



Michael Hornsby, Chief Project Development Officer
New Jersey Board of Public Utilities
PO Box 350
Trenton, NJ 08625

October 12, 2018

Dear Mr. Hornsby:

The New Jersey Fuel Cell Coalition appreciates the opportunity to provide input to New Jersey's 2019 Energy Master Plan (EMP), solicited by the Board of Public Utilities (BPU) in September 2018.

The New Jersey Fuel Cell Coalition (NJFCC or Coalition) is a group of business, government and academic organizations engaged collectively in education and outreach activities to promote adoption of hydrogen and fuel cell technologies. The Coalition is affiliated with the Northeast Electrochemical Energy Storage Cluster, which was launched through the U.S. Small Business Administration's Innovative Economies Initiative to assist the emerging the hydrogen and fuel cell supply chain in the Northeast. The NJFCC also collaborates with other entities in the Northeast that promote adoption of hydrogen and fuel cell technologies in New Jersey, Connecticut, New York, and Massachusetts.

The NJFCC encourages (1) a technology neutral approach to the transition to 100% clean energy usage by 2050, and (2) flexibility between now and 2050 to allow for approaches that may not be zero-emission today, but enable reduced emissions and other positive attributes today, and provide a pathway to the economies of scale needed to fully realize zero-emission energy technologies in the future. These "less than perfect" fuels can be phased out over time.

The Coalition's input is organized in response to the EMP discussion questions. The information we provide is focused on hydrogen and fuel cell systems - clean energy technologies that have seen increased market growth over the past decade, particularly in California.

Sincerely,

A handwritten signature in black ink that reads "JoAnn Milliken". The signature is written in a cursive, flowing style.

JoAnn Milliken
Director
NJ Fuel Cell Coalition

CLEAN AND RENEWABLE POWER

General

1. How should clean energy be defined?

Clean energy should be defined as heat and power sources that significantly reduce greenhouse gas emissions, criteria air pollutants, short-lived climate pollutants, and air toxic emissions, while providing high efficiency and reliability. Clean energy programs should include those that save energy through energy efficiency measures.

Fuel cell systems possess all of these attributes – they are highly efficient power sources that produce zero criteria pollutant emissions. Stationary fuel cell systems also provide heating and cooling, and energy resiliency – they maintain power and heat during grid outages and enable local capacity to produce continuous power.

2. Should the definition of clean energy contain flexibility between now and 2050 to allow for transitional fuels to be used and phased out over time? What intervening steps should be taken to complete the transition?

Yes, flexibility between now and 2050 will allow for approaches that may not be zero-emission today, but enable reduced carbon emissions, zero criteria pollutant emissions, and energy resilience today, and provide a pathway to the economies of scale needed to fully realize zero-emission energy technologies in the future. These “less than perfect” fuels can be phased out over time.

Many experts argue that removing CO₂ from the electricity grid affordably requires a broad range of technologies, including nuclear power and carbon capture and storage with continued use of some fossil fuels, in addition to increased use of renewable energy. For 100% renewable energy to be affordable, it must be scaled up over time. See for example this article from the Proceedings of the National Academy of Sciences ---

<http://www.pnas.org/content/early/2017/06/16/1610381114.full>.

In the transportation sector, natural gas must be an option during the transition – as part of the grid mix for the battery electric vehicle (BEV) recharging infrastructure and currently the most economical source of hydrogen for fuel cell vehicles (FCVs).

3. What is the most significant obstacle to getting to 100% clean energy by 2050? How can the state address it?

While technical and economic barriers exist, many experts believe the most significant obstacles to 100% clean energy are social and political. See for example Mark Jacobson in Energy and Environmental Science ---

<https://web.stanford.edu/group/efmh/jacobson/Articles/I/USStatesWWS.pdf>

Political will; consistent and stable policies that reduce the risk to companies, investors, and consumers; regional collaborations, and government-industry partnerships are needed to

overcome political barriers. Education programs, and regulatory frameworks and incentives, are needed to address lack of awareness and resistance to change, respectively.

For FCVs, the most significant challenge is the same chicken and egg issue facing BEVs. Hydrogen stations must be built before consumers will purchase or lease FCVs. However, much has been learned through California's efforts. Analysis by the California Energy Commission indicates that a hydrogen station can be built in two years. See "Joint Agency Staff Report on Assembly Bill 8: 2016 Assessment of Time and Cost Needed to Attain 100 Hydrogen Refueling Stations in California," January, 2017, Page 22
<http://www.energy.ca.gov/2017publications/CEC-600-2017-002/CEC-600-2017-002.pdf>.

New Jersey can address this challenge by tapping the expertise and experiences of hydrogen station developers who planned and built California's hydrogen station network and exploring the State's FCV and hydrogen policies for approaches that would work in New Jersey. Hydrogen infrastructure will be discussed in more detail in the Transportation section.

State Policy

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?

Power Generation. There are almost 10MW of stationary fuel cell systems installed in New Jersey. For comparison, California has 250 MW of stationary fuel cell installations, and Connecticut has over 150 MW of systems operating or in development. California's installations have been driven by its Self-Generation Incentive Program and Fuel Cell Net Energy Metering tariff, while Connecticut's fuel cell systems have been supported through reverse auction, net metering and utility procurement.

In the near term, New Jersey's Clean Energy Program would benefit by incorporating market mechanisms, such as a reverse auction, and enabling projects to compete based on desired attributes, such as low emissions, resiliency and cost-effectiveness. Rather than up-front incentives, New Jersey should consider paying incentives based on the performance and actual capacity factor of power generation systems.

Transportation. ZEV policies should include fuel cell vehicles and the required hydrogen refueling infrastructure. FCVs are complementary, not competitive, to BEVs, with fuel cells enabling larger vehicles, providing longer range and faster refueling time. Supporting both battery and fuel cell vehicles will expand the availability of ZEVs and increase options for consumers. In addition, hydrogen infrastructure can support the expansion of clean and reliable power. Hydrogen produced by electrolysis offers an energy storage medium, effectively storing renewable energy until a fuel cell or engine converts it back to electricity. These considerations will be addressed in more detail in other parts of this document.

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?

As mentioned above, hydrogen produced via renewable electrolysis is a promising energy storage strategy for integrating large amounts of renewable energy into the electric grid. Hydrogen can be produced during off-peak periods or at times when there is excess renewable electricity. It can be converted back to electricity to provide constant power when a renewable source isn't available. Analyses by the National Renewable Energy Laboratory have determined that hydrogen's additional revenue streams (in vehicles, forklifts and other applications) give it an economic advantage over other bulk energy storage options using batteries, compressed air, or pumped water. For more information on hydrogen as an energy storage strategy see "Power-To-Gas: The Case for Hydrogen" by the California Hydrogen Business Council --- <https://www.californiahydrogen.org/wp-content/uploads/2018/01/CHBC-Hydrogen-Energy-Storage-White-Paper-FINAL.pdf>

Planning and Zoning

10. How can clean and reliable power support the expansion of clean transportation?

As noted above, using hydrogen for energy storage provides opportunities for synergies between the power and transportation sectors. Hydrogen produced by renewable electrolysis provides clean fuel for the transportation sector and a clean energy storage medium for the electric grid. Because hydrogen can be used in so many applications, generating several different revenue streams, using hydrogen to integrate the transportation and power sectors makes economic sense. Along these lines, the U.S. Department of Energy has launched an initiative called Hydrogen-at-Scale (or H2@Scale) to explore the synergies among all hydrogen applications - fuel for fuel cells in both stationary and transportation systems, energy storage medium for the power sector, and feedstock or by-product in industrial processes. These industrial processes include ammonia production, petroleum refining, food processing, metal refining, and chlor-alkali plants – industries that exist in New Jersey and make the State a prime location for H2@Scale projects. Projects designed to use those synergies could reduce the cost of hydrogen production and distribution and accelerate progress toward the economies of scale needed to realize the full benefits of hydrogen and fuel cell systems.

Economic Growth and Workforce Development

15. How can the transition to 100% clean energy grow New Jersey's economy and create new innovative and high paying careers for New Jersey residents?

16. How can the State encourage, require, or otherwise develop a robust supply chain for all clean energy industries?

Deployment of hydrogen and fuel cell technologies in New Jersey will result in high tech jobs. A recent economic analysis conducted by the Northeast Electrochemical Energy Storage Cluster through the Small Business Administration's Innovative Economies Initiative indicated that New Jersey's nascent hydrogen and fuel cell supply chain contributed to the State's economy in 2016 by providing approximately \$54 million in revenue and investment, more than 228 indirect and induced jobs, over \$2.7 million in state and local tax revenue, and labor income of approximately \$20 million. These supply chain companies are involved in manufacturing, parts distribution, fuel processing, industrial gas supply, engineering research and development,

coating applications, and venture capital management. The hydrogen and fuel cell industry and supply chain in NJ are poised for growth. The analysis and proposed roadmap describing near term opportunities can be found here --- http://neesc.org/wp-content/uploads/2015/01/2018_NJ_H2_Fuel_Cell_Dev_Plan_final4.pdf

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

California has passed legislation to monitor and address air quality in disproportionately impacted communities. 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.” New Jersey should take a similar approach by identifying the most impacted communities and implementing a plan for reducing NO_x, SO_x, and particulate matter emissions and improving air quality in those communities.

SUSTAINABLE AND RESILIENT INFRASTRUCTURE

State Policy

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.

Distributed energy resources can enable a resilient infrastructure without adding transmission and distribution costs. Microgrids are also important for resiliency. Microgrids that use fuel cell systems as baseload power can immediately disconnect from the grid and operate autonomously during disasters or grid instability. Compared with fossil fuel plants, wind or solar farms, fuel cells are relatively easy to site, making them ideal for densely populated areas. New Jersey’s DER and microgrid programs should value low GHG and criteria pollutant emissions in addition to reliability and resiliency.

11. What changes are needed to assure reliability, security, and resiliency of infrastructure? How is that balanced with affordability for ratepayers?

New Jersey’s current Clean Energy Program requires facilities to have well-matched thermal and electrical loads to qualify for project funding. However, there are critical facilities in New Jersey that require resiliency in their operations but do not have well-matched thermal and electric loads. The BPU should re-evaluate program requirements to include consideration of the resiliency and emissions benefits that electric-only DER fuel cells provide.

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?

Given their high efficiency and low to zero emissions, fuel cells should be considered in any strategy to reduce energy consumption. The thermal output of a fuel cell can also be used to provide heat, cooling, hot water, or steam, with efficiencies ranging from 55% to 80%, or even 90%.

State Policy

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

New Jersey should consider other technology/system attributes and benefits in addition to energy efficiency, including resiliency, grid benefits and environmental impacts, for example.

CLEAN AND RELIABLE TRANSPORTATION

General

1. What are the intermediate timeframes and pathways to new or enhanced clean transportation systems? What clean and reliable transportation goals should be set for 2030 and 2050?

Fuel cell vehicles should be included in New Jersey clean transportation goals. FCVs are complementary, not competitive, to BEVs, with fuel cells enabling larger vehicles, providing longer range and faster refueling time. In addition, not all U.S. households can accommodate BEV charging. Supporting both battery and fuel cell vehicles will expand the availability of ZEVs and increase options for consumers.

New Jersey should engage with auto manufacturers and fuel providers to identify goals for FCVs and hydrogen refueling stations, and with the State of California, where more than 5,000 FCVs are on the road today and 35 hydrogen stations are in operation. The FCVs are being sold or leased by Toyota, Honda, and Hyundai. The California Air Resources Board projects 13,000 - 18,000 FCVs will be on the road by 2020; and as many as 43,000 FCVs by 2022.

New Jersey should also engage with the National Renewable Energy Laboratory (NREL). The laboratory has developed a 50-State roadmap describing FCV and hydrogen refueling station deployment. NREL's analysis indicates that, following the rollout of the 200 stations planned in California, by 2025 a total of 320–570 additional stations would be required nationwide to enable significant FCV market growth.

New Jersey should also consider goals for fuel cell-powered trucks and other ground vehicles at airports and maritime ports, fuel cell buses, and fuel cell powered forklifts. There are currently

30 fuel cell buses operating in 4 states, and more than 20,000 fuel cell forklifts in operation across the country.

2. What is the most significant obstacle that the state will face in implementing a clean transportation plan by 2050? What are some solutions to these challenges?

As stated previously in this document, the most significant challenge for FCVs is the same chicken and egg issue facing BEVs. Hydrogen stations must be built before consumers will purchase or lease FCVs. Much has been said about the cost of hydrogen stations; however, analysis by McKinsey and Company indicates that the cost for deploying a hydrogen infrastructure on a per-vehicle or a per-mile basis is similar to that of the recharging infrastructure for battery electric vehicles, due to the lengthy recharging time of battery vehicles and the higher range of fuel cell vehicles.

Much has been learned about hydrogen station build-out in California. New Jersey can address the FCV infrastructure challenge by tapping the expertise and experience of hydrogen station developers who planned and built California's hydrogen station network and exploring the State's FCV and hydrogen policies for approaches that would work in New Jersey.

New Jersey should also consider collaborating with the U.S. Department of Energy in its Hydrogen-at-Scale (H2@Scale) initiative to explore the synergies among all hydrogen applications - fuel for fuel cells in both stationary and transportation systems, energy storage medium for the power sector, and feedstock or by-product in industrial processes. These industrial processes include ammonia production, petroleum refining, food processing, metal refining, and chlor-alkali plants – industries that exist in New Jersey and make the State a prime location for H2@Scale projects. Projects designed to use those synergies could reduce the cost of the hydrogen production and distribution and accelerate progress toward the economies of scale needed to realize the full benefits of hydrogen and fuel cell technologies.

3. What is the role of clean transportation in freight movement? What should the State do to promote low-carbon freight/goods movement?

See above.

4. How can clean transportation solutions impact goods movement and economic growth?

See above.

State Policy

5. What are the regulatory or statutory barriers to the expansion of low-and zero-emission vehicles?

In the Northeast, tunnel and bridge restrictions are a barrier to the FCV market. The Coalition anticipates that this issue will be addressed in comments provided by the auto companies and others, and therefore, will not go into detail here. New Jersey should work with regulatory officials in New York to address this issue.

6. What are the clean fuel transportation approaches the State should consider to achieve its zero-emission vehicle (ZEV) goals of 330,000 ZEVs on the road by 2025?

New Jersey could promote market growth for fuel cell vehicles through projects developed and selected in the Volkswagen settlement program, and by replacing conventional vehicles and buses with FCVs and FCBs. A recent analysis conducted by the Northeast Electrochemical Energy Storage Cluster through the Small Business Administration's Innovative Economies Initiative has estimated that, in the near term, fuel cell vehicles could replace more than 3,000 conventional fleet vehicles and buses in New Jersey, which could reduce annual CO₂ emissions by roughly 27,000 metric tons and NO_x emissions by approximately 10 metric tons.

7. What actions can the state take with its own fleet to demonstrate clean transportation leadership? How would these actions affect service reliability?

See above.

9. What best practices can the state adopt from other states and local governments that have advanced clean transportation goals?

New Jersey should look to California for best practices in FCV deployment and hydrogen station development. California has set standards for refueling station design, construction, installation and operation. An example is the State's hydrogen permitting guide --- <http://www.businessportal.ca.gov/wp-content/Documents/ZEV/Hydrogen-Permitting-Guidebook.pdf>

10. What actions can the state take to help promote clean and reliable transportation at the state's ports?

See above. It should also be noted that the NJFCC, in collaboration with the Fuel Cell and Hydrogen Energy Association (FCHEA), provided a background paper to the NJDEP describing the benefits of deploying fuel cell powered vehicles and material handling equipment in New Jersey ports.

Infrastructure Investment

15. What infrastructure investments, policies, and procedures are needed to support the future of clean transportation in the state? What infrastructure needs will the state have in the promotion of clean and alternative fuel vehicles?

See above.

16. What clean transportation funding mechanisms should the state explore? What type of financial planning and programming should be considered?

See above.

Reliability and Security

20. What strategies can NJ TRANSIT develop (infrastructure, facilities, vehicles, labor, workforce, training, etc.) to implement clean transportation (buses, paratransit and rail) by 2030 and 2050 while maintaining reliability?

See above.

Environmental Justice

25. What strategies could be implemented to allow for disproportionately impacted communities to have access to clean transportation options?

Fuel cells can replace diesel engines that typically operate in vehicles and equipment in or near areas that are disproportionately impacted by air and noise pollution. These include trucks, buses, cargo tractors and forklifts, and refrigeration equipment in ports, airports and warehouse distribution centers.