CARBONDIRECT

To: Charles P. Rettig
Internal Revenue Service

Notice 2022-58
Subject: Comments on Credits for Clean Hydrogen and Clean Fuel Production

December 3, 2022

Carbon Direct
17 State Street
New York, NY 10004
info@carbon-direct.com

Commissioner Rettig,

Carbon Direct is encouraged by the Internal Revenue Service's ("IRS") request for comments on different aspects of extensions and enhancements of energy tax benefits in the Inflation Reduction Act, particularly Notice 2022-58 requesting comments related to the credit for clean hydrogen and clean fuel production.

Carbon Direct employs over 40 world-class scientists and works with leading companies and governments to implement high-quality carbon management programs. Our services support our partners in vetting and purchasing high-quality carbon credits. Our belief—consistent with the latest IPCC research—is that carbon removal is an essential part of any pathway to meeting the climate goals outlined in the Paris Agreement.[1] We are motivated by the thousands of companies that have committed to achieving net-zero targets or other emissions reductions commitments, and the opportunity to turn these commitments into action.[2]

Specifically, we address:

1. Credit for Production of Clean Hydrogen:
2. Clean Fuel Production Credit:

1) Credit for Production of Clean Hydrogen

(1) Clean Hydrogen. Section 45V provides a definition of the term "qualified clean hydrogen." What, if any, guidance is needed to clarify the definition of qualified clean hydrogen?

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

- Clean hydrogen produced via natural gas reforming and carbon capture ("blue hydrogen"): The key aspect of upstream emissions that must be captured in the lifecycle emissions assessment is methane leakage resulting from the production, treatment, and transport/delivery of natural gas. Given the large global warming potential (GWP) of methane, relatively small leakage amounts can have large impacts on overall well-to-gate emissions. We note that EPA has recently (November 15) released a major proposed rule regarding methane leakage from oil and gas operations, including provisions for monitoring and verification.

[1] Friedmann, J., Mass, W., McCormick, C., & Bushman, T. (2022). On the IPCC AR6 WGIII Report: Why Carbon Removal is an Essential Part of Meeting Climate Goals. Carbon Direct. https://carbon-direct.com/2022/04/ipcc-why-carbon-removal-is-an-essential-part-of-meeting-climate-goals/

[2] Science Based Targets initiative. (2022). Companies Taking Action. https://sciencebasedtargets.org/companies-taking-action

Treasury and IRS should (a) ensure that lifecycle greenhouse gas emissions estimates for blue hydrogen include upstream methane leakage, and (b) closely align with the EPA rule. In general, there is growing availability of third-party commercial services to validate methane emissions estimates; IRS should work with EPA's Super Emitter Response Program to develop a qualification procedure for these services to provide methane leakage estimates for the taxpayers claiming the 45V credit.

- Clean hydrogen produced via methane pyrolysis/methane cracking ("turquoise hydrogen"): Because this form of clean hydrogen also uses natural gas as a feedstock, all of the considerations regarding methane leakage described above for blue hydrogen directly apply.
- Clean hydrogen produced via electrolysis ("green hydrogen"): The key aspect of upstream emissions that must be captured in the lifecycle emissions assessment is the emissions intensity of electricity consumed by the electrolyzers; see below for further discussion.

ii) *(b)(i) How should lifecycle greenhouse gas emissions be allocated to co-products from the clean hydrogen production process? For example, a clean hydrogen producer may valorize steam, electricity, elemental carbon, or oxygen produced alongside clean hydrogen.*

There are two ways to determine emissions of coproducts in GREET: displacement and allocation. Displacement analyses for co-products, such as electricity, often rely on the displacement of "grid averages" rather than "marginal" displacement. This tends to have a very large impact on the carbon intensity (CI) score, despite the likelihood that the actual electrons displaced may be very low emissions sources much of the time (hydro, solar, etc). Energy allocation tends to be more conservative, but it is very technology dependent making it easy to manipulate emissions. If one chooses the allocation method, ISO 14044 prioritizes mass/energy (aka physical) over economical (cost). Carbon Direct recommends avoiding allocation and pursuing a system expansion method instead. Alternatively, market based approaches have a stronger foundation in "causality," i.e., economics are driving the emissions and those economics are driven by the highest value products. This is the preferable method, but it is more difficult (i.e., less practical) to track and inconsistent with other parts of this policy.

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

Where possible to implement, we recommend a market-based allocation approach. This is the preferable method although there are challenges with tracking. For consistency with other components of the Inflation Reduction Act (namely on SAF and Clean Fuels), the energy allocation method is an acceptable yet imperfect proxy.

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

Hydrogen produced as a by-product is commonly reused as a source for heat. This is typically the case for petrochemical cracking. In other cases, it is vented or flared.

v) *(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 CO2-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?*

Taxpayers should not be restricted from claiming the credit if their facility produces both qualified and not qualified hydrogen during a single year. To implement this, Carbon Direct recommends that taxpayers be given two options for reporting the emissions intensity of their produced hydrogen. The first option would use the annual average emissions of hydrogen that is produced at a facility to determine whether the entire annual production amount is qualified, and which specific tier of the credit applies. The second option would allow taxpayers to designate a portion of their annual production as clean hydrogen that qualifies for the credit, based on verified life cycle greenhouse gas emissions for that portion of total hydrogen production.

vi) *(e) How should qualified clean hydrogen production processes be required to verify the delivery of energy inputs that would be required to meet the estimated lifecycle greenhouse gas emissions rate as determined using the GREET model or other tools if used to supplement GREET?*

- In general, all energy inputs during a reporting period should be accompanied by invoices proving source/destination, energy volumes, and environmental product declarations or certificates proving that the facility owns the environmental attributes associated with those deliveries. EPDs and certificates should be provisioned by reputable 3rd parties.
- The default GREET emissions factor for renewable electricity is zero. Renewable electricity in GREET should carry an embodied emissions factor as well as account for time-of-use when book and claim methods are being utilized to justify renewable electrons, e.g. a facility that runs at night should not get credit for solar power attributes during the hours when the sun is not shining.
- In the case of marginal electric grid emissions and upstream natural gas emissions (e.g., NG leakage). The emissions factors should be regionally and temporally specific, and existing models such as GREET and EPA's e-GRID should be modified to support regionally specific data.
- While accuracy is an important target, it is always subject to uncertainty in LCA. The primary goal is precision and consistency. We want to understand the "relative" differences between production techniques. To achieve precision, everyone must use the same tools and data sources unless there is an overriding reason to augment from an outside source (e.g., the existing tools and data do not contain an appropriate emissions factor)

vii) *(e)(ii) 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?*

We recommend that the time matching of energy inputs used in the qualification of clean hydrogen production process should be measured in units per hour.

b) *(2) Alignment with the Clean Hydrogen Production Standard. On September 22, 2022, the Department of Energy (DOE) released draft guidance for a Clean Hydrogen Production Standard (CHPS) developed to meet the requirements of § 40315 of the Infrastructure Investment and Jobs Act (IIJA), Public Law 117-58, 135 Stat. 429 (November 15, 2021).4 The CHPS draft guidance establishes a target lifecycle greenhouse gas emissions rate for clean hydrogen of no greater than 4.0 kilograms CO2-e per kilogram of hydrogen, which is the same lifecycle greenhouse gas emissions limit required by the § 45V credit. For purposes of the § 45V credit, what should be the definition or specific boundaries of the well-to-gate analysis?*

We recommend the IRS require the same emissions boundaries as is established by CHPs: clean hydrogen shall have a carbon intensity of no greater than 4.0 kilograms CO2-e per kilogram.

c) (4) Recordkeeping and Reporting.

i) *(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?*

We recommend that taxpayers be required to obtain a lifecycle analysis of greenhouse gas emissions from a competent third party, and retain this in their records to be made available to the IRS in the case of an audit.

ii) *(c) What technologies or accounting systems should be required for taxpayers to demonstrate sources of electricity supply?*

A strict approach would require either dedicated low/zero-carbon generation with minimal/zero grid dependence, or the use of marginal emissions accounting for grid-sourced power emissions. A slightly more permissive approach would allow a producer to count low-/zero-carbon emissions from a generator that they built/contracted for elsewhere (i.e. not dedicated/on-site and not on the same grid) likely per PPA, although this would have to be proven additional. A much more permissive approach would allow the use of renewable energy certificates (RECs). This would mean electrolytic hydrogen could be produced with grid-sourced power (which could come from coal- or gas-fired units) as long as an equivalent number of MWh were purchased (via RECs).

d) (5) Unrelated Parties.

i) *(c) What existing industry standards, if any, should the Treasury Department and the IRS consider for the verification of production and sale or use of clean hydrogen for the § 45V credit, § 45 credit, and § 48 credit?*

Unfortunately, there are no universally accepted standards for the production, sale, and use of clean hydrogen. We note that DOE is developing a Clean Hydrogen Production Standard[3] as required under the Bipartisan Infrastructure Law. While this is not a regulatory standard, Treasury and IRS should consider it while developing the relevant verification requirements.

[3] https://www.hydrogen.energy.gov/pdfs/clean-hydrogen-production-standard.pdf

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

Recent studies indicate that leakage of hydrogen from production facilities (and facilities for transportation, fueling and use) could result in significant greenhouse gas warming. Although hydrogen is not a greenhouse gas itself, it can indirectly increase global warming by increasing the atmospheric longevity of non-CO2 greenhouse gases.[4] Although not required in the 45V title legislative language, the spirit of the law, most notably the LCA requirements, suggest that qualifying facilities should limit hydrogen leakage.[5] Carbon Direct recommends that the IRS strongly encourage hydrogen production facilities to voluntarily monitor for hydrogen leakage and retain and/or publish records of monitoring or third-party validation and verification.

2) Clean Fuel Production Credit

b) *(2) Establishment of Emissions Rate for Sustainable Aviation Fuel. Section 45Z(b)(1)(B)(iii) provides that the lifecycle greenhouse gas emissions of sustainable aviation fuel shall be determined in accordance with the Carbon Offsetting and Reduction Scheme for International Aviation or "any similar methodology which satisfies the criteria under § 211(o)(1)(H) of the Clean Air Act (42 U.S.C. 7545(o)(1)(H)), as in effect on the date of enactment of this section." What methodologies should the Treasury Department and IRS consider for the lifecycle greenhouse gas emissions of sustainable aviation fuel for the purposes of § 45Z(b)(1)(B)(iii)(II)?*

This provision allows for multiple pathways to calculate SAF emissions:

- CORSIA Default SAF Values previously established via averaging or privileging of multiple life cycle models
- Certification of an independent LCA (using CORSIA default land use change values) and certified by the two currently approved auditing bodies, e.g. RSB and ISCC
- "Similar methodologies" which fit very vague Clean Air Act Critera. 42 U.S.C. 7545(o)(1)(H) simply asks for: "the aggregate quantity of greenhouse gas emissions (including direct emissions and significant indirect emissions such as significant emissions from land use changes), as determined by the Administrator, related to the full fuel lifecycle, including all stages of fuel and feedstock production and distribution, from feedstock generation or extraction through the distribution and delivery and use of the finished fuel to the ultimate consumer, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential."

The optionality above offers far too much latitude for program participants to "shop" for the most advantageous methodology, and it does not allow for fuels to be compared on a consistent basis. Some approaches to SAF are less impactful than others. Methodology shopping will obscure this fact. CORSIA contains strict guidelines as to how co-product allocation (e.g. by energy content), typology of feedstocks, and avoided emissions credits from use of MSW in recycling or landfill diversion should be carried out. Variations in methodology

[4] https://acp.copernicus.org/articles/22/9349/2022/acp-22-9349-2022-discussion.html
[5] https://www.energypolicy.columbia.edu/research/commentary/hydrogen-leakage-potential-risk-hydrogen-economy

will allow for significant manipulation of LCA results. Only one methodology should be allowed and CORSIA is the best candidate.

The CORSIA methodology for independent core LCA is good and viable provided all applicants use a consistent model and emissions factors. The Treasury should require that applicants use the CORSIA methodology with the following caveats:

- We find the default CI values under CORSIA, which are the product of aggregation of multiple modeling exercises and team efforts, to result in GHG emissions intensities which are often too generous. It is difficult to imagine a scenario where a SAF fuel producer would not forgo independent analysis in favor of default value, as an independent LCA would be unlikely to generate more favorable results. The use of default values should be provisional only. Fuel producers should in due course provide independent LCAs certified by a CORSIA-eligible body.
- Independent LCAs should be carried out using a consistent set of tools and emissions factors. The GREET model is recommended given its ubiquitous use in the U.S. context and consistency with other policy frameworks (LCFS, RFS).
- Where applicable, CORSIA assumptions for land use change and emissions crediting should take precedence over the default values in GREET.

The enactment of policies such as 45Z are likely to induce demand shocks on first-generation feedstocks. Great care should be taken to ensure that CORSIA default values for land use change (LUC) reflect those demand shocks in the near-term. If increased demand for first generation feedstocks are not appropriately considered under the CORSIA framework, the U.S. federal government should substitute their own modeling and LUC values, subject to regular update as the impact of the policy is better understood.

b) *(3) Provisional Emissions Rates. Section 45Z(b)(1)(D) allows the taxpayer to file a petition with the Secretary for determination of the emissions rate for a transportation fuel which has not been established.*

   i) *(a) At what stage in the production process should a taxpayer be able to file a petition for a provisional emissions rate?*
   Provisional emissions rates should require at least three months of supporting operational data. This is consistent with California's LCFS program.

   ii) *(b) What criteria should be considered by the Secretary to determine the provisional emissions rate?*
   A provisional LCA carried out under CORSIA guidelines using a standard tool (e.g. GREET) with assumptions supported by a year of operational data should be required for a provisional emissions rate.

c) *(4) Special Rules. Section 45Z(f)(1) provides several requirements for a taxpayer to claim the § 45Z credit, including for sustainable aviation fuel a certification from an unrelated party demonstrating compliance with the general requirements of the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) or in the case of any similar methodology, as defined in § 45Z(b)(1)(B)(iii)(II), requirements that are similar to CORSIA's requirements. With respect to this certification requirement for sustainable aviation fuel, what certification options and parties should be considered to support*

supply chain traceability and information transmission requirements?

Certification entities should be approved by the CORSIA framework. The approved bodies are ensured to have appropriate reporting and chain of custody systems in place. Additional entities that wish to serve these purposes should apply for CORSIA certification. At this time, those bodies only include Roundtable for Sustainable Biomaterials and the International Sustainability and Carbon Certification. Other reputable bodies should be encouraged to apply for CORSIA eligibility.

Path Forward

Despite the enormous challenge posed by ongoing greenhouse gas emissions and accelerating climate change, it is encouraging to see the increasing introduction of public policy to respond accordingly. The Infrastructure Reduction Act has provided the policy basis for catalyzing and accelerating private-sector investment in crucial carbon management technologies. The success of these efforts will depend on the ongoing and close cooperation between government and the private sector to ensure that enacted policies are implemented in a practical, effective, and transparent manner. To that end, Carbon Direct applauds the willingness of the IRS to seek external input on these matters.

We hope that our comments here will be helpful in shaping more effective and impactful tax policy, and we would be happy to expand or clarify any of these points in further discussions.

Jonathan Goldberg
CEO
Carbon Direct