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December 9, 2022

Via Electronic Mail
CThydrogentaskforce@strategen.com

Re: Request for Written Comments; Special Act No. 22-8

Dear Sir/Madam:

FuelCell Energy, Inc. submits these comments to the Connecticut Green Bank in response to its Request for Written Comments issued November 8, 2022, regarding the study mandated by Special Act 22-8. FuelCell Energy appreciates the opportunity to provide these comments and thanks the Connecticut Green Bank for allowing stakeholders and long-term clean energy-technology employers in the state like FuelCell Energy to participate in ensuring the success of the Hydrogen Task Force.

FuelCell Energy is proud to have its global headquarters in Danbury, Connecticut and its primary U.S. manufacturing facility in Torrington, Connecticut. FuelCell Energy is proud to be among the companies that have been dedicated to clean energy innovations since our inception five decades ago. The company was founded in the United States in 1969, by two scientists devoted to pursuing technological innovations that address a wide variety of energy priorities through patent-protected U.S. innovations, compound combinations that produce and use energy in ways that are smarter and cleaner. It is important to note that the strength of FuelCell Energy's technologies is that they can be combined in ways to achieve multiple objectives and to provide a myriad of energy and other direct community benefits such as improved air quality.

As examples, our current product portfolio includes two dynamic electrochemical platforms: molten carbonate and solid oxide. The platforms are similar in many ways, but they also have unique capabilities. Importantly, both can support power generation and combined heat and power applications from a variety of fuels, including natural gas, biofuels, renewable natural gas, and pure hydrogen.

These fuel cells react fuel electrochemically, without combusting the fuel, which avoids harmful emissions produced by fuel combustion such as oxides of nitrogen, oxides of sulfur, and particulate emissions each of which directly impact the communities where those technologies are deployed. As you know, these are emissions that impact air quality in communities in real time versus climate change, which is also harmful but happens over decades. In the electrochemical process, fuel and air are reacted in separate chambers in the fuel cell stack. As a result, the reactions producing CO_2 happen before the fuel is mixed with air while the CO_2 remains concentrated and easy to remove. Both molten carbonate and solid oxide fuel cell systems can benefit from this unique feature, with modifications enabling the capture of system level CO_2 for use or sequestration before it is emitted into the air. FuelCell Energy's molten carbonate fuel cell is unique in its ability to also capture CO_2 from an external source, such as a power plant or an industrial boiler just to name a couple. Our solid oxide fuel cell can operate on pure hydrogen as a feedstock to produce electricity and other value streams, emitting zero CO_2, which will become increasingly important as the uses of

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one hundred (100%) percent hydrogen for fuel, as an energy carrier, and energy store become more widely adopted. Hydrogen-based energy storage is the most practical and efficient long duration energy storage solution and the only zero carbon energy storage solution that largely avoids geopolitical risk since it is not solely dependent on mining. We recently announced the commercialization of our solid oxide electrolyzer that will produce hydrogen from power (electricity) and water, which is well suited to partner with renewable energy projects as firm capacity negating one of the most material downsides of intermittent renewable energy technologies, and as a generation source to fill hydrogen storage infrastructure.

Responses to Questions for Stakeholders:

Defining Clean Hydrogen

1. Based on Federal guidance in the Infrastructure Investment and Jobs Act and the Inflation Reduction Act, clean hydrogen is defined as hydrogen that is produced through a process that results in a lifecycle greenhouse gas emissions rate of not greater than 4 kilograms of CO2e per kilogram of hydrogen and with less than 2 kilograms of CO2e per kilogram of hydrogen at the point of production. Do you believe that Connecticut should pursue a more stringent definition for clean hydrogen than the one that has been established by the Federal government? If so, why? If not, why not?

Response: FuelCell Energy strongly recommends that Connecticut adopt the Federal standard for the definition of clean hydrogen. Widespread use of hydrogen will require a robust level of interstate commerce, and federal codes and standards that will facilitate that activity. For example, the state is working with New York, New Jersey, and Massachusetts to respond to the Federal Hydrogen Hub initiative. If Connecticut were to adopt a different standard for clean hydrogen it is likely Connecticut would struggle to participate in the broader hydrogen economy. Connecticut has an opportunity to be a hydrogen exporter in a free-market hydrogen economy and a balkanization of hydrogen standards would impede the evolution of that free market. Connecticut also has a number of clean technology energy companies based in and or operating in the state that need to serve the broader U.S., and global markets. The Federal standard establishes carbon intensity criteria and provides production incentives that increase at lower carbon intensities, but once the hydrogen is produced and placed in a pipeline or a transport truck, it should be free to be used in a common clean hydrogen market.

Stakeholder Engagement and Equity

2. When and how should the state of Connecticut engage with environmental justice and disadvantaged communities throughout the clean hydrogen planning and development process? What steps can the state take to support environmental justice and disadvantaged communities engagement in these processes?

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Response: The development of a hydrogen economy will impact environmental justice and disadvantaged communities in positive and negative ways. If implemented improperly, the addition of hydrogen production or transport infrastructure can be intrusive and provide visual and noise impacts. Production from renewable sources is not likely to create local emissions impacts but does impose other negative impacts, ranging from land utilization to new transmission build requirements which pose the same infrastructure risk. For some applications, the displacement of legacy fossil resources with hydrogen fueled resources will likely reduce local emissions and noise impacts. The state should create a task force that works with developers to define these impacts, and effectively communicate potential impacts – positive and negative – to environmental justice and disadvantaged communities, and that works with the communities to mitigate negative impacts.

As part of this mitigation strategy, Connecticut should prioritize education efforts within all communities, and specifically environmental justice and disadvantaged communities. Education is a key enabler for environmental and energy justice, and by providing educational resources to Connecticut residents, the state can ensure that its investments in manufacturing and infrastructure improvement will provide direct benefits of which residents are aware and to which they can avail themselves.

3. What steps should the state of Connecticut take to ensure that the clean hydrogen economy provides equitable benefits for environmental justice and disadvantaged communities?

Response: Connecticut is fortunate to have a significant representation of the nascent clean hydrogen industry in-state already, and some facilities like FuelCell Energy's Torrington manufacturing operations, are in DECD distressed communities. As these companies expand and as new companies enter the market, Connecticut should continue robust economic development outreach to attract these companies to the State and to environmental justice and distressed communities.
Connecticut can also prioritize, through a variety of incentives, projects that displace legacy systems that have negative local impacts with clean hydrogen alternatives. Connecticut should also work with the Federal government to ensure alignment with Federal and State definitions of distressed communities. Right now, not all DECD distressed communities are recognized in DOE's Justice40 model as Disadvantaged Communities, and alignment would help attract Federal support for hydrogen projects in DECD distressed communities.

With a continued focus on environmental justice and disadvantaged communities, the adoption of the cleanest air standards possible for hydrogen production is paramount, particularly where air pollution remains a local community burden. Stringent standards on air pollution would incentivize the development of truly clean hydrogen production, driving toward the lowest economic and social costs of hydrogen possible. Clean air emission standards need to be included in the state's

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strategy now, rather than delayed, to better serve the needs of environmental justice communities.

Hydrogen End-Uses

4. The Hydrogen Task Force has been exploring hydrogen end uses including: critical facilities, aviation, cargo ships, material handling equipment, long-haul heavy-duty trucks, fuel cells for peak power generation, high heat industrial processes, buses, ferries, rail, hydrogen blending in pipelines, and light-duty vehicles. How should the state address differing stakeholder perspectives about hydrogen end use prioritization? Which specific end uses are of greatest concern, and why? What actions can or should the state take to continue to solicit stakeholder feedback?

Response: In evaluating differing hydrogen end user perspectives, the state should consider how quickly each end use can grow in size as a source of hydrogen demand, and how effectively the end use supports decarbonization, as well as other air quality (e.g. criteria pollutants) and environmental justice goals. Hydrogen blending in existing pipelines can provide near term incremental carbon reductions in a state that depends on natural gas as much as Connecticut does. In fact, hydrogen blending would lend support for Connecticut to use natural gas to reduce the use of fuel oil, which produces about forty (40%) percent higher CO_2 emissions and is distributed via diesel trucks versus pipelines. And blending decarbonizes multiple sectors that require high Btu/high grade heat in their process of making products and or delivering services. Connecticut consumes about 300 million MMBtu/y of natural gas, about half of which is used in power generation with the rest split between commercial, residential, and industrial use. A 2% hydrogen blend would consume 45 thousand tonnes/year of hydrogen (which would be a good start on in-state hydrogen demand) and would avoid 15 million tonnes per year of CO_2 emissions even without fuel oil displacement.

While supporting this type of early end use, Connecticut should also support other end uses which have potential, such as hydrogen power generation, material handling, light- and heavy-duty vehicles. Light-duty vehicles are considered by some as being eclipsed by battery electric vehicles, but we believe that as the hydrogen ecosystem evolves as these other end uses grow, light duty hydrogen fuel cell vehicles can be a significant source of hydrogen demand. Given the significant advantages of fuel cell vehicles over battery vehicles (fast filling, long range, avoidance of geopolitical and mining issues associated with lithium and cobalt and other minerals). The lack of fueling infrastructure and uniformed regulations concerning the safety of hydrogen and hydrogen fuel cell vehicles has held fuel cell vehicles back. If the other markets evolve as expected, along with expanding infrastructure, distributed production technologies, regulatory advances and public education, the infrastructure barrier will go away. And for battery vehicles to completely replace combustion vehicles, there would be significant power distribution charging infrastructure issues to overcome. If all of Connecticut's 2 million passenger cars were fueled by hydrogen, there would be a demand of more than 300 thousand tonnes per year of hydrogen, while avoided CO_2 would

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total almost 10 million tonnes per year, along with significant avoided criteria pollutants. In the long term there will be a mix of battery and fuel cell vehicles, but the scale of the decarbonization potential is significant, even at modest market penetration rates.

Hydrogen Supply

5. If local (in-state) hydrogen supply is expected to limit in-state hydrogen end use applications, should the state consider the role of hydrogen imports in meeting supply needs?

Response: In-state hydrogen production is preferred from an economic development standpoint and also because transporting hydrogen adds costs and emission, so production as close as possible to end use is generally preferable. Having said that, Connecticut may benefit from an open market that allows the state to import as well as export hydrogen. We strongly advocate for the state to support hydrogen pipeline infrastructure being built-out throughout the state. In the early days of the energy transition, it might be the case that in-state hydrogen supply limits end use applications. But Connecticut has significant technical production potential from solar, offshore wind, and nuclear resources. Hydrogen produced in-state using out-of-state hydroelectric power could also have significant potential. It may well be that in some long-term scenarios, Connecticut could become a hydrogen exporter. Connecticut should be open to clean hydrogen imports if demand exceeds in-state supply because that will advance decarbonization and energy justice goals, as well as ensuring a fair and open market as Connecticut's hydrogen production expands.

In addition, FuelCell Energy encourages Connecticut to consider ways to motivate investment within the state through incentives such as tax credits and/or carbon capture credits, both for the price of carbon captured per kilogram and for the price of carbon emissions reduced per ton. By creating incentives such as these, Connecticut can ensure sufficient hydrogen supply to meet emerging end use applications, while simultaneously creating the opportunity for the state to become a hydrogen exporter in the event that in-state supply exceeds demand at any given time.

Hydrogen Infrastructure

6. What additional processes should the state consider to ensure that use of pipeline infrastructure for hydrogen transport is implemented safely, and supports community and climate goals?

Response: Initially hydrogen will be transported as it is now in the State, by truck as pressurized gas or liquid. To really scale the hydrogen supply and demand sectors, both distributed hydrogen and hydrogen pipeline transport will be needed. Connecticut should work with neighboring States and the Federal Government on codes and standards for pipelines and other infrastructure, thus speeding up permitting for pipeline and vehicle fueling infrastructure. For pipeline and fueling infrastructure, a Siting Council type approach that expedites approval while attending to energy justice concerns should be considered.

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7. What enabling infrastructure do you believe is highest priority for the state to pursue to support the development of Connecticut's hydrogen economy, and why?

Response: In the near term, support for producing clean carbon hydrogen utilizing distributed fuel cell technology to produce hydrogen at points of consumption, permitting fueling infrastructure for light- and heavy-duty trucks, ensuring that rules limiting transportation access are removed, and pipeline infrastructure for transport of hydrogen should be considered, as these can take significant time. Evidence that this infrastructure is being built out will drive investment in hydrogen production capacity, increase the probability of success in securing a DOE hydrogen hub and other large-scale projects especially given Federal incentives for hydrogen production.

Hydrogen Funding and Policy Activities

8. What portions of the hydrogen value chain (uses, sources, transport, storage) would be most benefited by further development of additional policy or regulatory guidance? Why, and what gaps should these policies be seeking to address?

Response: All of the above. But with the Federal Government providing significant support for hydrogen production, the state should consider how it can support manufacturing of hydrogen generating technologies up to and including incentives to expand in-state manufacturing, transport, fueling and storage infrastructure, and how to incentivize end users. Standardization of grid interconnection requirements will also yield reduced integration costs and help reduce the cost of hydrogen. Also, the state should support distributed hydrogen production utilizing carbon neutral fuels for the production of hydrogen in addition to hydrogen produced through electrolysis utilizing renewable energy.

9. Federal funding is hoped to represent a significant portion of hydrogen funding but is not expected to meet all funding needs. Which hydrogen investments (infrastructure, manufacturing, end use equipment, workforce training, etc.) would be the most important for the state to consider funding? Why?

Response: As noted above, the state should consider incentives/grants to expand in state manufacturing, and the state should set aside specific programs to implement in-state manufactured technologies at state owned/funded facilities, as well as programs that support transport, fueling and storage infrastructure, incentivize end users, and adopt constructive policies that promote hydrogen use within the state. Workforce training is another area where the state can play an important role. Connecticut has a tight labor market, and skilled workers will be needed in the manufacturing facilities that make hydrogen production equipment, and in hydrogen production and distribution facilities and infrastructure.

Connecticut should also consider funding pilot programs that allow companies like FuelCell

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Energy to continue demonstrating the value of their products and technologies. This avenue will yield near-term benefits to the entire state and will further allow Connecticut to secure its position as a leader and an innovator in the clean hydrogen economy. Beyond pilots, the state should implement commercial applications at state owned/funded facilities to spur manufacturing scale-up and drive down cost.

10. What are the best mechanisms for state agencies to gain visibility into federal funding opportunities pursued by individual commercial actors or other organizations? What actions can the state take to support these applications?

Response: Connecticut's congressional delegation has been very supportive of the in-state hydrogen industry, and state agencies should keep in touch with congressional staffers to gain this type of visibility. Also trade organizations like the Fuel Cell and Hydrogen Association and in-state organizations like CCAT can help keep agencies informed.

11. What federal funding opportunities have stakeholders applied to? Are these formula grants or competitive? Are these opportunities hydrogen-related? Do stakeholders have lessons learned to share based on the application or implementation process?

Response: Many CT stakeholders (hydrogen producers and consumers) have been active in the regional Clean Hydrogen Hub initiative by the Department of Energy, now in the concept paper evaluation stage. FuelCell Energy also routinely applies for and receives Federal funding to advance the development of our hydrogen production platforms. The typical mechanism is a cost-shared grant, awarded on a competitive basis. The Hydrogen Hub initiative is very unique in requiring a regional submission with many different participants, so although there are not many lessons learned in this area yet, these will also be grants with significant cost share requirements. If the state is successful in securing a DOE hydrogen hub or hubs, the state should consider assisting local manufacturing companies with their portion of the cost share in deploying their technologies in support of the hydrogen hub(s).

Conclusion

At FuelCell Energy, we are particularly proud of our history as an energy technology innovator and we celebrate the women and men who have, for decades, been driven to create and share new technologies that produce multiple value streams for our customers worldwide. We are also proud that we are a significant employer in the state, that we have executed research and manufactured in the state for five decades and that we purchase the vast majority of our technical manufacturing equipment (i.e., the equipment we use daily that we have not invented) almost exclusively from U.S. based manufacturers across the country.

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We thank you for the opportunity to submit these comments and appreciate your willingness to consider our recommendations. Should you need any additional information, Alexandrea Isaac, FuelCell Energy's Senior Counsel (aisaac@fce.com) can assist you.

Sincerely,

Anthony Leo

Anthony Leo
Chief Technology Officer & Executive Vice President