November 14, 2022

Via Electronic Submission to: Cleanh2standard@ee.doe.gov

U.S. Department of Energy
Office of Energy Efficiency and Renewable Energy
1000 Independence Ave. SW
Washington, DC 20858

Re: Valero Comments to U.S Department of Energy's Request for Stakeholder Feedback on the Clean Hydrogen Production Standard (CHPS) Draft Guidance

To Whom It May Concern:

Please find below the comments of Valero on DOE's Request for Stakeholder Feedback on the Clean Hydrogen Production Standard (CHPS) Draft Guidance, issued on September 22, 2022. Valero appreciates the opportunity to provide feedback on this guidance.

I. About Valero

Valero Energy Corporation and its subsidiaries are major suppliers of both traditional and low-carbon renewable fuels to the U.S. market. In addition to being one of the world's largest independent refiners, Valero was the first traditional petroleum refiner to enter the large-scale ethanol production market and is now one of the largest ethanol producers in the U.S. Valero is one of the largest renewable diesel producers in the world, and as such is credited with significant contributions toward meeting the declining carbon intensity targets under the California Low Carbon Fuel Standard. In accordance with commitments to shareholders to further reduce greenhouse gas ("GHG") emissions, Valero is actively engaged in renewable diesel expansion projects and is pursuing carbon sequestration opportunities. As a fuel producer that is already playing a significant role in reducing GHG emissions from the transportation sector, we ask that DOE consider our unique frame of reference in evaluating the views and recommendations presented in these comments.

II. DOE's Request for Stakeholder Feedback

Valero appreciates the opportunity to provide feedback on DOE's Clean Hydrogen Production Standard (CHPS) Draft Guidance. Valero has the following comments:

1) Data and Values for Carbon Intensity

a) 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

Specific to parameter 5 of the DOE provided spreadsheet, "Other (e.g., pressure and purity conditions at output of hydrogen production facilities)", DOE modeled to achieve hydrogen production with 99% purity and 3 MPa at the outlet. Additionally, Footnote 11 of the DOE CHPS states "To enable consistent comparisons across different hydrogen production technologies, the target corresponds to a functional unit of 1 kilogram of hydrogen at 99% purity and 3 megapascals (MPa) pressure."

In the "Hydrogen Life-Cycle Analysis in Support of Clean Hydrogen Production" report that accompanied the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) 2022 release,[1] Argonne National Laboratory describes that all hydrogen production pathways "include cleanup and compression operations to deliver >99% pure H2." Argonne shows in the report that hydrogen pressures at the production gate typically range from 20 to 30 bar (2 to 3 MPa), depending on production technology (see excerpt below), and the GREET model corrects the GHG emission intensities to a common pressure basis of 20 bar (2 MPa). Valero recommends that DOE adopt the same approach and methodology as Argonne and define clean hydrogen boundary conditions as 99% purity and 2 MPa.

Table 3. H_2 pressure at production gates

Pathway[a]	Absolute Pressure (bar)	WTG effect[c] (kg CO_2e / kg H_2)
SMR, SMR-CCS	24	0.03
Coal gasification	30	0.07
Biomas gasification	26	0.04
All others	20	0

[a] SMR–steam methane reforming; CCS–carbon capture and storage.

[b] Assumed based on the pressure swing adsorption step.

[c] WTG effect refers to the slight overestimation of the carbon intensity arising when H_2 pressure exceeds 20 bar at the production gate. Computed based on electricity used during compression from 20 bar to the production gate pressure. Electricity used is assumed to be the US average grid mix.

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

[1] *See* https://greet.es.anl.gov/publication-hydrogenreport2022

One Valero Way • San Antonio, Texas 78249-1616
Post Office Box 696000 • San Antonio, Texas 78269-6000 • Telephone (210) 345-2000

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?

"The [Argonne] Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model is a tool that examines the life-cycle impacts of vehicle technologies, fuels, products, and energy systems. It provides a transparent platform through which energy and vehicle producers, researchers, and regulators can evaluate energy and environmental effects of vehicle technologies and energy and product systems. For any given energy and vehicle system, GREET can calculate total energy consumption (non-renewable and renewable), emissions of air pollutants, emissions of greenhouse gases, and water consumption."[2] Additionally, the GREET model is specified in the Inflation Reduction Act of 2022 as the methodology to calculate the lifecycle greenhouse gas emissions "through the point of production (well-to-gate)" when determining the level of tax credit for clean Hydrogen production (26 U.S.C. § 45V) , unless and until a successor is approved by the Secretary of the Treasury.[3] As the foremost model in evaluating the emissions life-cycle of fuels, the GREET model continues to improves over time through modeling, review, and industry engagement process, culminating in annual releases ensuring the most current evaluation of a given fuel's life-cycle emissions. Valero recommends that DOE's CHPS adopt the most current version of the GREET model, wherein:

- Applications, pathway approvals, and annual audits should rely on the applicable version of the GREET model at the time of a project's pathway application;
- Pathway process changes which require a new application for a project or pathway should apply the most recent version of the GREET model; and
- Participants with existing pathways should be allowed to update their pathways using the most recent GREET model, at their discretion.

The DOE should also confirm that the CHPS will allow project applicants to utilize GREET defaults or averages, facility specific attributes of the input stream(s) utilized in each project pathway, or any combination of such defaults and facility specific attributes, as allowed within the GREET model or as approved by Argonne National Laboratory.

c) Are any key emission sources missing from DOE Figure 1 (Slide 4)?

---

[2] https://www.energy.gov/eere/bioenergy/articles/greet-greenhouse-gases-regulated-emissions-and-energy-use-transportation

[3] H.R. 5376, 117th Cong. § 13204 (2022).

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

Figure 1 should indicate that feedstock extraction and hydrogen production will generate co-products or displace energy using the "displacement method" as described in the Argonne GREET model that are part of the hydrogen life-cycle (e.g., steam and electricity generation as co-products to hydrogen production).

Footnote 11, which addresses the life-cycle analysis boundary depicted in Figure 1 of the DOE CHPS, states "In the CHPS, the lifecycle target corresponds to a system boundary that terminates at the point at which hydrogen is delivered for end use."

It should be noted that the statement is not aligned with Figure 1 of the CHPS or with the "well-to-gate" boundary definition for Qualified Clean Hydrogen in the Inflation Reduction Act.[4]

Valero recommends that DOE adopt the lifecycle system boundaries, definitions, and methodologies as set forth in the Inflation Reduction Act as the lifecycle system boundaries, definitions, and methodologies for the CHPS.

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?

DOE can rely on CCS permanence requirements established by other government authorities to validate potential CO2 leakage. For projects in the US, the US EPA has established permitting criteria for Class VI wells, including:

- Extensive site characterization requirements,
- Injection well construction requirements for materials that are compatible with and can withstand contact with CO2 over the life of a geological storage (GS) project,
- Injection well operation requirements,

[4] "The term 'lifecycle greenhouse gas emissions' shall only include emissions through the point of production (well-to-gate)," H.R. 5376, 117th Cong. § 13204 (2022).

- Comprehensive monitoring requirements that address all aspects of well integrity, CO_2 injection and storage, and ground water quality during the injection operation and the post-injection site care period,

- Financial responsibility requirements assuring the availability of funds for the life of a GS project (including post-injection site care and emergency response), and

- Reporting and recordkeeping requirements that provide project-specific information to continually evaluate Class VI operations and confirm USDW protection.

EPA has published several guidance documents to assist with permitting these wells.[5]

e) Atmospheric modeling simulations have estimated hydrogen's indirect climate warming impact. 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?

Valero recommends that DOE adopt the requirements set forth in the Inflation Reduction Act of 2022, under which "Qualified Clean Hydrogen" must be "for sale or use", and "(ii) the production and sale or use of such hydrogen is verified by an unrelated party."[6] DOE's incorporation of the § 45V requirements will ensure consistency between the DOE and the supporting tax law, while ensuring that the hydrogen losses to the atmosphere are minimized and that the hydrogen is not over-produced and vented.

f) How should the lifecycle standard within the CHPS be adapted to accommodate systems that utilize CO_2, such as synthetic fuels or other uses?

No Valero comment.

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

[5] *See* https://www.epa.gov/uic/class-vi-guidance-documents.
[6] H.R. 5376, 117th Cong. § 13204 (2022).

One Valero Way • San Antonio, Texas 78249-1616
Post Office Box 696000 • San Antonio, Texas 78269-6000 • Telephone (210) 345-2000

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?

No Valero comment.

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?

Valero recommends that DOE adopt the Argonne GREET model as required under the Inflation Reduction Act of 2022, including the underlying audit and verification requirements.[7]

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?

Emissions for the hydrogen producer should be reduced according to a displacement methodology. The reduction in a hydrogen producer's emissions due to the production of a co-product would be equivalent to the lifecycle emissions avoided due to substitution of the co-product for other produced material. The hydrogen producer should have the flexibility to select the methodology for allocating emissions to co-products, as allowed within the Argonne GREET model – e.g., displacement method, Btu-based allocation.

For example, a clean hydrogen production process may result in excess steam production that can be exported for use outside the facility. Such excess steam, if utilized in another industrial process, may directly displace steam that would otherwise have been generated in a boiler heated by fossil fuel combustion. The avoided emissions associated with this by-product steam should be attributed to the hydrogen production as a displacement credit to decrease the hydrogen's lifecycle emissions.

[7] H.R. 5376, 117th Cong. § 13204 (2022).

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)?

No Valero comment.

3) Implementation

a) How should the GHG emissions of hydrogen commercial-scale deployments be verified in practice?

1) What data and/or analysis tools should be used to assess whether a deployment demonstrably aids achievement of the CHPS?

Valero recommends that DOE should require annual third-party verification of all projects and approved pathways, including evaluation of the projects "well to gate" processes, receipt of energy and feedstock inputs, production of hydrogen for sale or use, Argonne GREET modeling, and certification as "Qualified Clean Hydrogen" as required under the Inflation Reduction Act of 2022[8].

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?

DOE should allow for the use of book-and-claim for the movement of low carbon intensity natural gas, renewable natural gas (RNG), and other renewable gases that are supported by commercial contracts and subject to annual third-party audit verification.

For projects applying book-and-claim, the developer should utilize the applicable facility specific and regional specific fugitive emissions.

For projects utilizing grid supplied natural gas, the developer should utilize the grid emissions incorporated into the Argonne GREET model.

Book-and-claim accounting refers to the chain-of-custody model in which decoupled environmental attributes are used to represent the ownership and transfer of transportation fuel

[8] *Id.*

under low carbon fuel programs without regard to physical traceability. While physical supply chains are being built, the book-and-claim option drives demand via the sale and purchase of certificates or credits. While creating a critical mass of certified material, book-and-claim also provides market access to all within the industry, regardless of their global location or size. Allowing for book-and-claim use of low carbon natural gas and RNG in the production of Qualified Clean Hydrogen will facilitate clean hydrogen investment and production, while ensuring the projects meet the life-cycle greenhouse gas emissions requirements of the program.

Allowing for the use of book-and-claim is consistent with other Federal, State, and International greenhouse gas and carbon reduction standards, including: the U.S. Renewable Fuels Standards[9] California LCFS legislation (Cal. Code Regs. Tit. 17 § 95488.8(i)(2)(B)), and European programs (REDII and RTFO) which recognize indirect accounting for pipeline injected biomethane that is either claimed as a transportation fuel or claimed as a feedstock to produce hydrogen for transportation purposes. Valero urges DOE to adopt a book-and-claim model for low carbon natural gas and RNG used in the production of hydrogen, which includes an audit standard that can be validated and traced by a third-party verifier.

c) Should renewable energy credits, power purchase agreements, or other market structures be allowable in characterizing the intensity of electricity emissions for hydrogen production?

Direct "behind-the-meter" electricity production should not be the only method allowed for hydrogen producers to demonstrate that electricity emissions intensity differs from default grid values for hydrogen production within DOE's CHPS and the underlying requirements of the Infrastructure Investment and Jobs Act. Rather, hydrogen producers should be able to utilize certain contractual market structures to establish a linkage to specific sources of low-carbon electricity.

DOE should develop a standard that ensures such contractual structures establish; 1) that the hydrogen producer is the sole acquirer of the environmental attributes associated with the amount of electricity generation that is claimed, 2) a contractual relationship exists between the hydrogen producer and a specific low-carbon electricity project (or bundle of projects), and 3) that such contracts are established between generators and consumers within the same Independent System Operator (ISO) or Regional Transmission Operator (RTO), ensuring a feasible grid interconnection exists.

"State Renewable Portfolio Standard (RPS) policies are a major demand driver for [Renewable Energy Credits] (RECs), as state RPS policies create demand for RECs by requiring utilities to generate or purchase an increasing number of RECs annually to demonstrate increasing delivery of renewable electricity to their customers. RPS policies also define which RECs are eligible to meet that demand by defining the project types and geographic locations from which utilities must source RECs to use towards compliance. States' distinct RPS eligibility and

[9] 40 C.F.R. § 80.1426

compliance requirements create distinct state compliance markets with different REC [qualities and] prices."[10]

Not all REC's are created equally. "RPSs may also have special provisions targeting specific resources that further magnify the price differences between RECs meeting the provision's eligibility requirement and those that do not. One common special provision of state RPSs are 'solar carveout' policies that require utilities to generate or purchase RECs from in-state or in-region solar facilities. Solar carveouts are the main mechanism that drives up the price of solar RECs (SRECs) and create significant price differentials between various types of RECs. Since RECs are also used to demonstrate voluntary delivery and use of renewable energy in the United States, demand by state compliance can affect REC prices in the voluntary market, albeit for RECs from specific resources and locations."[11]

While the structure, flow, and tradability of REC's lend themselves well to RPS compliance programs, or even ESG reporting, the volatility of the credit markets, combined with the spot nature of REC's trading, are not effective as a feedstock input into a manufacturing production process. While some RECs may fail to meet DOE's standard, there are some RECs that effectively serve to meet the commercial and regulatory limits imposed on regulated utilities operating in local ISO's or RTO's, which DOE should allow for use in the CHPS. For example, a long term "green tariff" contract with a regulated utility may offer the environmental attributes, via a so-called "REC", to a hydrogen producer as evidence of purchased of electricity from a low-carbon power source, utilizing a REC as a way of commercially executing a long term PPA in a regulated electricity market. These RECs would likely demonstrate more certainty than other RECs generated as part of a state's RPS program that are openly exchange traded for renewability compliance purposes. Therefore, the purchase of RECs, or other market traded "paper credits," on a spot basis would not sufficiently establish such a linkage and should not be allowed under the CHPS or the IRA, while environmental attribute ("RECs") derived from low carbon electricity producers physically linked with a regulated utility within a local ISO or RTO should be allowed.

Power Purchase Agreements (PPA's) are another example of a contractual relationship that should be allowed in characterizing the intensity of electricity emissions for hydrogen production within DOE's CHPS and the underlying requirements of the Infrastructure and Investment Jobs Act. In stark contrast to RPS based REC's, which are the tradable "creditized" by-product for enabling state electricity renewability compliance obligations, PPAs are direct or indirect contractual structures that can vary depending on whether the local electricity market is regulated or deregulated. PPAs are effective tools to match electricity producers and consumers within a regional market that are similar to the well-established "book-and-claim" accounting processes applied to natural gas and consistent with other Federal, State, and International greenhouse gas and carbon reduction standards, including: the U.S. Renewable Fuels Standards California LCFS legislation (Cal. Code Regs. Tit. 17 § 95488.8(i)(2)(B)), and European programs (REDII and RTFO). When contracts are established between generators and consumers within the same ISO or RTO, DOE should allow the hydrogen producer to apply the environmental attributes of the low

[10] https://www.epa.gov/sites/default/files/2017-09/documents/gpp-rec-arbitrage.pdf
[11] *Id.*

carbon electricity within the production process, as allowed for in the Argonne GREET model. DOE should not allow PPAs where a feasible grid interconnection does not exist between the electricity generator and consumer.

Similar to the other audit requirements referenced throughout these comments, DOE should require a third party audit of any qualifying contractual commitments and low carbon supporting documents.

> 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)?

DOE and the IRS, for purposes of applying both the CHPS and § 45V tax credit, should apply regional considerations when evaluating the utilization of low carbon electricity in the generation of Qualified Clean Hydrogen. Projects should be connected to the source of low carbon electricity directly where the low carbon electricity producer is not directly connected to the local Independent System Operator (ISO) or Regional Transmission Operator (RTO). Or, alternatively, the project and the low carbon electricity producer should both be directly connected to the local ISO or RTO, with the parties having the ability to contract for any low carbon electricity production within the projects respective local ISO or RTO.

> 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?

d) What is the economic impact on current hydrogen production operations to meet the proposed standard (4.0 $kgCO_2e/kgH_2$)?

No Valero comment.

4) Additional Information

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

i. <u>Concentration of Environmental Attributes</u>
If a hydrogen producer simultaneously runs a combination of feedstocks, such that:

a. Feedstock A, on its own, would produce hydrogen with emissions exceeding 4.0 $kgCO_2e/kgH_2$,
b. Feedstock B, on its own, would produce hydrogen with emissions below 4.0 $kgCO_2e/kgH_2$, and
c. Feedstocks A and B combined would produce hydrogen with emissions exceeding 4.0 $kgCO_2e/kgH_2$,

the producer should have the ability to designate a portion of the total produced hydrogen as clean hydrogen under the CHPS, proportionate to the volume and environmental attributes of Feedstock B.

Allowing for the concentration of environmental attributes is consistent with other Federal and International greenhouse gas and carbon reduction standards, including: the U.S. Renewable Fuels Standards and European programs (RTFO).

Similarly, if the hydrogen producer runs Feedstock A for part of the year and Feedstock B for the remainder of the year, the producer should have the ability to produce clean hydrogen under the CHPS for the hydrogen produced from Feedstock B.

ii. Independent Mechanisms for Reducing Lifecycle GHG Emissions

a. It should be noted for the purposes of the CHPS that lifecycle GHG emission reductions associated with the processing of renewable feedstocks are independent from those associated with carbon capture and sequestration. These independent mechanisms for reducing lifecycle GHG emissions should not be considered "double-counting", but rather each input should contribute to the overall lifecycle GHG emissions reduction of the finished hydrogen production.

* * *

Valero appreciates the opportunity to comment on the request for Stakeholder Feedback and welcomes the opportunity to have additional discussions on these issues. Please do not hesitate to contact me with any questions or if Valero or I can otherwise be of assistance.

Sincerely,

Amanda Gal

Mandy Garrahan
Executive Director Strategic Planning & Public Policy