SUBMITTED ELECTRONICALLY

Monday, February 26, 2024

The Honorable Janet Yellen
Secretary of the Treasury
Department of Treasury
1500 Pennsylvania Avenue, NW
Washington, D.C. 20220

Re: IRS and REG–117631–23 – 45V Credit for Production of Clean Hydrogen, Election to Treat Clean Hydrogen Production Facilities as Energy Property

Dear Secretary Yellen,

Thank you for the opportunity to provide comments on the 45V Clean Hydrogen Production Tax Credit Notice of Proposed Rulemaking. Electric Hydrogen Co. applauds the Administration for their thoughtful work on a complex issue. Anchoring the 45V rules in temporal matching and deliverability is important in driving emissions reductions, expanding the market for US produced hydrogen by aligning with the EU standard, and establishing the green hydrogen industry with rampable electrolysis systems where US manufacturers have a competitive advantage versus Chinese competitors.

To meet DOE's Hydrogen Shot Goal of lowering the unsubsidized production cost of clean hydrogen to $1/kg by 2030, the clean hydrogen industry must scale well before the end of this decade. To compete with fossil fuel resources, the cost of clean hydrogen must come down by a factor of five. The capital cost of electrolyzers is a significant component of that reduction. While there is a clear roadmap for reducing the cost of electrolyzers by the amount needed, it requires cycles of learning and technology innovation that are only possible when production is ramping rapidly to meet project-related demand. Due to infrastructure limitations, early project developers need flexibility to begin building projects where hydrogen demand is currently present. Based on feedback from the market, Electric Hydrogen has concluded that limited phase-in of the "3-pillar" requirements will support growth of the green hydrogen industry along the trajectory that is necessary to make green hydrogen a viable alternative to fossil fuels. As long as the duration of applicability is short, grandfathering may also support that trajectory by fortifying financing certainty for early green hydrogen project growth.

As addressed below, any such phase-in flexibility must be short-lived, or significant emissions savings will be lost, and the emissions-reduction innovation needed to make green hydrogen competitive with fossil fuels will be put at risk. The "3 pillars" debate within the 45V rulemaking has largely come down to finding the right balance between a short-term need to kick-start the

industry and a long-term need to maintain emissions integrity. Both are essential to making clean hydrogen a viable decarbonization tool in a timeframe that matters.

ZeroPark's landmark green hydrogen project in Beaumont, Texas, (ZeroPark 1) is exemplary of the type of project that will jump start the technological learning curve and that will need to be replicated to scale the industry to compete with fossil fuels. ZeroPark 1 will utilize up to 200 megawatts of Electric Hydrogen's advanced, flexible PEM electrolyzers to supply green hydrogen to OCI Global's green ammonia and green methanol plant. Projects of this scale and complexity take years to develop. The pipeline of viable green hydrogen projects (like ZeroPark 1) will continue to be constrained by the location of hydrogen demand, particularly over the next three to four years. Early movers, with projects ready to supply green hydrogen where it is needed, should not be discouraged by rigid application of "3 pillar" rules too early.

To meet DOE's Hydrogen Shot Goal, such early movers should be supported so that the industry can progress down its learning curve. As explained above, a shortfall in project volumes will undermine the industry's ability to develop the enabling technologies and scale equipment production volume, both of which are necessary to drive down the levelized cost of hydrogen (LCOH). In other words, there is a circular interdependence between the robustness of the early green hydrogen project pipeline, equipment production scale, and LCOH.

This circular interdependence was also present in the solar industry. With the right balance of incentives and RPS demand drivers, the industry was able to scale, driving down the cost of capital equipment for solar projects and allowing the solar industry to beat thermal generation on cost (LCOE) faster than predicted. That same balancing and virtuous cycle of learning and improvement is now needed to grow the clean hydrogen industry along the same path. If enough electrolytic hydrogen projects get built in the next three to four years, scaling of the industry will get the bump needed to build a strong electrolyzer manufacturing base in the United States that can compete globally and stay on a cost reduction roadmap that will make green hydrogen cost competitive with fossil fuel resources this decade.

While green hydrogen must scale rapidly to achieve these outcomes, Electric Hydrogen continues to support expeditious application of the Administration's temporality and regionality requirements, which are critical to ensuring emissions integrity and driving innovation towards fossil fuel cost parity. We are advocating for early flexibility, not long-term avoidance. Waiting more than three or four years to apply these energy sourcing principles will undermine the emissions reductions that 45V was meant to incentivize and cause green hydrogen innovation to stagnate.

Treasury and DOE must find the right balance between early deployment to jump start green hydrogen projects and equipment cost reductions, on the one hand, and emissions integrity, on the other hand. Identifying the appropriate points and degrees of flexibility is essential to the success and durability of the credit and the nascent green hydrogen industry. Electric Hydrogen applauds the open door approach the Administration has taken to listening to stakeholders from all perspectives. We encourage Treasury to use the input that will be provided by all stakeholders through the rule-making process to keep green hydrogen green, while also providing limited flexibility for early projects to get built.

From the Electric Hydrogen perspective, we remain willing to compromise on 45V rules that enable rapid implementation. More important than anything else is getting final and durable rules in place quickly. Following the submittal of 45V comments, we will continue to engage with all stakeholders in the hopes of finding a pragmatic compromise that strikes the right balance between short-term growth and long-term emissions integrity.

In the meantime, Electric Hydrogen's comments focus on one critical area of flexibility that is not included in the proposed rules or the Administration's questions. Specifically, Electric Hydrogen respectfully encourages the Administration to adopt a kilogram-by-kilogram approach to calculating the amount of qualified hydrogen on which a taxpayer is eligible to claim the 45V credit as opposed to an annual averaging approach. Additionally, these comments encourage DOE to update the 45VH2-GREET model to move upstream methane leakage rates to foreground data and to require direct measurement of fugitive methane emissions rather than an assumed leakage rate. Finally, these comments highlight the need for qualified clean hydrogen production facilities to be able to "lock in" the version of 45VH2-GREET in use at the facility's commercial operation date for the duration of the facility's eligibility for the credit.

Sincerely,

Beth Deane

Beth Deane
Chief Legal Officer

About Electric Hydrogen:

Electric Hydrogen manufacturers components of its 100-megawatt electrolyzer systems in Massachusetts and assembles the remaining components in Texas. Our proton exchange membrane (PEM) electrolysis technology, which is designed to load follow variable renewable energy resources, enables the efficient conversion of electrical energy into chemical energy in the form of hydrogen. This conversion allows our customers to utilize clean hydrogen as long duration storage to firm intermittent renewables on the electric grid, to produce clean hydrogen for clean energy export and for energy security, or use the chemical energy as a clean feedstock in hard to decarbonize industries, including steel manufacturing, fertilizer production, chemical processing, refining, and transportation fuels for aviation, shipping, and long-distance transportation.

Clean hydrogen is a necessary tool in the energy transition to a net-zero economy. The Department of Energy's Clean Hydrogen Roadmap describes hydrogen as "a key part of a comprehensive portfolio of solutions to achieve a sustainable and equitable clean energy future."[1] In alignment with the Roadmap, Electric Hydrogen's mission is to achieve cost parity

[1] Department of Energy. "U.S. National Clean Hydrogen Strategy and Roadmap." June 2023, pg 1, DOE, https://www.hydrogen.energy.gov/pdfs/us-national-clean-hydrogen-strategy-roadmap.pdf

with fossil fuels before 45V production tax credits expire. In essence, the company exists to make green hydrogen an economic inevitability.

Kilogram-by-Kilogram Versus Annual Averaging:

To develop green hydrogen production projects to decarbonize heavy industry, taxpayers need certainty regarding the credit tier for which their project will be eligible. To enable that certainty, Electric Hydrogen recommends Treasury reject an annual averaging approach to calculating credit eligibility and tier and instead adopt a kilogram-by-kilogram approach to credit calculation in the final 45V rule.

In the Notice of Proposed Rule Making (NPRM), Treasury appears to require a taxpayer producing qualified clean hydrogen via electrolysis to calculate the value of the credit for which the taxpayer is eligible by averaging the EACs the taxpayer has procured and retired over the entire volume of hydrogen produced by the taxpayer during the year. Section 1.45V—4(b) of the NPRM states:

> For each taxable year during the period described in section 45V(a)(1), a taxpayer claiming the section 45V credit determines the lifecycle GHG emissions rate of hydrogen produced at a hydrogen production facility under the most recent GREET model separately for each hydrogen production facility the taxpayer owns. This determination is made following the close of each such taxable year and must include all hydrogen production during the taxable year.

This annual averaging approach creates risk that through no fault of the taxpayer, but simply due to the variable nature of renewable energy, a taxpayer may be entitled to less tax credit than anticipated or no credit at all. An annual averaging approach could make it difficult for taxpayers to secure financing for electrolytic projects as the revenue stream from tax credits would be uncertain.

When the transition from annual to hourly temporal matching occurs, taxpayers will have a variety of options and strategies for sourcing EACs on an hourly basis. Taxpayers could sign hourly power purchase agreements (hourly PPAs) with renewable energy developers to procure both electricity and hourly EACs designed to match the modelled electricity consumption profile of the electrolyzer. Alternatively, taxpayers could sign contracts for unbundled hourly EACs designed to match the anticipated load profile of the electrolyzer.

However, even with the best EAC and electricity modelling, there will be times when the actual production from contracted renewable generation does not match what was anticipated. There will be gaps between the EACs procured and the hydrogen produced to meet firm hydrogen production requirements. Many existing industrial plants utilizing hydrogen as a feedstock, including ammonia production, have a limited turndown capacity and therefore require a firm supply of hydrogen.[2] Over time, a liquid real time or day ahead spot market for hourly EACs

[2] Rouwenhorst, Kevin. "Flexible ammonia synthesis: shifting the narrative around hydrogen storage." Ammonia Energy Association, Friday, February 16, 2024, https://www.ammoniaenergy.org/articles/flexible-ammonia-synthesis-shifting-the-narrative-around-hydrogen-storage/

may evolve and give some opportunity to retroactively make up gaps, but even if that happens, the reality will continue to exist that sometimes the wind does not blow and the sun does not shine. During those periods, make-up EACs may not be available in the market. While clean hydrogen project owners will be incentivized to find make-up EACs and claim the credit, they should not be penalized on the rest of their volume production when that is not possible.

Treasury should allow taxpayers to address "missed" hours by excluding them from the credit calculation and choosing "kilogram-by-kilogram" matching with available hourly EACs. In other words, Treasury should allow taxpayers the option to forego the credit on production volume that cannot be matched with EACs. Loss of the tax credit would be a significant economic loss, but requiring averaging would be doubly burdensome as it could result in a reduction of the credit tier for all of the hydrogen produced by a facility in a tax year. Moreover, this approach is consistent with the statute. For purposes of calculating the credit, the statute states:

> **(a) Amount of credit**
> For purposes of section 38, the clean hydrogen production credit for any taxable year is an amount equal to the product of—
> **(1)** the kilograms of qualified clean hydrogen produced by the taxpayer during such taxable year at a qualified clean hydrogen production facility during the 10-year period beginning on the date such facility was originally placed in service, multiplied by
> **(2)** the applicable amount (as determined under subsection (b)) with respect to such hydrogen.[3]

Qualified clean hydrogen is subsequently defined in the statute as "hydrogen which 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."[4] Nothing in the statute requires that a taxpayer claim a credit against every kilogram of hydrogen produced at the qualified clean hydrogen production facility. All that is required is that any kilogram that the taxpayer does claim as "qualified clean hydrogen" must have a lifecycle greenhouse gas emissions rate that complies with the emissions tiers in the statute. The requirement to meet the emissions standard in the statute is applied at the unit of product level rather than the facility level.

In addition to complying with the statute, the kilogram-by-kilogram approach would be consistent with how Treasury administers other production tax credits like the 45Q Carbon Oxide Sequestration Credit. Under the 45Q credit, Treasury grants a taxpayer a credit for each ton of "qualified carbon oxide" that is either geologically sequestered or utilized without regard to the average annual performance of the qualified facility.

Adopting a kilogram-by-kilogram approach will also create an incentive for taxpayers to improve performance to minimize missed hours. Utilizing Electric Hydrogen's publicly available

[3] United State, Congress. Title 26, Subtitle A, Chapter 1, Subchapter A, Part IV, Subpart D, Friday, February 16, 2024, https://www.law.cornell.edu/uscode/text/26/45V
[4] Id.

levelized cost of hydrogen model on the Electric Hydrogen website can help demonstrate this.[5] Assuming a fully installed electrolyzer price of $1500/kW, an electricity price of $35/megawatt hour and a utilization rate of 65%, a hydrogen producer can produce hydrogen for $1.31/kg of hydrogen after applying the $3/kg tax credit. For a desired selling price of $1.5/kg this project achieves an internal rate of return of 13%. However, for each missed hour, the hydrogen producer loses $2.56 for each kg of hydrogen produced for an internal rate of return of -170%. The value of the credit creates a strong incentive for producers to minimize missed hours through either optimizing their electricity/EAC procurement strategy, adding electricity storage, and/or adding hydrogen storage.

Electric Hydrogen respectfully encourages the Treasury department to adopt a kilogram-by-kilogram approach to credit calculation. This approach will make it easier for project developers to secure financing, is consistent with the statute and the policy approach taken in 45Q, and will create an incentive for hydrogen producers to continually improve their operations to minimize missed hours.

Moving Upstream Methane Leakage to Foreground Data and Requiring Direct Measurement:

By relying on an assumed upstream methane leakage rate in the background data, 45VH2-GREET, likely underestimates actual methane leakage rates. Moving the upstream methane leakage rate to a foreground variable and requiring verification will both improve the integrity of the program and incentivize project developers to source feedstock from suppliers that can verify low leakage rates.

45VH2-GREET assumes in its background data an upstream methane leakage rate of approximately 0.9% of methane consumed by the reformer. This assumption likely underestimates actual leakage rates. Peer-reviewed research from Cornell University professor Robert Howarth set the default rate for upstream methane leakage at 3.5%.[6] Similarly, a study published in the journal *Science* by Ramon Alvarez using ground-based as well as arial monitoring from gas fields accounting for nearly a third of US production found the leakage rate to be 2.3%.[7] Requiring that the upstream leakage rate be based on verified monitoring would ensure projects meet the emissions reductions required in the statute.

To comply with a requirement to base upstream methane emissions on monitored and verified leakage rates, taxpayers could require their fuel feedstock supplier to collect and share fugitive emissions data from their facilities. To ensure consistency in monitoring, emissions data could be collected by a certified third-party consultant monthly using standardized protocols. Such a certification system is administrable and would incentivize taxpayers to require their fuel feedstock supplier to proactively address fugitive emissions in their systems.

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[5] https://eh2.app/lcoh/model

[6] Howarth, Robert, and Mark Jacobson. "How Green is Blue Hydrogen?" *Energy Science and Engineering*, Volume 9, Issue 10, 2021. https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956

[7] Ramon A., Alvarez et al. "Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain." *Science,* Volume 361, Issue 6398, 2018. https://www.science.org/doi/10.1126/science.aar7204

Ignoring the variability of methane leakage and relying on an assumed methane leakage rate in the background data of 45VH2-GREET risks undermining the core purpose of the Section 45V credit to incentivize clean hydrogen production. We encourage the Treasury Department in cooperation with the Department of Energy to update 45VH2-GREET to require the use of actual methane leakage rates verified by independent monitoring as a foreground input in 45VH2-GREET.

Locking in a Version of 45VH2-GREET:

Electric Hydrogen recognizes the need to annually update 45VH2-GREET to reflect changes in technology, energy markets, and emissions data. These updates will improve the accuracy of hydrogen producers' carbon intensity (CI) calculations and the efficacy of the 45V credit in reducing GHG emissions. However, Treasury must ensure that the appropriately dynamic nature of 45VH2-GREET does not impede the ability of green hydrogen developers to secure financing.

§ 1.45V–4(b) of the proposed rule requires a taxpayer to use the most recent version of 45VH2-GREET when calculating the lifecycle greenhouse gas emissions of qualifying clean hydrogen at the close of each taxable year. This requirement creates the possibility that a taxpayer could be eligible for the credit or a certain tier of the credit at the commercial operations date (COD) of the facility but in a subsequent year be ineligible for the same credit tier or any credit at all based solely upon changes to the 45VH2-GREET model rather than changes in the electricity procurement or operation of the electrolytic hydrogen production facility. Structuring the rule this way further increases the project development risk profile of a nascent industry and could make projects unfinanceable.

Treasury can easily remedy this risk by allowing taxpayers to "lock in" the version of 45VH2-GREET in use at the COD of the qualified clean hydrogen production facility for the duration of the facility's eligibility for 45V. Taxpayers would then use the 45VH2-GREET model vintage in use at the facility's COD to annually calculate the CI of qualified clean hydrogen produced at the facility. DOE could continue to update and improve 45V-H2GREET annually, and each iteration would be used by qualified clean hydrogen production facilities that reach COD that year. This would allow certainty for qualified clean hydrogen producers seeking financing while allowing DOE to continue to improve 45VH2-GREET.