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November 11, 2022

Sent Via Electronic Mail
Department of Energy
1000 Independence Avenue
Washington, D.C. 20585
Cleanh2standard@ee.doe.gov

Re: Request for Comment, U.S. Department of Energy, Clean Hydrogen Production Standards

Dear Secretary Granholm,

This letter has been prepared by FuelCell Energy, Inc., a global leader in clean energy manufacturing, in response to the Request for Comment on the draft guidance for a Clean Hydrogen Production Standard (CHPS), as released on September 22, 2022, by the Department of Energy (DOE).

Undoubtedly, Congressional passage and enactment of the Bipartisan Infrastructure Law (BIL) and the Inflation Reduction Act (IRA) marked fundamental changes in the United States related to the federal government's view on the wide a wide variety of policies, including policies that dictate and govern the way we are investing in and driving changes across the energy sector.

FuelCell Energy is proud to be among the companies that have been dedicated to clean energy innovations for decades. 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, compound combinations that produce and use energy in ways that are smarter and cleaner. It's important to note that the strength of FuelCell Energy's technologies is that they can be combined to achieve multiple objectives and to provide multiple benefits.

We are proud of our long-standing relationship with the DOE, as an early innovator in energy technology. We are also very proud to see our Trigeneration project, initially made possible with DOE funding support, highlighted in the Clean Hydrogen Roadmap as an example of how innovative technology can use hydrogen as a source of power, back-up power, and as a vehicle fuel supplier.[1]

Per the DOE's request, the balance of this letter includes both general observations and comments on specific questions posed by the DOE when the draft guidance for the CHPS was released.

[1] DOE National Clean Hydrogen Strategy and Roadmap Draft - September 2022; p.49; See: Tri-Generation Success Story: World's First Tri-Gen Energy Station - Fountain Valley

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In General:

As noted, passages of the BIL and IRA demonstrated significant commitments on the part of the federal government to change the way in which we consider, design, and implement energy and other policies in the U.S. For companies like FuelCell Energy, a global technology firm committed to using innovations worldwide to fuel energy advancement, enactment of these comprehensive pieces of legislation has been unrivaled. Our current customers, industry partners, and prospects have become acutely focused on understanding the intent and the letter these legislative efforts.

Similarly, we believe it is critically important for Congress, the Administration, and all agencies responsible for implementation of CHPS to continue to consider and account for all new energy technologies that will contribute to the diversification of the energy sector in the U.S. As it relates to FuelCell Energy, we believe we share in the responsibility to achieve the energy goals, which includes providing the DOE, other agencies, and Congress with timely information related to regulatory implementation.

Recommendations and Analysis (Specific Questions):

1. The DOE asked for responses related to incorporating recommendations from the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) and the benefits or drawbacks in so doing.

FuelCell Energy strongly recommends that the DOE take a national and an international leadership role in establishing and maintaining control over a clear and consistent compliance regime for hydrogen. Consistent governance over CHPS, will enable its harmoniously usage with the BIL and IRA over the next two decades to successfully solidify U.S. leadership in clean hydrogen production. The U.S. has developed and maintained a leadership position in the development of the life cycle assessment (LCA) framework and must be fully engaged and participating in its refinement. The hydrogen industry needs stability in policy, standards, and approved analysis tools to justify the financial investment being contemplated by private and public organizations. The ISO Frameworks can continue to be used as long as the DOE has leadership and participates in the definition and modifications of such ISO Frameworks. FuelCell Energy cautions the DOE on allowing a regulatory compliance framework to be crafted and reshaped without U.S. control in a way that would create inconsistencies in short- and long-term policies, codes and standards, and market uncertainty.

FuelCell Energy recognizes and very much appreciates the DOE's leadership and involvement in the IPHE HPTF Working Paper thus far. As such, the various generally accepted ISO Frameworks can be continued to be used. Given the structure and significance of the incentives in the IRA, the U.S. cannot depend on LCA and carbon accounting methods which are not in the full control of the U.S.

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Billions of public and private dollars, as well as thousands of clean energy jobs, will be dependent on the emissions and LCA accounting methods. As the U.S. drives to $2/kg hydrogen and the $1/kg "Hydrogen Shot" goal, stability in the qualifications for the emissions and LCA is of vital importance. If these measures and standards are not in control of the U.S. through the DOE, the Environmental Protection Agency (EPA), and other U.S agencies, then hydrogen which meets all of the qualifications of clean hydrogen could be eliminated or pressured to be eliminate through non-scientific opinions outside of the U.S. The economics, financial strength and stability of the U.S. hydrogen industry is dependent on the U.S. and the DOE maintaining the standards for the U.S.

2. The DOE asked for responses related to biogenic resources for hydrogen production and the methods by which carbon emissions may be counted for purposes of the IRA.

FuelCell Energy strongly recommends that the DOE use the existing GREET model as the standard for determining the carbon intensity (CI) of hydrogen. GREET will act as a single, industry-wide and national standard for hydrogen production. FuelCell Energy further recommends that the DOE use the GREET model's existing approach for determining the CI score of biogenic resources, especially and including biomethane, in hydrogen production and that the DOE signal that the GREET model will continue to be used as the standard for analysis. The DOE must maintain the GREET model methods as the standard to provide leadership and stability to the U.S. hydrogen industry - as opposed to other less well-understood or less widely adopted standards.

FuelCell Energy contends that a strong link between market acceptance and the GREET model pathways has already been established through tax incentives under the IRA and the BIL as industry has begun analyzing and developing business plans to realize the incentives laid out in both pieces of legislation. As a result of the strong policy signals from the federal government and the already-underway work in the private sector, it is very important the standard for implementing the CHPS be the GREET model. The IRA established a ten-year horizon for the clean hydrogen production tax credits that will create the opportunity for hydrogen projects to be producing hydrogen beyond 2040, depending on the beginning construction dates for clean hydrogen projects. These projects need the certainty of the GREET model being applied to bring them to fruition.

Biomethane must continue to be included as a key feedstock for the production of clean hydrogen. U.S. biomethane sources, like dairies and wastewater treatment plants, will likely grow in volume as digester technology improves and as organic waste is increasingly diverted from landfills and processed. Additionally, investments in dairy digester equipment and technology through the IRA will allow digesters to more efficiently capture, concentrate, clean, and sell biomethane. In the case of wastewater plants, the biomethane is often close to urban centers and well-located for conversion to hydrogen via Trigeneration fuel cells, avoiding emissions from flaring the biogas. Hydrogen produced near to demand centers reduces the need for trucking hydrogen or the building of dedicated pipelines, reducing barriers to delivering low-cost zero-carbon hydrogen to end users and avoiding emissions through transportation. In the case of dairies, biomethane can be injected into pipelines and delivered to hydrogen production projects at ports, logistic centers, or industrial facilities, aiding the effort to decarbonize those hard-to-decarbonize sectors. Utilizing biomethane in fuel cell platforms versus combustion engine platforms further adds to improved air quality by virtually eliminating SOx, NOx, and other particulates.

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FuelCell Energy contends that the GREET model must continue, throughout that timespan, to value the benefits of producing hydrogen from renewable natural gas and biomethane as carbon negative resources that support the establishment and growth of the clean hydrogen industry. The GREET model appropriately considers the emissions baselines of various sources of biomethane through the LCA of those feedstocks. Additionally, the book and claim process for delivering these renewable resources is integral to the efficient and effective deployment of this important renewable resource. FuelCell Energy urges the DOE to ensure that that book and claim process remains an acceptable option for the sourcing and use of biomethane as a feedstock for hydrogen production.

3. The DOE asked for responses related to the accounting of greenhouse gas (GHG) emissions related to co-products from the hydrogen production process.

FuelCell Energy recommends that the DOE allocate GHG emissions to co-products of hydrogen production on an input and output energy basis. It is fundamental for DOE to establish a clear methodology with intelligible parameters for this GHG accounting to be used within the context of the GREET model. This structure will allow industry to readily understand how to develop hydrogen production projects that serve the goals of the DOE.

FuelCell Energy's Trigeneration project, noted above, uses renewable natural gas delivered by pipeline as a single fuel input to deliver multiple outputs: electricity, hydrogen, heat and water. The electricity may be used for onsite load which may also include electric vehicle charging. The heat and water produced from this project could offset onsite heating and cooling needs, or offer resources eliminate or significantly reduce the use of water resources, reducing the demand for fresh water in a drought-stricken area. These value streams each offset emissions when compared to traditional delivery pathways for the same outputs.

The reduction in GHG and criteria air emissions as a result of these useful and valuable outputs is significant and should be credited and accounted for in the creation of the CHPS using the GREET model. For a hydrogen production project with multiple outputs, the input energy emissions should be split between the product outputs so that emissions reductions or avoidances that can be identified and credited. As an example, FuelCell Energy's Trigeneration system produces renewable electricity with a much lower CI score than the local electric grid's daily average GHG emissions for a comparable amount of power production. In addition, the power from FuelCell Energy's Trigeneration platform avoids more emissions than wind and solar as it operates at much higher efficiency as a baseload platform. The emissions reductions associated with this power co-production from a hydrogen production project should be valued and credited.

Additionally, FuelCell Energy recommends that a similar allocation of GHG emissions based on an input and output energy basis be conducted for hydrogen that is a by-product, such as in chlor-alkali production, petrochemical cracking, or other industrial processes. FuelCell Energy urges the DOE to establish clear rules and methodologies within the GREET model to allocate GHG emissions to co-products.

FuelCell Energy also recommends that the lifecycle system boundary include emissions from transport of hydrogen to end users, such as pressurized gas or liquid hydrogen truck transport. This would incentivize

distributed hydrogen approaches, where hydrogen is produced near the point of consumption. This could avoid infrastructure additions and the environmental justice impacts of moving hydrogen through communities.

4. The DOE asked for responses related to renewable energy credits, power purchase agreements, and other market structures in characterizing the intensity of electricity emissions for hydrogen production.

FuelCell Energy recommends that renewable energy credits, power purchase agreements, renewable natural gas contracts, renewable natural gas credits (including renewable gas attributes), and other market structures be allowed in characterizing the intensity of electricity and gas emissions for hydrogen production.

In addition, FuelCell Energy urges the DOE to consider clear requirements for credits to be sourced and generated within the U.S. in order to ensure verifiable emissions reductions. We also support the transfer of credits and attributes and believe that such transfers should be allowed for projects creating clean hydrogen in service of the CHPS and DOE goals. The ability to transfer credits and attributes would be similar to current practices in renewable electricity markets and renewable natural gas markets.

Energy markets in the U.S., including electricity, gas, fuels, and transportation, have existing tracking, trading and verification systems in place. These systems have been developed and confirmed over approximately the last 10 years with the development of GHG reporting standards, emissions scoping, EPA emissions reporting, and as environmental & social governance programs in the private sector have accelerated. These existing frameworks for renewable electricity, renewable fuels, and other markets are diligent on source verifications, documentation and reporting, and prohibiting the double counting of credits.

With regard to clean hydrogen, FuelCell Energy suggests that a harmonizing of the existing reporting and verification systems described above be undertaken with the DOE's technical leadership so that there will be an understand of how to use best practices in the clean hydrogen market. Through a study period with public comment, industry can help the DOE apply important lessons to the emerging clean hydrogen market. Until such harmonization, the DOE should allow commercial contract certifications and verifications to be used as proof or confirmation of credits or applicable emission reductions instruments which can be utilized to reduce the emissions in the production of hydrogen.

5. The DOE asked for responses related to the economic impact on current hydrogen production operations to meet the proposed standard of 4.0 kgCO2e/kgH2.

On this point, FuelCell Energy recommends the DOE consider the environmental impacts of combustion in the hydrogen production process and incorporate a method for scoring production pathways based on emissions associated with combustion. While it is important to focus on greenhouse gas emissions, criterial pollutants such as SOx, NOx, and particulates have significant immediate local impacts on health. A methodology that flags these impacts would be an important part of evaluation of environmental justice

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considerations for projects. It should be noted that this impact is not currently contemplated in the LCA of the GREET model.

The policy framework decisions that happen over the next few months will create an enduring policy environment, not just for the next decade, but likely for the next two decades, influencing project finance and development for a significant amount of time. A multi-year timeline to meet the 4 kg CO2e/kg H2 level should be considered for production technologies. Accompanying this multi-year timeline should be a requirement for significantly low criteria air emissions for hydrogen production projects to drive the CHPS toward a truly clean emissions profile—not just clean as it relates to carbon, but also as it relates to emissions of criteria pollutants, oxides of nitrogen, and oxides of sulfur.

While certain technologies, like steam methane reforming, may be able to offer a lower cost pathway to clean hydrogen from renewable gas, the emissions associated with the combustion of gas should be understood and weigh against the value of the lost cost technology. The 2 kg CO2e/kg H2 BIL point of production target is already well below the generally accepted approximate GHG emissions of a large steam methane reformer that emits roughly 9-10 kg CO2e/kg H2.

Fuel cells offer an alternative to combustion that efficiently converts gas to hydrogen without harmful criteria emissions.

With a continued focus on environmental justice and disadvantaged communities, the adoption of cleanest air standards possible for hydrogen production is paramount 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 cost, economic and social, of hydrogen possible.

In Conclusion

At FuelCell Energy, we are particularly proud of our history as an energy technology innovator and we celebrate the men and women 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 to 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.

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 provide more information as needed.

Sincerely,

Jason Few
President and CEO

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cc: Tony Leo, Executive Vice President, Chief Technology Officer
Lilyanne H. McClean, Senior Vice President, Global Public Policy