Industrial Innovation Initiative

a partnership between Great Plains Institute and World Resources Institute

From: Industrial Innovation Initiative, I³
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Re: Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production (Notice 2022-58)
https://www.irs.gov/pub/irs-drop/n-22-58.pdf

Background

The Treasury Department and the Internal Revenue Service have a crucial role to play in advancing the tax provisions needed to support the investments necessary for significantly decarbonizing the industrial sector. We are supportive of the inclusion of the 45V and 45Z credits under the Inflation Reduction Act of 2022 and appreciate this opportunity to provide comment. In response to the Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production, the Industrial Innovation Initiative (I^3) has prepared the following document.

About I^3

The Industrial Innovation Initiative (I^3) is an ambitious coalition which aims to advance solutions key to decarbonizing the industrial sector through policy development and implementation, technology demonstration and adoption, and demand-side market development. The Initiative builds on years of stakeholder engagement and extensive work by its co-conveners, Great Plains Institute and World Resources Institute (WRI), to collaborate with government officials and advance decarbonization solutions important to the industrial sector.

I^3 values a stable climate, a safe and healthy environment, thriving livelihoods for American workers, and a strong US economy. I^3 supports policies that will put American industry on a path to net-zero emissions, retain and create high-wage jobs, and advance technology leadership and economic competitiveness. The Initiative convenes key industry, environmental, labor, and other stakeholders, to advance cross-cutting strategies, policies, and programs for achieving industrial decarbonization by midcentury.

.01 Credit for Production of Clean Hydrogen.

(1) Clean Hydrogen.

(a) Section 45V defines "lifecycle greenhouse gas emissions" to "only include emissions through the point of production (well-to-gate)."[1] Which specific steps and emissions should be included within the well-to-gate system boundary for clean hydrogen production from various resources?

Well-to-gate emissions include the conventional GREET definition encompassing upstream (i.e., feedstock extraction and transportation and energy use) and point of production emissions. There is significant literature on upstream and production emissions (e.g., Clean Air Task Force), thus, below are several key considerations that, although not necessarily comprehensive, should be paid particular attention when determining the boundaries of well-to-gate emissions.

- Feedstock emissions: Emissions associated with extracting and transporting feedstocks.
    - Natural gas: In addition to the CO_2 emissions from extracting, processing, and transporting natural gas to the production facility, fugitive methane emissions can greatly affect hydrogen's carbon intensity.
    - Biomass: Extracting biomass must include land use, land use change, and forestry emissions (LULUCF), which could be significant depending on the type of land use and change. A reference case for each resource (land type, forest, etc.) should be determined to estimate this contribution.
    - Electricity and Heat: While it is likely that most early-stage electrolysis plants will seek dedicated renewable and nuclear energy, that does not preclude the possibility of some plants using grid electricity that has a fossil-generation component. The carbon intensity of electrolysis-based hydrogen greatly depends on how its electricity feedstock is generated.
- Production: CO_2 emissions associated hydrogen's production, namely deriving from energy generation to drive production and possible process emissions. In addition, methane or hydrogen leakage at the plant level should be counted. Additionally, electricity needed to power carbon capture equipment will likely generate emissions upstream if derived from fossil-based grid sources and will thus need to be counted.
- Hydrogen leakage and hydrogen's global warming potential, which recent research estimates as significantly higher than that of CO_2. However, because research on the effects of hydrogen leakage are still emerging and measurement and mitigation technologies are not widespread, their inclusion in the lifecycle assessment may be premature. Their inclusion should be considered following further research and guidance by DOE and EPA.

[1] The well-to-gate system boundary for hydrogen production includes emissions associated with feedstock growth, gathering, and/or extraction; feedstock delivery to a hydrogen production facility; conversion of feedstock to hydrogen at a production facility; generation of electricity consumed by a hydrogen production facility (including feedstock extraction for electricity generation, feedstock delivery, and the electricity generation process itself); and sequestration of carbon dioxide generated by a hydrogen production facility.

(b)(ii) How should emissions be allocated to the co-products (for example, system expansion, energy-based approach, mass-based approach)?

We recommend the International Partnership for Hydrogen and Fuel Cells in the Economy's priority for co-product allocation, found in their GHG methodology paper. They suggest prioritizing, in order, allocation based on energy, then system expansion, and finally economic value. A mass-based approach is not recommended due to hydrogen's high energy to mass ratio.

(c)(i) How should lifecycle greenhouse gas emissions be allocated to clean hydrogen that is a by-product of industrial processes, such as in chlor-alkali production or petrochemical cracking?

So long as the hydrogen produced meets the required "placed in service" date and lifecycle assessment standards, then the product should be eligible for the production credit. Like hydrogen co-products, determining lifecycle emissions of by-product hydrogen requires considering the impacts of inputs on outputs and their resulting energy use and environmental impact.

ISO 14404 lays out the analytic framework and methodologies for determining these impacts. Their most recent update (2020) attempts to reduce confusion around allocation methods (for example, where allocation or system expansion should be used), yet there is likely no clear, universal answer to how emissions should be allocated across different by-product processes. Moreover, the most recent amendment is argued to have muddled the difference between system expansion and substitution. Thus, these suggestions below should be considered tentative and subject to change following further clarifying guidance from the ISO.

Today, by-product hydrogen is either combusted to generate plant heat, vented, or sold on the merchant market. We recommend that a substitution method be prioritized for hydrogen by-product that is diverted from combustion streams to be sold on the merchant market. A plant that exports hydrogen for market sale that would otherwise be used to generate heat on-site would likely need to import fossil fuels for their combustion needs (this heat equivalency is approximately 2.54 kg of natural gas imported and burned per kg of hydrogen exported). Substituting new fossil fuels on-site requires adding the emissions from isolating and exporting the hydrogen and burning the new fuel. While substitution for other non-hydrogen products often yield lower net emissions because the by-product is displacing production of an equivalent unit elsewhere, by-product hydrogen fuel displacing dedicated hydrogen must still account for that heat deficit.

For petrochemicals and chlor-alkali process, this substitution method yields an insignificant GHG reduction if using GREET's baseline carbon intensity for SMR of $9kgCO_2/kgH_2$. Although a more straightforward method, it is complicated by the need to understand the emission intensity of the product it is displacing. GREET baselines may assist with this extra data collection requirement, but more individualized data over averages should be prioritized if and when available.

Allocation methods should be used for by-product hydrogen that is sold to the market that would otherwise by vented, with priority towards energy allocation. Every allocation method has strengths and weaknesses. As previously stated, for hydrogen, mass may underestimate the actual environmental impact, while market/economic allocation can yield great uncertainty due to varying and changing business and trade conditions. Energy allocation provides a more stable physical relationship between the by-product and product slate, although it can be complicated when other by-products do not have an energy value (e.g., oxygen and chlorine).

(ii) How is byproduct hydrogen from these processes typically handled (for example, venting, flaring, burning onsite for heat and power)?

While extensive research on dedicated hydrogen is available, there is a paucity of publicly available data on by-products. This is likely due to the proprietary use of by-produce by plants or a lack of need to report on amounts vented as a waste product. By-product hydrogen is predominately handled as outlined below:

- Refining, the largest hydrogen market, satisfies slightly less than half of its hydrogen needs with hydrogen by-product from catalytic reforming. It is isolated from flue gas and fed into hydrocracking and hydrotreating units to upgrade and desulphurize fuels, namely diesel. It can also be recycled into process heaters for combustion.
- Steam crackers for olefin production at petrochemical plants produces not insignificant amounts of by-product that is fed back into the cracker's furnace as fuel. One study estimated that steam crackers could add 3.5Mt of hydrogen to the merchant market if isolated and exported. However, that would require importing or using additional methane to meet the heat deficit lost by removing hydrogen.
- Chlor-alkali processes that manufacture chlorine create by-product hydrogen through electrolysis, which is typically powered by grid electricity or on-site combined heat and power turbines (CHP). The power source affects the product's carbon-intensity and how hydrogen is handled, with by-product mostly likely recycled if CHPs are used. Most of the hydrogen not combusted is sold to the merchant market, with smaller amounts vented, leading to indirect atmospheric warming.

(d) If a facility is producing qualified clean hydrogen during part of the taxable year, and also produces hydrogen that is not qualified clean hydrogen during other parts of the taxable year (for example, due to an emissions rate of greater than 4 kilograms of CO_2-e per kilogram of hydrogen), should the facility be eligible to claim the § 45V credit only for the qualified clean hydrogen it produces, or should it be restricted from claiming the § 45V credit entirely for that taxable year?

Should hydrogen be produced that is verified to meet clean hydrogen qualifications, the facility should be eligible to claim the 45V credit for only the qualified hydrogen produced. This would incentivize manufacturers to create the cleanest hydrogen possible as soon as possible, as restricting the credit by taxable year may lead to upgrades and the resulting emissions reductions to be timed around the tax calendar.

(2) Alignment with the Clean Hydrogen Production Standard.

For purposes of the § 45V credit, what should be the definition or specific boundaries of the well-to-gate analysis?

The 2021 working paper from the International Partnership for Hydrogen and Fuel Cells in the Economy defined the emission analysis system boundary for hydrogen to cover a "well-to-gate" boundary, inclusive of emission associated with raw material acquisition, raw material transportation and hydrogen production.

Hydrogen can be produced from various feedstocks, with different technologies and varied emission profiles. Therefore, standardized definitions for clean hydrogen and associated accounting protocols are needed to weigh the performance of these varied pathways to clean hydrogen. The Department of

Energy should take immediate steps to collaborate with the Environmental Protection Agency and create a robust definition and standardized protocol to assess the emission profile of hydrogen production inclusive of upstream emissions.

(6) Coordinating Rules.

(c) Coordination with § 45Q. Are there any circumstances in which a single facility with multiple unrelated process trains could qualify for both the § 45V credit and the § 45Q credit notwithstanding the prohibition in § 45V(d)(2) preventing any § 45V credit with respect to any qualified clean hydrogen produced at a facility that includes carbon capture equipment for which a § 45Q credit has been allowed to any taxpayer?

While statutory language prohibits a single "facility" from simultaneously claiming both the 45V and 45Q credits, the term "facility" is not defined in the IRA which grants IRS the discretion to determine the term's scope, including how it differs from specific and independent process trains. To answer this question, we encourage IRS and Treasury to narrowly interpret a "facility" as including related components of property that are functionally independent. Industrial properties may have many facilities on site which, independently of one another, function to create various products.

Clean Air Task Force, an I[3] participant, has also submitted additional rationale, quoted below:

> "...prior IRS guidance on determining the scope of a "facility" is consistent with this interpretation. In 2016, the IRS published guidance on the construction of energy facilities. *See* 2016 IRB LEXIS 317, Notice 2016-31, 2016-1 C.B. 1025, 2016-23 I.R.B. 1025 (I.R.S. May 5, 2016). As part of this guidance, the IRS defined "facility" as follows:
>
> 'a facility . . . *generally includes all components of property that are functionally interdependent*. Components of property are functionally interdependent if the placing in service of each of the components is dependent upon the placing in service of each of the other components in order to generate electricity.'
>
> *Id.* at *10-11 (emphasis added). Replacing "generate electricity" with "produce hydrogen," this guidance is useful in defining the scope of the 45Q exclusion. The above definition of "facility" would consider producing hydrogen with ATR plus CCS a single "facility" because the production of clean hydrogen is dependent on the ATR plus CCS, and the carbon capture equipment services the production of clean hydrogen. Conversely, the above examples illustrate pairs of processes that can operate independently of one another and would therefore be separate facilities under this definition."

We suggest referring to their submission for additional information and rationale.

There are scenarios in which an industrial plant might contain a hydrogen production facility alongside a different facility with carbon capture equipment installed. For example, refineries are both large hydrogen producers and consumers, with a substantial number containing steam methane reforming facilities on site that could, with carbon capture, qualify for the 45V credit. The other large CO_2 point source at a refinery is the fluid catalytic cracker, for which carbon capture and the 45Q credit could be applied. In this case, a refinery with both a steam methane reformer and a fluid catalytic cracker capturing the two separate flue streams should qualify for both 45V and 45Q, respectively. To reiterate, the 45Q credit would only be applied to the fluid catalytic cracker facility, not to the captured carbon associated with hydrogen production facility seeking credit under 45V.

(7) Please provide comments on any other topics related to § 45V credit that may require guidance.

We recommend more granular, facility specific, third-party verifiable GHG data to update or replace the GREET model, given the GREET model uses default and average numbers for most calculations. This lack of specificity will negatively impact early movers who decarbonize their process beyond the industry average. The following considerations should be included in an updated GREET or successor model, as it relates to 45V:

- A comprehensive set of hydrogen production pathways;
- The removal of any calculations that do not consider the 45V system boundary definition, such as hydrogen compression;
- The varied electricity sources for each step of the production process; and
- An update of default assumptions to match real-world applications.

.02 Clean Fuel Production Credit (§ 45Z)

The central feature of Section 45Z is that it provides for tax credits that increase as the lifecycle GHG emissions of a transportation fuel decrease. To drive the greatest GHG reductions possible, Treasury must develop guidance that allows transportation fuel producers to lower the emissions rates for their fuels based on the GHG-reduction strategies that they deploy.

Examples of those strategies include renewable electricity use, carbon capture and sequestration, and climate-smart feedstock production. By incorporating this type of granular approach into the guidance that implements the 45Z credit and the associated emissions rate table that 45Z requires, Treasury will incentivize fuel producers to reduce their fuels' lifecycle GHG emissions and satisfy the intent of 45Z.

Any other approach, such as GHG emissions rates that do not account for the full array of GHG-reduction strategies that fuel producers may use, would fail to incentivize further reductions and accordingly frustrate the purpose of these tax credits.

I^3's coalition of industry stakeholders are here to connect

The information contained within this document represents a small fraction of the collective knowledge and expertise of our participants. Additionally, this document was prepared with the input and feedback of I^3 participants but does not reflect the express opinion of each participating organization. Members of I^3 are ready and willing to connect with the Treasury and IRS to provide key industry, labor, environmental, and business perspectives from our stakeholder group. The Initiative meets bi-monthly and is happy to schedule ad hoc meetings to facilitate vital discussions such as these. If you would like to connect with us directly, please reach out to I^3 Project Manager, Gabrielle Habeeb, at ghabeeb@gpisd.net, and we will gladly arrange a meeting.