for local communities.

4. How does the state plan for fuel diversity and renewable energy within a modern grid?
As stated in the *Clean and Renewable Power* section on page 2 of this document, New Jersey must ensure continued grid reliability while transitioning to expanding renewables on the grid. Energy storage alone will not create the desired reliability and resiliency that is required; clean, firm power sources are also needed that can be used today through the transition.

---

[14] International Energy Agency and International Renewable Energy Agency Joint Policies and Measures Database available at: https://www.iea.org/policiesandmeasures/pams/korea/name-39025-en.php?s=dHlwZT1yZSZzdGF0dXM9T2s&s=dHlwZT1yZSZzdGF0dXM9T2s

[15] Brooklyn Queens Demand Management Demand Response Program available at: https://www.coned.com/en/business-partners/business-opportunities/brooklyn-queens-demand-management-demand-response-program

Fuel cell systems are fuel flexible. While hydrogen is the ideal fuel for fuel cells, fuel cells can also operate on natural gas, biogas, or propane. While the longer-term goal for New Jersey should be to operate fuel cells on renewable hydrogen, a viable approach for now and the transition, is utilization of natural gas given its availability and relatively low cost, and the high efficiency and reduced emissions of fuel cells relative to combustion systems even when operating on natural gas. Fuel cells are zero-emission with respect to nitrogen oxides, carbon monoxide, sulfur oxides, and particulate matter, and they emit less GHG when operating on natural gas (as opposed to the combustion of natural gas), and fuel cells produce zero carbon when operating on renewable hydrogen.

Fuel cells have highly dynamic dispatch capabilities to (1) manage the diurnal variation, constrained capacity factor, and intermittencies associated with solar and wind power generators, and (2) increase the maximum penetration of renewable resources that can be accommodated in the utility grid network. These capabilities will result in maximum sustainability and GHG reductions when integrated with renewables.

Technology

16. What technologies and measures can be adopted to make the energy distribution systems more efficient and reduce losses? How do these technologies assist in managing annual and peak load?

As New Jersey implements the EMP in the next five years, it should support an increase of DER for clean power generation and CCHP. These types of DER are capable of avoiding line losses, as well as transmission and distribution costs.

Fuel cell systems should be installed for the express purpose of supporting capacity needs throughout the utility grid network. Rate structures should be developed to compensate clean, load-following resources that provide increasingly valuable ancillary services such as ramping, capacity, spinning reserve, and voltage and frequency support to the utility grid network. The exact purpose for installing and operating fuel cell systems in a highly dynamic environment is to directly complement intermittent renewable power generation, and improve the reliability and stability of a grid utilizing a high penetration of renewable power generation.

22. What are the security risks of expanding distributed energy resources, variable energy resources, smart grid and advanced meters? How can they be mitigated?

The risks created by intermittent and diurnal varying power generation resources, such as wind and solar power, are primarily related to over-and under-generation. By using distributed, 24/7, load-following power generation resources, these risks can be mitigated. Another challenge associated with variable energy resources includes voltage and frequency instabilities in the utility grid network that can be caused by a high use of inverters that have no inherent rotating inertia, and are not currently allowed to inject or absorb reactive power to simulate such. Consideration and study of smart inverters and converters that can help the utility manage voltage and frequency is encouraged.

Environmental Justice

26. How could modernizing the grid address the needs of disparately impacted communities and low and moderate income (LMI) families/communities?

DER that emit criteria pollutants have the potential to introduce new sources of emissions into urban airsheds with large populations and thereby cause risks to human health. Many areas of New Jersey currently suffer from poor air quality and face major challenges in achieving clean air for the many citizens that live and work within these areas. This is particularly true for economically disadvantaged communities that are often disproportionately burdened by air pollution. Therefore, DER such as fuel cells that provide clean, efficient energy conversion produce a wide range of energy, environmental, and economic benefits for many different industries and applications that should be preferentially adopted because of the significant value they provide to the State.
New Jersey can additionally consider the waiver of air emissions permitting requirements for non-combustion generation such as fuel cell systems, and support the replacement of diesel backup generators. Policies that waive air emission permits for fuel cells have existed for over a decade in California. By recognizing the superior co-benefits of fuel cells, a program can be created to both limit new permitting of diesel generators and provide an option to use fuel cell systems for both onsite power generation and rapid transfer to provide backup power to critical loads.

30. How can the State play a role in ensuring that disproportionately impacted communities receive opportunities and benefits connected to modernizing the grid?
The Port of New York and New Jersey is an example of a near-term, cross-cutting opportunity for clean energy to modernize the grid and create immediate benefit to surrounding communities.

Ports face both challenges and opportunities in managing and meeting future energy and public health requirements. Fuel cell technologies can facilitate meeting future energy requirements and contribute co-benefits to port energy and environmental goals, including objectives of the environmental justice community. Power generation can be provided at various magnitudes by several fuel cell systems, while combined cooling, heat, and power applications from the same systems can further enhance environmental and energy benefits, and reduce costs. Tri-generation systems that produce on-site hydrogen, electricity, and high-quality recoverable heat represent a system and application that can support port operations, zero emission vehicles including heavy-duty vehicles, and customer requirements.

As an example, the Port of Long Beach (POLB) is located in the South Coast Air Basin of southern California and experiences high levels of health damaging air pollution (also termed degraded air quality). The deployment of a 2.3MW tri-generation stationary fuel cell system, contracted for deployment at the POLB, will provide distributed self-generation and renewable hydrogen for the port, without the addition of combustion-based emissions to operations.[16] This is a key co-benefit of fuel cell systems. Combustion-driven power generation, such as natural gas turbines and reciprocating engines, have pollutant emissions which produce air quality and permitting challenges. The use of fuel cells for stationary power provides a path for the POLB to secure its resilient energy island future, reduce local criteria pollutant emissions, and provide improvements in regional air quality and health benefits to disadvantaged communities in the surrounding area. Specifically, reductions in pollutants will assist the POLB in meeting goals

[16] *Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, June 28, 2016.

established under the San Pedro Bay Ports Clean Air Action Plan and the Green Port Policy.[17, 18] The system currently under design will use a FuelCell Energy stationary fuel cell to tri-generate hydrogen, heat and power, with the hydrogen dispensed into Toyota zero emission fuel cell cars and fuel cell heavy-duty drayage trucks.[19]

The EMP can propose a similar cross-cutting port project across energy sectors.

SUSTAINABLE AND RESILIENT INFRASTRUCTURE

General

8. What is the role of the following in achieving 2030/2050 goals: decoupling; advanced metering infrastructure (AMI); distributed energy resources (DER); and micro grids? If previously answered in another stakeholder group, please cite which one.

DER are essential to a resilient infrastructure that also avoids transmission and distribution losses, costs and risks. As stated prior, both the GHG and pollutant emissions of DER must be valued to achieve 2030/2050 goals. Microgrids are also essential to meeting these goals, especially for ensuring reliability and resiliency while increasing renewables on the grid.

Microgrids that use fuel cell systems as baseload power are able to immediately disconnect from the grid and island (operate autonomously) from the larger grid when circumstances demand (e.g., grid outage). These microgrids can therefore create strong resiliency and reliability on the grid in the event of disasters or grid instability. Stand-alone fuel cell systems as DER can also create resiliency outside of a microgrid and provide continuous clean power in addition to islanding connection to critical loads onsite. A fuel cell system can smoothly transition from the grid to fully power the load during a grid outage, without interruption to the end user.

As mentioned in the *Clean and Renewable Power* comments above, an increase in renewable resources requires 24/7, baseload, load-following power generation to mitigate intermittency from seasonal and diurnal variation of solar and wind power. Microgrids that use fuel cells integrated with renewable resources create a firm, highly reliable and zero emission microgrid. A microgrid's fuel cell enhanced reliability is even more important when considering the recent increased adoption throughout the state of intermittent renewable wind and solar resources which only supply power when the wind blows or the sun shines. Additionally:

> "Those in search of reliable energy also are likely to find it easier and quicker to site a fuel cell microgrid than many other energy resources. Compared with fossil fuel-fired plants, wind, or solar farms, fuel cells are relatively easy to site. They do not require specialized orientation to operate, or wide swaths of land. They can be sited either outdoors or indoors. This means that fuel cell microgrids are more likely to be accepted within communities, especially in densely populated areas where microgrids are often deployed to bolster grid resilience and reliability... The flexibility and continuous output

---

[17] Port of Long Beach, Green Port Policy available at: http://www.polb.com/environment/green_port_policy.asp

[18] *Assessment of Fuel Cell Technologies to Address Power Requirements at the Port of Long Beach.* MacKinnon, M and Samuelsen, S. Advanced Power and Energy Program, University of California Irvine, June 28, 2016.

[19] 24/7 Wall St. "Toyota, Fuel Cell Energy Hydrogen Plant Going Up in Long Beach" November 30, 2017, available at: https://247wallst.com/autos/2017/11/30/toyota-fuel-cell-energy-hydrogen-plant-going-up-in-long-beach/

of fuel cells make them an ideal partner for microgrid installations that seek increase grid reliability while maintaining strict environmental standards."[20]

9. Are the regulatory constructs currently in place to assure reliability, security, and resiliency of infrastructure adequate to meet the EMP's goals? If not, what steps can the state take to address the inadequacies?
It is important that the BPU value and ensure the ability of DER to island while decreasing both GHG and criteria air pollutant emissions. Current policy disincentivizes reliability, resiliency and security by favoring solar and wind (intermittent) over fuel cells. By designating fuel cell systems with a Class I equivalent, they would be more equitably recognized for their attributes in the State of New Jersey.

Fuel cell systems continue to experience barriers to adoption in the utility interconnection process. In order to realize the significant co-benefits of GHG and criteria air pollutant reduction, streamlined and state-wide uniform processes for interconnection in all utility territories should be developed. The interconnection processes should also be low cost and rapid, especially in the near-term while the grid can manage and significantly benefit from the widespread use of firm, 24/7 dispatchable power from fuel cell systems. The BPU should also explore similar streamlined processes for interconnecting DER in publicly owned utility systems. This recommendation to streamline the interconnection process for DER remains relevant, requires interagency cooperation, and could be simplified by the qualification of fuel cell systems as a Class 1 resource.

State Policy

11. What changes are needed to assure reliability, security, and resiliency of infrastructure? How is that balanced with affordability for ratepayers?
The industrial and commercial incentives through the New Jersey Clean Energy Program should provide for resiliency in all facilities. The structure and efficiency requirements of the current program requires customers to have well-matched thermal and electrical loads. This type of load represents the smaller percentage of clean generation projects in New Jersey and does not necessarily correspond to the critical facilities that require resiliency in their operations. For example, an emergency call center may not have a well-matched thermal and electrical load to qualify for current clean energy funding, based only on an efficiency threshold as mentioned in the *Reducing Energy Consumption* section on pages 4 and 5 of this document. Thus, policies should be changed to allow electric-only DER qualification for funding, and qualifications that are also based upon the valuable reliability and resiliency services that either all-electric or combined heat and power DER can provide.

CONCLUSION

The NFCRC appreciates the open public process that New Jersey is using to seek stakeholder input on the EMP. This process can ensure that diverse energy systems and programs are included to meet the needs of diverse energy consumers, as well as meet the broader environmental objectives that benefit all residents in New Jersey.

---

[20] Microgrid Knowledge, "*Fuel Cell Microgrids: The Path to Lower Cost, Higher Reliability, Cleaner Energy*" copyright 2017, Energy Efficient Markets, LLC.