SUBMITTED ELECTRONICALLY

December 3, 2022

U.S. Department of Energy
James V. Forrestal Building
1000 Independence Avenue Southwest
Washington, D.C. 20585

Re: Comments on Section 45V

Thank you for the opportunity to provide comments to the Department of the Treasury (Treasury Department) and the Internal Revenue Service (IRS) regarding the clean hydrogen production credit under § 45V of the Internal Revenue Code (§ 45V credit). We offer these comments in response to the IRS notice seeking input on different aspects of the § 45V credit (Notice).

Electric Hydrogen Co. (EH2) is a manufacturer of low-cost electrolyszer systems that produce fossil-free hydrogen at industrial scale. Our technology is designed to enable users to efficiently and cost-effectively take advantage of variable renewable energy resources to generate clean power and clean feedstock for multiple industries, including steel manufacturing, fertilizer production, chemical processing, refining, and long-distance heavy transportation. Passage of the Inflation Reduction Act (IRA) has created new opportunities for hydrogen to become a significant tool in transitioning the United States to a net zero carbon economy that enjoys enhanced energy security and resilience. To ensure that clean hydrogen realizes its full potential in this transition, EH2 believes it will be important to establish clear criteria that will ensure emission reduction assumptions underlying the tax benefits created by IRA are truly realized.

Enclosed please find EH2's narrative comments in response to questions posed in the Notice related to the (I) use of market-based mechanisms, and (ii) importance of accurately documenting fugitive emissions in the lifecycle greenhouse gas analysis supporting § 45V eligibility. Also attached is a summary of emissions data related to grid electricity feedstock.

We appreciate the efforts of the Administration to support development of a robust clean hydrogen economy. If there is additional information we can provide or questions we can answer, please let us know.

Sincerely,

Beth Deane
Chief Legal Officer

Electric Hydrogen Section 45V Credit Comments

Achievement of emission reduction targets is a central tenet of the IRA. To carry out that tenet effectively, the integrity of lifecycle greenhouse gas emissions accounting must be maintained. **In other words, the Section 45V credit must be implemented in a manner that directly supports one of the more time-critical goals of the IRA – reduction of greenhouse gas emissions.**

I. Comments on the Use of Market Mechanisms

To align with the goal of truly reducing green gas emissions, EH2 comments first focus on the use of renewable energy credits, power purchase agreements, renewable thermal credits, biogas credits, and other market structures ("Market Mechanisms") to demonstrate that a hydrogen production plant is "using" a source of clean energy.[1] Under this approach, rather than receiving clean electricity directly from a renewable energy asset, the hydrogen production plant would be physically powered by grid electricity. To offset the high-carbon content of grid electricity, the plant would secure renewable energy offset credits through one of the Market Mechanisms. These types of credits, which can be unbundled from the underlying energy, would be created from renewable energy generation assets located elsewhere. Upon retirement of the credits, the claim is made that the electricity feedstock for the plant is carbon-free, even though the hydrogen is generated at a physical level using high-carbon grid electricity.

The Treasury Department and the IRS have asked whether use of such Market Mechanisms should be allowed, and if so, whether any requirements should be placed on these instruments. Allowing the use of Market Mechanisms is expected to increase development flexibility and therefore speed up the deployment of clean hydrogen technology, production, and use. Certainty around the use of Market Mechanisms will also help establish a financing market for clean hydrogen projects. For these reasons, EH2 generally supports the use of Market Mechanisms, provided that appropriate emission accounting measures are established. **Such measures are critical because unfettered use of Market Mechanisms, without any effort to virtually match the renewable energy generation and hydrogen production, could have the perverse result of increasing, rather than decreasing, greenhouse gas emissions.** Moreover, laying out a path for the adoption of such measures will go a long way towards protecting projects from future unwanted emissions claim challenges.

[1] The Treasury Department and the IRS have asked the following questions about Market Mechanisms:

1. What granularity of time matching (that is, annual, hourly, or other) of energy inputs used in the qualified clean hydrogen production process should be required?
2. Should indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions (also known as a book and claim system), including, but not limited to, renewable energy credits, power purchase agreements, renewable thermal credits, or biogas credits be considered when calculating the § 45V credit?
3. If indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions, such as zero-emission credits or power purchase agreements for clean energy, are considered in calculating the § 45V credit, what considerations (such as time, location, and vintage) should be included in determining the greenhouse gas emissions rate of these book accounting factors?

A. Time-Matching to Support Emission Accounting Integrity

The unfortunate reality is that using grid electricity to produce 24/7 hydrogen in the United States today results in greenhouse gas emissions that are higher than emissions generated from using natural gas to produce 24/7 hydrogen. This is because the electricity on the typical grid in the United States comes from different generation sources throughout the day. To the extent electricity on the grid is sourced to a greater extent from renewable energy assets, the greenhouse gas emissions associated with grid electricity are lower. The reverse is true when electricity on the grid is sourced to a greater extent from fossil fuel assets. In other words, the greenhouse gas emissions associated with grid electricity vary significantly throughout the day. For example, as illustrated on slides 4-6 in the attached presentation, there is a high degree of emission-related variability throughout the day and throughout the year on the CAISO grid. Only in a limited number of hours in certain seasons, would the CAISO grid have emissions low enough to result electrolyzed hydrogen production that is even marginally cleaner than SMR-produced hydrogen.

What this means is that hydrogen production can more accurately be characterized as "clean" if the production is matched to grid electricity generated during periods of high renewable energy penetration. In other words, to maintain emissions accounting integrity, the temporal variability of grid-associated emissions should be factored into the criteria for using Market Mechanisms. **Specifically, where a plant relies upon Market Mechanisms to qualify for IRA benefits, time matching would ensure that subsidized hydrogen production is linked to low emission grid electricity. EH2 encourages the Treasury Department and the IRS to establish time-matching criteria within their implementation guidance for the 45V Credit.**

We have engaged with stakeholders who oppose the use of time-matching criteria. Their primary concern is that it will be difficult to establish a liquid market for time sensitive Market Mechanisms. Without a liquid market, the argument is that time-matching criteria will impede the ability to get clean hydrogen projects financed. First, we do not believe there is any technical roadblock against instituting an hourly-matching mechanism. Most regional transmission systems and utilities are already settling power on sub-hourly basis. Similarly, grid storage systems, which are already in use by utilities and grid operators to maintain reliability, are routinely able to respond to market signals and bid into the market on a sub-hourly basis. In our experience, the market for time-sensitive Market Mechanisms is already evolving. In response to requests from companies seeking 24/7 clean energy products, aggregators are currently using Market Mechanisms to shape products that account for the variability of renewable energy generation. It is possible that establishing timing-matching criteria within implementation guidance for the Section 45V credit may serve to expedite the 24/7 clean energy product evolution that is already occurring, which could in turn expedite the reduction of greenhouse gas emissions more broadly.

B. Geographic-Matching to Support Emission Accounting Integrity

Like temporal variability, greenhouse gas emissions associated with grid electricity also vary significantly by region. Grids with higher clean energy penetration have lower associated greenhouse gas emissions than grids with less clean energy penetration. Geographic matching between hydrogen production and

the renewable energy assets sourcing Market Mechanisms will improve emissions accounting integrity in the same way that temporal matching achieves that outcome. **EH2 encourages the Treasury Department and the IRS to establish appropriate geographic matching criteria within their implementation guidance for the Section 45V credit, whether that is based on emissions-related data or grid operation parameters.**

C. Additionality to Support Emission Reduction Claims

Beyond temporal and geographic matching, EH2 also encourages the Treasury Department and the IRS to consider the concept of additionality as yet another tool that can be used to validate emission reductions claims. Additionality requires that certificates underlying Market Mechanisms be sourced from newly built generation assets. Without additionality, the concern is that Market Mechanisms may move emission reductions from existing renewable energy assets over to the hydrogen side of the ledger, but with no incremental reduction in overall greenhouse gas emissions. **Additionality is already widely used by companies making greenhouse gas reduction claims.** It is seen as a useful mechanism to address greenwashing concerns from environmental stakeholders. For example, in the United States, it has become routine to use green energy certificates sourced from newly added projects to support corporate claims regarding the attainment of clean energy goals. This approach allows companies using Market Mechanisms, like virtual power purchase agreements, to claim that their investment is causing incremental clean energy generation. Additionality is an easy-to-validate measure that has become widely accepted by a broad range of stakeholders, including developers, eNGOs, and financing parties. We recommend that the Treasury Department and the IRS consider application of the additionality standard to validate the use of Market Mechanisms under IRA. Such a step will strengthen the overall credibility of these programs and reduce potential challenges to the legitimacy of carbon displacement claims.

Within implementation guidance for the Section 45V credit, the imposition of criteria related to temporal and geographical matching, along with additionality, will improve the long-term integrity of emission reduction accounting and protect projects against negative press that could arise if grid-related emission accounting is not proactively addressed. In a perfect world, these criteria would be implemented at the onset of reliance on Market Mechanisms. That said, EH2 recognizes that the Treasury Department and the IRS may also be considering the technological and economic feasibility of the guidance that it is promulgating for the Section 45V credit. Certainly, EH2 is supportive of the fast deployment of green hydrogen technology. We also see the importance of balancing long-term accounting integrity with short-term feasibility assessments.

D. Phased Approach

To strike an appropriate balance, EH2 recommends a phased approach for the implementation of standards applicable to the use of Market Mechanisms to validate electrical feedstock claims. Additionality is an existing and widely used mechanism that is easy for financing parties to validate. To grab the “low hanging fruit” on emissions accountability, we encourage the Treasury Department and

the IRS to consider integrating additionality into guidance on the use of Market Mechanism from the onset. For the reasons outlined above, however, additionality alone will not ensure accurate long-term emission reduction accounting.

Over time, temporal and geographical matching requirements should be integrated into Market Mechanism standards. It is always difficult to predict how long it will take to deploy a new technology at scale. If past experience scaling wind and solar technologies is any indicator, scaling clean hydrogen technologies may occur faster than anticipated. Once the deployment of clean hydrogen at scale is proven up and a financing market for such projects is confirmed, temporal and geographic matching requirements should be applied to the use of Market Mechanisms. At that point, technological and economic feasibility will be established, and it will be easier to completely shore up the integrity of emission accounting.

EH2 encourages the Treasury Department and the IRS to set a phasing schedule for implementation of temporal and geographic matching requirements. The schedule could be based on achievement of critical feasibility criteria (e.g., technology availability at scale, number of projects financed, development of time-stamped certificate market, etc.), or the schedule could rely on firm dates for the application of temporal and geographic matching requirements. We are confident that the market for green hydrogen will develop quickly and robustly. If a firm date is selected for a phase-in approach, we urge that the initial date be 12 months from issuance of implementation guidance. The Treasury Department and IRS could reserve flexibility to make adjustments, as needed. In the end, if the market becomes bottlenecked, it will be easier to push out the phase-in date, than it will be to ignore this issue now and end up addressing the long-term impacts of a reputation tarnished industry that facilitated production of "clean" hydrogen with a carbon intensity worse than current SMR-produced hydrogen.

Rather than take that type of risk, we urge the Treasury Department and the IRS to set standards upfront in the implementation guidance for the Section 45V credit. By establishing a clear path from the onset for phasing in the application of temporal and geographic requirements, developers and financing parties will be able to plan accordingly with respect to using Market Mechanisms. In general, markets adjust most efficiently when clear regulatory parameters are established in advance. **By applying additionality now and promulgating a set schedule for phasing in temporal and geographic requirements over time, the Treasury Department and the IRS will establish a well understood trajectory for increasing emission accounting credibility. Such credibility will bolster long-term integrity of the overall program and ensure its ultimate success in reducing greenhouse gas emissions.**

II. Accurate Documentation of Fugitive Emissions in Lifecycle Greenhouse Gas Analysis

Fugitive emissions from the upstream fossil fuel feedstocks have a significant impact on the carbon intensity of hydrogen from non-renewable sources. That means that carbon intensity calculations used to assess Section 45V eligibility depend heavily on the reliability of upstream emissions data. We encourage the Treasury Department and the IRS to consider stringent monitoring and certification requirements designed to ensure that carbon intensity determinations are based on accurate fugitive emissions data.[2] Without such safeguards, the opportunity to incentivize meaningful greenhouse gas emission reductions will be severely undermined.

Currently, monitoring and reporting on methane emissions from the production, transport and supply of petroleum products is limited. Consequently, instead of actual fugitive emission data, the October 2022 version of the GREET model, which was developed by the National Renewable Energy Laboratory (NREL), relies on a bottoms-up estimation from EPA. EPA generates its analysis by compiling an inventory of equipment and estimating the associated emissions for that equipment. This process, which relies on engineering models and emission assumptions, yields an estimate of methane leakage from upstream processes of no more than 1.0%. Contrary to this type of bottom-up analysis, a top-down emissions analysis relies on the direct measurement of fugitive emissions in the field. We believe a top-down approach will yield a more accurate picture of upstream fugitive emissions and a more honest assessment of the carbon intensity of hydrogen production from fossil fuel feedstock.

Concerns that the EPA's bottom-up approach is underestimating actual emissions from upstream processes have been voiced by several researchers. For example, Robert Howarth, a professor at Cornell University, noted the high level of fugitive methane releases associated with upstream natural gas sources in a peer-reviewed paper he published in 2021. He determined the appropriate default emission rate for methane from natural gas is more in the range of 3.5%, much higher than the current 1.0% default rate. The National Energy Technology Laboratory (NETL), another Department of Energy (DOE) national laboratory, issued a 2022 report comparing costs and emissions for steam methane reforming (SMR) of natural gas, SMR combined carbon capture, and autothermal reforming (ATR). That report assumed methane leakage from upstream processes to be 2.3%. In the field, we understand that methane leakage rates vary throughout the country and can range anywhere from 0.3% to 9.1%. [Alvarez et al. (2018), Table S2] The point is that unless there is some effort to require the collection of actual data for fugitive emissions from upstream sources, the integrity of well-to-gate emissions tracking for Section 45V eligibility will remain questionable.

To improve the accuracy of fugitive emissions data on a well-to-gate basis, we encourage the Treasury Department and the IRS to require taxpayers claiming the Section 45V credit to submit certifications of actual emissions from their upstream fuel feedstock. If taxpayers wish to rely on the EPA assumptions

[2] The Treasury Department and the IRS are seeking input on the following monitoring, reporting and standard setting questions:
(4) Recordkeeping and Reporting.
(a) What documentation or substantiation do taxpayers maintain or could they create to demonstrate the lifecycle greenhouse gas emissions rate resulting from a clean hydrogen production process?
(b) What technologies or methodologies should be required for monitoring the lifecycle greenhouse gas emissions rate resulting from the clean hydrogen production process?

embedded in the GREET model, the required certification would be that their actual emissions are no greater than EPA's assumed emissions. Alternatively, the required certification could simply document actual emission data from upstream processes. In that case, eligibility for the Section 45V credit would be determined by incorporating actual data into the GREET model analysis. In addition, we encourage the Treasury Department and the IRS to work with DOE to further update the GREET model to better reflect top-down fugitive emissions analysis.

To comply with the certification requirement, we anticipate that taxpayers would require their fuel feedstock suppliers to collect and share fugitive emissions data from their facilities. To ensure consistency in monitoring, we recommend that the emission data be collected by a certified third-party consultant on a monthly basis using standardized testing protocols. The emissions certifications for any given tax year could be based upon an average of the actual emissions data provided by the fuel feedstock supplier within that tax year. This type of certification program would be relatively easy to implement and would incentivize taxpayers to require their fuel feedstock suppliers to proactively address fugitive emission issues in their systems. Without this type of monitoring and certification program, Section 45V credits could be incentivizing the production of hydrogen using fossil fuel products that have high fugitive emissions. In fact, according to Professor Howarth, if fugitive emissions are accurately accounted for, the greenhouse gas footprint of hydrogen production from natural gas could be as much as 20% higher than the greenhouse gas footprint of burning natural gas or coal for heat. If that is true, it is essential that fugitive emissions be accurately tracked for the purposes of determining Section 45V credit eligibility.

Ignoring the variability of methane gas releases and failing to incorporate top-down data into the GREET model will be a step backward for IRA, with a high risk of undermining the core purpose of the Section 45V credit to incentivize clean hydrogen production. **We encourage the Treasury Department and the IRS (i) to collaborate with DOE on making the GREET model fugitive emissions assumptions more accurate, and (ii) to implement monitoring and certification protocols that ensure actual fugitive emissions from upstream fuel sources are documented, certified, and incorporated into eligibility determinations. Otherwise, the production of hydrogen from high emission feedstock will have the perverse result of using federal tax dollars to increase, rather than decrease, greenhouse gas emissions.**