February 26, 2024

U.S. Department of the Treasury, Internal Revenue Service
Office of Tax Policy
Ben Franklin Station
P.O. Box 7604, Room 5203
Washington, DC 20044

Submitted via www.regulations.gov, IRS REG–117631–23

Re: Proposed regulations relating to the credit for for production of clean hydrogen (IRS-REG–117631–23)

Thank you for the opportunity to provide comments on the proposed 45V Hydrogen Production Tax Credits. Please accept these comments on behalf of Earthworks.

Since 1988, Earthworks has helped communities secure protections of their health, land, water, and air from extractive industries. Earthworks is a national nonprofit organization committed to protecting communities and the environment from the impacts of mining and energy development while seeking sustainable solutions. For nearly 30 years, we have fulfilled our mission by working with communities and grassroots groups to reform government policies, improve corporate practices, influence investment decisions and encourage responsible materials sourcing and consumption.

Introduction

The purpose behind the hydrogen production tax credit (PTC) is to facilitate the large-scale production of clean hydrogen, which does not release carbon dioxide (CO2) when burned, to address difficult to decarbonize sectors of the economy and help the US achieve its goal of significantly reducing greenhouse gas (GHG) emissions over the coming decades.[1] Depending on the method used to produce the hydrogen, however, the total lifecycle emissions of a given project may actually be higher than that of the fossil fuel energy it is intended to replace.[2] Without strong guardrails around requirements to qualify for the massive subsidies, the PTC is at risk of not only failing to reduce GHG emissions but to actually increase them. Spending potentially 100's of billions of taxpayer dollars to inadvertently subsidize additional carbon dioxide emissions would be a grave policy failure that must be avoided.

---

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

[2] Robert W. Haworth, Mark Z. Jacobson, "How Blue is Green Hydrogen?" Energy Science & Engineering, Vol. 9, Issue 10, pp. 1676-1687, August 12, 2021 (after calculating the lifecycle emissions of blue hydrogen, the study observed, "[p]erhaps surprisingly, the greenhouse gas footprint of blue hydrogen is more than 20% greater than burning natural gas or coal for heat and some 60% greater than burning diesel oil for heat, again with our default assumptions.") https://onlinelibrary.wiley.com/doi/full/10.1002/ese3.956.

The current draft of the proposed rule takes positive steps to avoid some of the worst possible emissions outcomes from electrolytic (green) hydrogen but still needs to address some potential loopholes for hydrogen produced from natural gas (blue). The final rules should **maintain the "three pillars" approach**, a series of requirements designed to ensure the green hydrogen production process is actually clean, and **create additional safeguards** around calculating the life cycle emissions of blue hydrogen projects.

The Final Rule Should Maintain the Three Pillars for Electrolytic Hydrogen Production

The hydrogen production tax credit must be built on the "three pillars," new clean supply, hourly matching, and deliverability, to avoid increasing emissions. These are necessary steps to ensure hydrogen projects actually stay below the carbon intensity threshold outlined in the Inflation Reduction Act (IRA). These guardrails are collectively referred to as "pillars" because if just one is removed, the goal of using hydrogen as an emissions reduction tool comes crashing down.

A recent analysis in Environmental Research Letters found "that subsidized grid-connected hydrogen production has the potential to induce additional emissions at effective rates worse than those of conventional, fossil-based hydrogen production pathways."[3] The analysis states, however, that these emissions can be minimized by "requiring grid-based hydrogen producers to match 100% of their electricity consumption on an hourly basis with physically deliverable, 'additional' clean generation…."[4]

Moreover, the European Union (EU), which is expected to be a major importer of clean hydrogen in the next decade,[5] has already set strict rules. The EU rules incorporate the three pillars and prohibit the import of hydrogen or products produced using hydrogen that do not conform to their standards.[6] Despite some industry players arguing strict rules will stifle the growth of the hydrogen industry, since the EU adopted its guidelines, more three pillar-compliant hydrogen projects have been announced.[7] Likewise, a 2023 impact analysis by Evolved Energy

---

[3] Ricks W, Xu Q, Jenkins J "Minimizing emissions from grid-based hydrogen production in the United States" 2023 Environmental Research Letters, Volume 18, Number https://iopscience.iop.org/article/10.1088/1748-9326/acacb5/meta.

[4] Id.

[5] Oleksiy Tatarenko, Natalie Janzow, Joaquin Rosas, Quailan Homann, "The Value of Green Hydrogen Trade for Europe: How the EU can get its hydrogen market started on the front foot," RMI, (2023) https://rmi.org/insight/the-value-of-green-hydrogen-trade-for-europe/.

[6] Gregor Erbach, Sara Svensson, "EU rules for renewable hydrogen: Delegated regulations on a methodology for renewable fuels of non-biological origin," European Parliamentary Research Service, April, 2023. https://www.europarl.europa.eu/RegData/etudes/BRIE/2023/747085/EPRS_BRI(2023)747085_EN.pdf

[7] Jesse D, Jenkins, "Biden admin's long-awaited hydrogen rules are here — and on the right track,“ Canary Media, December 22, 2023 https://www.canarymedia.com/articles/hydrogen/the-biden-administration-has-a-chance-to-do-clean-hydrogen-right.

Research finds, due to the generosity of the PTC, large scale deployment of hydrogen in the US will happen even with strict rules in place.[8]

It is essential the final rules are strong and incorporate all three pillars. Without all three, there will be a deluge of emissions subsidized at great cost to the taxpayer. Finalizing the three pillars approach plays an important role in both protecting the climate and the reputation of a nascent industry.

Grid-Connected Projects Complicate Emissions Calculations

It is difficult to calculate the lifecycle GHG emissions from grid-connected projects. The analysis is less complex when a project is directly connected to a clean energy generation source like solar, wind, or geothermal. When a project is connected to the grid, it draws power from a variety of sources that supply the grid, which may include coal and gas plants in addition to renewable energy. For these more complex project configurations, rigorous rules are required to ensure the projects are actually using clean energy.

Studies show plugging an electrolyzer directly into an existing grid can yield massive emissions increases,[9] the extent of which varies based on the grid's carbon intensity. Because the process of converting water into hydrogen through electrolysis is exceptionally energy intensive, additional fossil fuel resources may be required to replace the energy being consumed to create hydrogen. The three pillars, if properly deployed, can help ensure these projects do not simply use up the available clean energy on the grid and, as a result, increase fossil fuel demand to make up the difference.

New Clean Supply

When increased demand is added to the grid in the form of something like an energy intensive electrolyzer, new energy generation is required to meet the demand. Hydrogen producers must be responsible for ensuring that any additional demand is met with new, or additional, renewable energy supply. Otherwise, a green hydrogen producer may simply use clean energy from the grid that would have gone to decarbonize other sectors. Adding demand without adding new clean energy supply to offset that demand could incentivize extending the life of fossil fuel power plants or even the construction of new ones to supply the energy needed from the additional demand.

---

[8] Evolved Energy Research, "45V Hydrogen Production Tax Credits: Three Pillars Accounting Impact Analysis," June 2023.

[9] Ricks, *supra* note 3 ("Using the current average US generation mix, embodied emissions from grid-connected electrolysis would be far too high to meet statutory requirements for even the minimum PTC.")

Hourly Matching

In addition to new clean supply, the PTC guidance for grid-connected projects must also require that the project only consumes energy during the same time new clean energy supply is available. In selecting the temporal granularity needed to show clean supply matches demand, the Treasury Department should require the most granular matching window feasible. Grid emissions can vary on an hourly basis.[10] For this reason, hourly matching, as opposed to less granular approaches, has the best chance at accurately assessing when clean energy is supplying the demand from electrolyzers, meaning the projects prove they are actually consuming clean energy while in use.

Proposed alternatives to hourly matching, like annual matching, would create the illusion of supply meeting demand over a year long time frame, but, in reality, electrolyzers would be consuming energy at times clean energy supply is low and would, as a result, be powered by fossil fuel plants. Studies show that relying on annual matching as opposed to hourly matching would substantially increase emissions with some estimates calculating the impact would be twice as great as using hydrogen made from natural gas.[11] Annual matching can underestimate the emissions impact by up to 35%[12] and has a negligible emission benefit,[13] which defeats the purpose of using hydrogen. In fact, an MIT report found hourly matching was the only temporal rate that would allow project emissions to remain under the 45V emissions intensity thresholds outlined in the IRA.[14]

Deliverability

The third pillar, deliverability, is also critical to ensuring green hydrogen is clean.[15] The electricity from new clean energy projects must be physically deliverable to the location where the hydrogen project is located. Without requiring geographic deliverability, as Professor Jesse Jenkins describes, a hydrogen project may inaccurately represent the actual source of its energy: “[a] hydrogen producer in Louisiana could claim to be powered by cheap wind power

---

[10] U.S. Energy Information Administration, “FAQs: How much carbon dioxide is produced per kilowatthour of U.S. electricity generation?” https://www.eia.gov/tools/faqs/faq.php?id=74&t=11#:~:text=The%20amount%20of%20CO2,daily%2C%20monthly%2C%20and%20annually.

[11] Ricks, *supra* note 3.

[12] Gregory J. Miller, Kevin Novan, Alan Jenn, “Hourly accounting of carbon emissions from electricity consumption,“ Environmental Research Letters, Vol. 17, No. 4, April 8, 2022 https://iopscience.iop.org/article/10.1088/1748-9326/ac6147/meta.

[13] Qingyu Xu, Wilson Rick, Aneesha Manocha, Neha Patankar, Jesse D. Jenkins, “System-level impacts of voluntary carbon-free electricity procurement strategies,” Joule, Vol. 8, Issue 2, pp. 374-400, February 21, 2024 https://www.sciencedirect.com/science/article/pii/S2542435123004993?dgcid=coauthor.

[14] Anna Cybulsky, Michael Giovanniello, Tim Schittekatte, Dharik S. Mallapragada, “Producing hydrogen from electricity: How modeling additionality drives the emissions impact of time-matching requirements,” MIT Energy Initiative, April 2023 https://energy.mit.edu/wp-content/uploads/2023/04/MITEI-WP-2023-02.pdf.

[15] Aaron Bergman & Kevin Rennert, “Emissions Effects of Differing 45V Crediting Approaches,” Resources for the Future, June 30, 2023 https://www.rff.org/publications/reports/emissions-effects-of-differing-45v-crediting-approaches/.

from North Dakota, even when it is really using electricity from a gas or coal plant on the Gulf Coast."[16]

The Final Rule Should Create Additional Safeguards for Blue Hydrogen

The final rules should guard against incentivizing hydrogen derived from natural gas (blue hydrogen) that does not actually reduce emissions. There are numerous pitfalls that could lead one to underestimate the climate warming impact of blue hydrogen.

Along with the CO2 released in the process of making blue hydrogen, there can be significant methane emissions. In theory, the CO2 created in the process is captured before it can be released into the atmosphere. Even if one were to grant the claims made about the effectiveness of current carbon capture technology, carbon capture does not address methane leaks. Carbon capture also does not address fugitive hydrogen emissions, which act as an indirect GHG. Both methane and hydrogen have powerful short-term warming effects, which must be taken into account.

Calculating the lifecycle emissions for projects claiming the PTC, then, should incorporate an accurate accounting of **methane emissions**, the **warming effects of hydrogen**, and calculate **impacts in the near and long term**.

Accurately Assess Methane Emissions

Upstream emissions from blue hydrogen must be included in the lifecycle analysis of a project looking to claim the PTC. Methane, a component of natural gas, is leaked into the atmosphere throughout the natural gas supply chain from the point of extraction to the pipelines that transport it. The leaked methane, along with the warming impact of other emissions from the process can make the blue hydrogen more harmful in the short term than the fossil fuel alternatives it is intended to replace.[17]

The 45VH2-GREET model, used to determine tax credit eligibility, uses a 0.9% national average leakage rate.[18] However, this number is not representative of specific projects because leakage rates within different basins vary substantially. For instance, Utah's Uinta Basin emits methane at a rate of around 6-8%.[19] To ensure only clean hydrogen projects receive the tax credits, the

---

[16] Jenkins, *supra* note 7.
[17] Ilissa B. Ocko & Steven P. Hamburg, "Climate consequences of hydrogen emissions," Atmos. Chem. Phys., 22, 9349–9368, July 20, 2022. https://acp.copernicus.org/articles/22/9349/2022/.
[18] U.S. Department of Energy, "Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2-GREET 2023," December, 2023 https://www.energy.gov/sites/default/files/2023-12/greet-manual_2023-12-20.pdf.
[19] John C. Lin, Ryan Bares, Benjamin Fasoli, Maria Garcia, Erik Crosman, Seth Lyman, "Declining methane emissions and steady, high leakage rates observed over multiple years in a western US oil/gas production basin," Sci Rep 11, 22291, November 16, 2021 https://doi.org/10.1038/s41598-021-01721-5.

model should be updated to include basin specific inputs. The warming effect of methane, which is 86 times more powerful than CO_2 over a 20-year time scale,[20] cannot be ignored.

Incorporate the Indirect Warming Effect of Hydrogen

Hydrogen is an indirect greenhouse that contributes to global warming, especially in the short term. Over the first 20 years, it exceeds the warming power of CO_2 many times over.[21] Further, because hydrogen molecules are smaller than methane, H_2 is even leakier and can easily escape into the atmosphere. Despite its high risk of leakage and significant indirect impact on global warming, hydrogen is not currently included in the calculation of lifecycle emissions for a project. To get the full picture of the warming impact of a given project, these fugitive hydrogen must be factored into the analysis.

Use of Differentiated or Certified Gas

Differentiated and certified gas programs are relatively new technologically-oriented approaches to methane monitoring, measurement, and mitigation. As noted by EDF, many such programs currently lack robust measurement, reporting, and verification standards; have been unevenly adopted across oil and gas firms; and, have immense potential for firms to cherry-pick which sites are certified within their portfolio.

Last year Earthworks released Certified Disaster - a report that examined the use of continuous emissions monitors (CEMs), which are widely used "measurement" tools by gas certification companies as part of differentiation or certification processes. The results were very concerning. Our seven months of field research in Colorado involved 77 surveys of 30 different oil and gas production sites in the Front Range. We found that CEMs failed to capture all 22 significant pollution events detected by trained thermographers using industry-standard FLIR optical gas imaging cameras. Our investigation left us with little confidence that differentiated or certified gas programs are currently able to do what they promise.

Therefore, we made the following recommendations for differentiated or certified gas programs and associated legislation or regulations:

- Companies undergoing certification have a clear, independently accredited plan to end fossil fuel production, including 5-year milestones which they must meet to maintain certification status.
- CEM manufacturers and distributors subject products and services to independent, peer-reviewed studies to ensure an accurate assessment of their capabilities. Such studies must be publicly available.

---

[20] Gayathri Vaidyanathan, "How bad of a greenhouse gas is methane?" Scientific American, 2015. https://www.scientificamerican.com/article/how-bad-of-agreenhouse-gas-is-methane/.
[21] Didier Hauglustaine, Fabien Paulot, William Collins, Richard Derwent, Maria Sand, Olivier Boucher, "Climate Benefit of a future hydrogen economy," Communications Earth & Environment 3. 295, November 26, 2022 https://www.nature.com/articles/s43247-022-00626-z#citeas.

- Certifiers use CEMs that have been shown through independent peer review to meet the following minimum requirements:
    - Provide minute-by-minute readings of methane emissions measured in mass over time (kg/hr).
    - Demonstrate accurate detection and quantification of point source emissions of 0.1 kg/hr or higher with 90% confidence.
    - Maintain a 12-month rolling average of less than 10 percent operational downtime in field conditions.
- The certifier guarantees that implementation of monitors in the field matches conditions tested in peer- reviewed studies (e.g., number and placement of monitors related to type, size, and location of the site).
- Certification is obtained on a site-by-site basis rather than on a company-wide basis. Additionally, the certifier makes details of any certified site (i.e. type, quantity, and placement of monitors) publicly available and grouped by company.
- The certifier requires operators to submit monthly, site-specific monitoring reports for all certified sites to maintain certification. These reports must be publicly available and include the following:
    - Evidence of calibration.
    - Description of monitoring equipment deployed, including manufacturer and model.
    - Number and placement of monitors (including height) and meteorological measurement devices.
    - Topographic map of site.
    - Raw stream of minute-by-minute monitor data for all parameters measured.
    - Number and date of pollution threshold exceedances.
    - Full list of monitor failures, power outages, and connection losses.
    - Verified chain of custody.
- The certifier publicly discloses company performance details such as the number of wells or sites monitored versus unmonitored, the amount of oil and gas production certified versus uncertified, total measured emissions, violations, and improvement in absolute emissions reductions over time.
- The certifier takes immediate action to ensure board members, senior management, and staff have no financial ties or investments in the companies being certified.

These recommendations need to be implemented to ensure actual reductions in emissions; to ensure accurate, robust, and transparent measurement, reporting, and verification standards; to safeguard against cherry-picking and misrepresentation; and, to create the transparency and accessibility to data required for regulators, the public, and other stakeholders to evaluate the efficacy of differentiated or certified gas programs.

Calculate Near Term Impacts as Well as Long Term

To determine the climate impact of different GHGs, scientists calculate their inherent warming ability in relation to CO2, the climate pollutant that is generally emitted in the largest volumes.[22] CO2 is assigned a value of “1” and other gasses are given values relative to that baseline, called Global Warming Potential (GWP).[23] This allows for the comparison of the potency of different greenhouse gasses and the calculation of overall volumes in terms of “carbon dioxide equivalent” (CO2e).

The model, in order to accurately assess the near term warming potential of a given project should use a 20-year GWP. Using a 20-year GWP for methane better reflects the real impacts of the gas, which remains in the atmosphere for about 12 years.[24] This shift is necessary because, according to the general scientific consensus, there is only about a decade left to avoid the most catastrophic environmental and social impacts of climate change.[25]

Respectfully,

Charlie Palladino
Policy Advocate
Earthworks

---

[22] Intergovernmental Panel on Climate Change, Fifth Assessment Report 2014, Chapter 8, “Anthropogenic and Natural Radiative Forcing.”
[23] US Environmental Protection Agency, Understanding Global Warming Potentials, https://www.epa.gov/ghgemissions/understanding-global-warmingpotentials.
[24] Intergovernmental Panel on Climate Change, Fifth Assessment Report, Climate Change 2013: The Physical Science Basis, Contribution of Working Group I.
[25] Intergovernmental Panel on Climate Change, “Global Warming of 1.5 degrees celsius,” 2018 https://www.ipcc.ch/sr15/.