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VIA E-mail: cleanh2standard@ee.doe.gov

U.S. Department of Energy
James V. Forrestal Building
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U.S. Department of Energy Clean Hydrogen Production Standard (CHPS) Draft Guidance: Stakeholder Comment

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Stakeholder Feedback:

Monolith is a leading clean hydrogen and materials producer based in Nebraska. Through its proprietary technology, Monolith has pioneered the process of methane pyrolysis, which uses 100% clean electricity to convert natural gas or renewable biogas into clean hydrogen and a solid carbon, called carbon black, which is an indispensable input for manufacturing tires and an essential component in everyday products, including plastics and batteries. In addition, heat is released during the process and that heat is captured in a sustainable way to create steam for productive use.

Monolith's carbon-free process reduces greenhouse gas (GHG) emissions by 96% as compared to traditional ways of making hydrogen (e.g, steam methane reforming, "SMR") and carbon black. Furthermore, when Monolith utilizes renewable biogas from landfill gas or other sources, the result is a negative carbon intensity score, drawing down emissions that would have otherwise gone into the atmosphere.

Since founding, Monolith has developed and successfully operated a clean hydrogen demonstration plant in Redwood City, California and a commercial scale facility in Hallam, Nebraska ("Olive Creek 1"). Monolith is actively developing phase two of its commercial facility, which it expects to be online in 2026 ("Olive Creek 2"). Monolith also has five near term projects in its pipeline, and up to 40 under consideration. Importantly, the company provides lasting, high quality, high wage clean manufacturing jobs wherever its projects are located.

Monolith's experience and expertise make it uniquely positioned to discuss and provide insight with respect to the Clean Hydrogen Production Standard (CHPS) and looks forward to the opportunity to engage with the Department of Energy (DOE) in its preparation of guidance with respect to this standard.

1) Data and Values for Carbon Intensity

a) Many parameters that can influence the lifecycle emissions of hydrogen production may vary in real-world deployments. Assumptions that were made regarding key parameters with high variability have been described in footnotes in this document and are also itemized in the attached spreadsheet "Hydrogen Production Pathway Assumptions." Given your experience, please use the attached spreadsheet to provide your estimates for values these parameters could achieve in the next 5-10 years, along with justification.

b) Lifecycle analysis to develop the targets in this draft CHPS were developed using GREET. GREET contains default estimates of carbon intensity for parameters that are not likely to vary widely by deployments in the same region of the country (e.g., carbon intensity of regional grids, net emissions for biomass growth and production, avoided emissions from the use of waste-stream materials). In your experience, how accurate are these estimates, what are other reasonable values for these estimates and what is your justification, and/or what are the uncertainty ranges associated with these estimates?

Monolith's experience is that the greatest accuracy – and incentive for companies to exceed national and locational averages - comes from allowing companies to use project-specific emission calculations as opposed to averages and estimates.

While there is no doubt that the Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (commonly referred to as the "GREET" model) is a critical tool for calculating carbon intensity, estimates can at times be incomplete and vary widely. For example, Monolith can use Renewable Natural Gas ("RNG") in its process, and many types of RNG have an associated negative carbon intensity in the range of -100 to -250 kg of CO2/MMBtu (for example, animal manure). Another example is the average leakage rates calculated in upstream emissions, which can vary by a factor of ten in the GREET model depending on the origin of the natural gas. Historically, the GREET model has used average leakage rates from the entire country. These averages can result in a wide variety of outcomes which may not be in line with the actual inputs or results of a given project. As such, GREET contemplates a more accurate result by permitting users to override the default assumptions with project-specific leakage rates.

Similarly, as part of Monolith's commitment to environmental transformation, the company plans to partner with Responsibly Sourced Gas ("RSG") providers (i.e., certified low-leak natural gas) for the supply of certified low-leak natural gas, which will be transported through the natural gas pipeline networks. But, if the emissions are calculated on a U.S. average, there would be no benefit from the reduced emissions that come from RSG or incentive for companies to partner in this way. In addition, if consumers of such RSG are not permitted to utilize the benefit of low emissions, there will be little or no incentive for RSG producers to reduce methane emissions and that will go against the objectives of reducing emissions.

With the above in mind, Monolith suggests any guidance/regulations should provide taxpayers the ability to use reasonable, supported project specific inputs and not limit the model to published provisional emissions rates. Taxpayers/projects should be incentivized to exceed averages and get the benefit of project specific attributes. Project specific emission rates incentivize companies to optimize design choices, employ state-of-the-art technologies, and form innovative partnerships to reduce rates below the national average, all of which support the policy objectives of lowering emissions rates.

c) Are any key emission sources missing from Figure 1? If so, what are those sources? What are the carbon intensities for those sources? Please provide any available data, uncertainty estimates, and how data/measurements were taken or calculated.

d) Mitigating emissions downstream of the site of hydrogen production will require close monitoring of potential CO2 leakage. What are best practices and technological gaps associated with long-term monitoring of CO2 emissions from pipelines and storage facilities? What are the economic impacts of closer monitoring?

e) Atmospheric modeling simulations have estimated hydrogen's indirect climate warming impact (for example, see Paulot 2021).19 The estimating methods used are still in development, and efforts to improve data collection and better characterize leaks, releases, and mitigation options are ongoing. What types of data, modeling or verification methods could be employed to improve effective management of this indirect impact?

f) How should the lifecycle standard within the CHPS be adapted to accommodate systems that utilize CO2, such as synthetic fuels or other uses?

2) Methodology

a) *The IPHE HPTF Working Paper (https://www.iphe.net/iphe-working-paper-methodology-doc-oct-2021) identifies various generally accepted ISO frameworks for LCA (14067, 14040, 14044, 14064, and 14064) and recommends inclusion of Scope 1, Scope 2 and partial Scope 3 emissions for GHG accounting of lifecycle emissions. What are the benefits and drawbacks to using these recommended frameworks in support of the CHPS? What other frameworks or accounting methods may prove useful? Pankaj*

The International Organization for Standardization ("ISO") framework is widely used in the United States and internationally and lays down the basis for what is to be included in emissions calculations and how to draw up an LCA. Monolith supports the use of this standard to support the CHPS.

b) *Use of some biogenic resources in hydrogen production, including waste products that would otherwise have been disposed of (e.g., municipal solid waste, animal waste), may under certain circumstances be calculated as having net zero or negative CO2 emissions, especially given scenarios wherein biogenic waste stream-derived materials and/or processes would have likely resulted in large GHG emissions if not used for hydrogen production. What frameworks, analytic tools, or data sources can be used to quantify emissions and sequestration associated with these resources in a way that is consistent with the lifecycle definition in the IRA? Pankaj*

Both the GREET model and ISO provide a good methodology for calculating the carbon intensity score of biogenic resources, as long as there is consistency in the calculation. Taxpayers should be incentivized to procure RNG and be able to account for the full positive impact of such resources in the resulting carbon intensity score. Monolith suggests the DOE consider following other reliable methodologies, e.g., the California Air Resources Board ("CARB"), as well.

c) *How should GHG emissions be allocated to co-products from the hydrogen production process? For example, if a hydrogen producer valorizes steam, electricity, elemental carbon, or oxygen co-produced alongside hydrogen, how should emissions be allocated to the co-products (e.g., system expansion, energy-based approach, mass-based approach), and what is the basis for your recommendation?*

Monolith is particularly interested in guidance as to allocation of emissions between by-products, co-products, and other minerals, products, and materials produced in the hydrogen production process (such as elemental carbon). Monolith believes that taxpayers should be entitled to utilize any reasonable allocation method (e.g., mass-based / offset / economic allocation) absent compelling facts that such a method is patently unreasonable or would be abusive.

Monolith (and other methane pyrolysis companies) can produce both hydrogen and solid carbon with virtually no emissions. Methane pyrolysis, therefore, can reduce the emissions that would otherwise be produced through two separate facilities -- a carbon black plant and a SMR hydrogen plant -- in one process that results in two clean co-products. GREET and ISO provide a variety of options for allocating emissions in the case of a multiproduct plant, such as Monolith's projects. Monolith encourages the Department of Energy to allow for a company that produces co-products, bi-products, or other minerals, products, and materials produced in the hydrogen production process to utilize the calculation that reasonably represents the emissions reduction on a single product basis. Limiting the ability to select an appropriate allocation methodology would stifle taxpayer's ability to utilize novel, clean technologies and undermine the policy objective of encouraging clean hydrogen production and decarbonization.

d) How should GHG emissions be allocated to hydrogen that is a by-product, such as in chlor-alkali production, petrochemical cracking, or other industrial processes? How is by-product hydrogen from these processes typically handled (e.g., venting, flaring, burning onsite for heat and power)?

3) Implementation

a) How should the GHG emissions of hydrogen commercial-scale deployments be verified in practice? What data and/or analysis tools should be used to assess whether a deployment demonstrably aids achievement of the CHPS?

Projects should be entitled to rely on a reputable third party to validate the Project's LCA.

In addition, a project LCA based on the GREET model, and the inputs and assumptions therein, (as may be adjusted for project specific inputs as described herein) and verified by a third party should be determined at a point in time which allows for flexibility and efficient financing (e.g., on or around the final investment decision ("FID") and should be effective for the life of the project.

A locked-in LCA is critically important for taxpayer certainty. Taxpayers must be able to reasonably rely on their verified LCA as well as the then-currently available information and guidance when a project is in development. Without such certainty, especially in the context of a 10-year hydrogen tax credit, companies would be unable to secure and maintain financing and operations if changes to the LCA or related guidance were constantly a risk. This would not help meet the policy objective of rapidly maturing a clean hydrogen economy to achieve environmental and economic goals.

b) DOE-funded analyses routinely estimate regional fugitive emission rates from natural gas recovery and delivery. However, to utilize regional data, stakeholders would need to know the source of natural gas (i.e., region of the country) being used for each specific commercial-scale deployment. How can developers access information regarding the sources of natural gas being utilized in their deployments, to ascertain fugitive emission rates specific to their commercial-scale deployment?

As part of Monolith's commitment to environmental transformation, the company plans to partner with RSG and RNG providers for the long-term supply of both RSG and RNG – averaging 10-year commitments. But if the emissions are calculated on a U.S. average, Monolith would not be able to take into account the reduced emissions that come from both the procurement of RSG and RNG, and there would be little incentive for companies to partner in this way. Project specific emission rates incentivize companies to optimize design choices, employ state-of-the-art technologies, and form innovative partnerships to reduce rates below the national average. For the above reasons, Monolith encourages the DOE to allow for companies to apply project specific emissions in the GREET model in lieu of provisional emission rates.

In addition, taxpayers should be incentivized to procure RNG and must be able to account for the full positive impact for the CHPS to meet its stated goals, which means the DOE should consider following reliable methodologies for RNG emission calculations, such as CARB.

c) *Should renewable energy credits, power purchase agreements, or other market structures be allowable in characterizing the intensity of electricity emissions for hydrogen production? Should any requirements be placed on these instruments if they are allowed to be accounted for as a source of clean electricity (e.g. restrictions on time of generation, time of use, or regional considerations)? What are the pros and cons of allowing different schemes? How should these instruments be structured (e.g. time of generation, time of use, or regional considerations) if they are allowed for use?*

Consistent with IRC section 45V legislative history, Monolith recommends that taxpayers be able to take into account a wide variety of these market-based mechanisms, including, but not limited to renewable energy credits (RECs), virtual power purchase agreements (VPPAs), environmental attribute certificates, and other synthetic contractual/market-based arrangements in the LCA and in determining GHG emissions (such arrangements, “market-based mechanisms”). Monolith suggests the same logic be applied to recognize the carbon-intensity of ANY energy resource used in the hydrogen production process.

Thus, an LCA would assume that renewable power/gas/etc. purchased by the taxpayer and introduced into the grid by the supplier-counterparty is, in fact, used by the taxpayer as an input, regardless of whether the actual renewable-derived electrons/gas/etc. is not physically used by the purchasing taxpayer. This is an important concept from many reasons including (i) most hydrogen process requires a constant source of power that cannot be provided from intermittent renewable sources, (ii) some states regulatory regimes will not allow the purchasing taxpayer to directly connect carbon-free power sources to their facilities and (iii) optimal location of a project may lead to longer distances from sources of RNG, RSG, and clean energy and physically transporting the molecules may not be viable. Maintaining a ‘book and claim” method would be a sound solution.

We encourage the DOE to implement practical regulations to achieve the overall policy goals of lower emissions and clean-energy production – and, as such, should permit market-based mechanisms to be encouraged and taken into account. For instance, the use of such market-based mechanisms should be considered on an annual basis (i.e., there should be no shorter time of use limitations), and such arrangements should not be location restricted (i.e., it should not matter whether the feedstock producer/generator and purchaser are part of the same transmission system). This latter point is critical given that not all load-serving entities will pursue adoption of renewables into their generation portfolio equally. Without these functionalities, the section 45V credit may have limited utility and may not meet its stated goals and policy objectives.

Additionally, guidance with respect to any minimum standards for such market-based mechanisms should be based on resources that are reasonably available in the market – i.e., if taxpayers are able to establish a reasonable, economic plan for procuring RECs, virtual PPAs, environmental attributes, and other contractual arrangements, it should not be necessary that the taxpayer must fully contract for such resources for the life of the project. Accordingly, guidance should clarify that taxpayers have the flexibility to contract for these attributes as needed, with emphasis on traceability of the attribute to the energy consumed on a per annum basis.

The foregoing approach is consistent with explicit legislative history (namely the Wyden/Carper colloquy reported in Congressional Record vol. 168, No 133). Monolith recommends that any regulations/guidance should be drafted accordingly.

[1] Mr. Carper: Section 13204 of title I of the Inflation Reduction Act of 2022 provides a production and investment tax credit for the production of clean hydrogen. In Section 13204, the term "lifecycle greenhouse gas emissions" for a qualified hydrogen facility is determined by the aggregate quantity of greenhouse gas emissions through the point of production, as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Technologies—GREET—model. It is also my understanding of the intent of section 13204, is that in determining "lifecycle greenhouse gas emissions" for this section, the Secretary shall recognize and incorporate indirect book accounting factors, also known as a book and claim system, that reduce effective greenhouse gas emissions, which includes, but is not limited to, renewable energy credits, renewable thermal credits, renewable identification numbers, or biogas credits. Is that the chairman's understanding as well?

Mr. Wyden: Yes

Congress.gov. "H.R. 5376 – 117th Congress (2021-2022): Inflation Reduction Act of 2022" August 6, 2022.

d) What is the economic impact on current hydrogen production operations to meet the proposed standard (4.0 kgCO2e/kgH2)?

4) Additional Information

a) *Please provide any other information that DOE should consider related to this BIL provision if not already covered above.*

The lifecycle boundary of the clean hydrogen is appropriately limited to "well-to-gate," i.e., to include upstream emissions associated with hydrogen production through the point of hydrogen production.

Examining Scope 3 emissions broadly, the goal of the clean hydrogen standard is to define technologies that are able to reduce emissions compared to the traditional way of manufacturing clean hydrogen and, therefore, the scope 3 definition should be narrow, and limited to procurement of raw materials only.