SUBMITTED ELECTRONICALLY

December 8, 2022

Internal Revenue Service
CC:PA:LPD:PR
Room 5203
P.O. Box 7604, Ben Franklin Station
Washington, D.C. 20044

The Honorable Lily Batchelder
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Re: Notices 2022-57, 2022-58: Request for Comments on Implementing the Inflation Reduction Act's Clean Hydrogen, Clean Fuel, and Carbon Capture Tax Incentives

Dear Ms. Batchelder and Mr. Paul:

Thank you for the opportunity to provide input to the Department of the Treasury and the Internal Revenue Service regarding implementation of the historic Inflation Reduction Act (IRA).

Breakthrough Energy is a network of philanthropic programs, investment vehicles, and policy efforts founded by Bill Gates with the goal of accelerating the clean energy transition and reaching net-zero emissions by 2050. Our initiatives include the two-billion-dollar Breakthrough Energy Ventures fund, which helps build groundbreaking companies that can significantly reduce emissions across the economy, and the Breakthrough Energy Catalyst program investing in demonstration projects to get new clean energy technologies to scale.

The Inflation Reduction Act's historic clean energy tax credit framework includes new and expanded credits for nascent clean energy technologies including sustainable aviation fuels, clean hydrogen, and direct air capture that will be crucial to achieve net-zero emissions economy-wide. These types of projects are still considered novel and risky by investors and face long project construction timelines of three to five years or more. Therefore, the issuance of swift guidance and interpretation, particularly of new tax credits, will be critical to drive investment decisions.

Below please find our comments on questions pertaining to IRS' request for public input on implementing 45Q, 45V, and 45Z provisions in the IRA.

Comments

Section 45Q (Carbon Oxide Sequestration Credit)

- **(In response to Question 1) Treasury should continue to use and recognize the current stated definition of "DAC facility"**[1] which states "…any facility which uses carbon capture equipment to capture carbon dioxide directly from the ambient air, except the term does not include any facility which captures carbon dioxide that is deliberately released from naturally occurring subsurface springs or using natural photosynthesis."
    - There is a growing diversity of DAC approaches but many fall under three distinct technologies: solid sorbent, liquid solvent, and electrochemical. All these approaches should be eligible for 45Q tax credits. Each one of these technologies uses carbon capture equipment and captures carbon dioxide directly from the ambient air. None of these technologies use natural photosynthesis. Coupled with the DAC facility is the ability to store that CO2 safely, deep underground in a suitable geologic formation, or otherwise utilize the captured CO2.
    - There are several other carbon dioxide removal and reduction technologies that currently do not qualify for the 45Q credit. These technologies include but are not limited to biomass pyrolysis, ocean-based approaches, various forms of ex-situ and in-situ mineralization and the production of solid carbon. The above carbon dioxide removal approaches that do not qualify under the 45Q credit could ultimately be an important part of a portfolio of CDR strategies and would benefit from other federal support, including tax policy, in the future but today do not meet qualifications under 45Q. These technologies either do not use carbon capture equipment, capture carbon dioxide directly from the ambient air, or they use natural photosynthesis. Further still some of these technologies do not store their qualifying carbon dioxide in a geologic reservoir but in some other natural media like the ocean, soils, or bio-oil.

- **(In response to Question 2) Methodologies to determine and verify the amount of qualified carbon oxides captured by a DAC facility.** Given the definition of a qualifying DAC facility identified above, the existing framework in regulation (and planned by the IRS and Environmental Protection Agency) should be used. These methodologies include:
    - DAC-Dedicated Storage: Subpart PP of the Greenhouse Gas Reporting Program (GHGRP) to measure qualified carbon oxide captured (and Subpart RR of GHGRP for storage)
    - DAC-EOR Storage: Subpart PP of GHGRP to measure qualified carbon oxide captured (and Subpart RR of GHGRP for storage) or the ISO 27916 and Subpart VV of GHGRP
    - DAC-Utilization: Based on lifecycle analysis of carbon oxide captured and permanently isolated from the atmosphere or displaced from being emitted into the atmosphere, according to the rules and guidelines laid out in 26 CFR § 1.45Q-4[2].

- **Treasury should provide guidance to ensure in-situ mineralization is included within applicable forms of "secure geological storage."** The current 45Q regulations state that "secure geological storage includes, but is not limited to, storage at deep saline formations, oil and gas reservoirs, and unminable coal seams." However, in-situ mineralization, the process of injecting a CO2 brine directly into mafic or ultra-mafic lithologies, like the Columbia River Basalts, can provide gigaton scale removal of CO2 and should be eligible for the 45Q credit. In-situ mineralization is allowed under the Class VI regulation that requires reporting of stored CO2 quantities under GHGRP subpart RR. In-situ mineralization, as a geophysical process, will happen in saline aquifers or in mafic rocks like basalts.

[1] https://uscode.house.gov/view.xhtml?req=(title:%20section:45q%20edition:prelim)%20OR%20(granuleid:USC-prelim-title-section45q)&f=treesort&edition=prelim&num=0&jumpTo=true
[2] https://www.law.cornell.edu/cfr/text/26/1.45Q-4

The only difference is the time the supercritical carbon CO2 takes to mineralize. Clarifying the eligibility of in-situ mineralization, by allowing its use, will unlock new DAC sites, and increase the viability of this vital climate technology.

- **Treasury should narrowly interpret a "facility," such that an industrial plant site with multiple independent facilities could qualify for both the 45Q credit and the 45V credit**, applied to two different facilities on the site. 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 CO2 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.

Section 45V (Clean Hydrogen Production Credit)

Incentivizing the production of hydrogen with a low carbon emission intensity (specifically below 4kgCO2e/kg H2 up the point of production) is the primary objective of the 45V tax credit. Given the nascency of clean hydrogen production and of this credit, estimating rather than measuring the carbon intensity (CI) associated with each step in the production process from well-to-gate is the most feasible approach in the near-term. Accordingly, establishing methodologies and rules that maintain the integrity of the lifecycle greenhouse gas emissions accounting upon which these estimates will rely is essential to implement the credit as intended by Congress.

Some processes, such as electrolysis powered with behind-the-meter renewables and steam methane reforming capped with carbon capture technology, have clear and defined CI accounting rules as defined in the Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies (GREET) model. However, for production pathways that are not currently defined in GREET, such as grid-powered electrolysis paired with indirect clean energy procurements that offset direct grid emissions, Treasury must define processes to apply offset mechanisms to demonstrate that hydrogen production plants are "using" a source of clean electricity.[3] Accurately evaluating how hydrogen producers using grid-powered electrolyzers are procuring clean electricity to offset the emissions associated with grid use is critical to ensure the credit is being applied to projects in the way intended by Congress; that is, to taxpayers who produce a kilogram of hydrogen with an embodied carbon intensity below 4kgCO2e/kgH2.

We believe three key ingredients are essential to ensure accurate, high integrity offset mechanism rules, which we outline in the following paragraphs. However, since a variety of non-cost barriers add complexity and limitations to the feasibility of immediately implementing some of these measures, we propose phase-in considerations that take these barriers into account in a way that balances integrity with market feasibility.

(1) Additionality

Ensuring additionality requires that certificates underlying offset mechanisms be sourced from newly built generation assets that are not already being used to offset emissions under another voluntary or mandated offset program. This standard is important to ensure the credibility of the offsets and reduce potential challenges to the legitimacy of carbon displacement claims. However, to avoid ambiguity in determining eligibility, Treasury should provide a *clear, implementable definition* of "additionality". One straightforward approach would be to define an additional asset as a new clean electricity generation

[3] As clarified by Senator Carper during passage of the Inflation Reduction Act. https://www.congress.gov/congressional-record/volume-168/issue-133/senate-section/article/S4165-3

asset that was brought online after the date the Inflation Reduction Act was enacted (i.e. 8/16/22), and, which is proven to not be double counted in another carbon market scheme or voluntary commitment. Additionality is becoming an increasingly ubiquitous standard in carbon markets. As a result, in our experience working with diverse emerging hydrogen technologies and startups, the economic burden of requiring additionality is minimal to none. Moreover, favorable economic conditions from continued tech cost improvements and clean energy production and investment tax credits from the IRA will continue to drive down the cost of building new clean electricity generation, meaning future additional installations will remain inexpensive.

(2) Geographic matching

The U.S. electricity grid today is divided into numerous regions with limited capacity to move electricity between them. As a result of this limited interregional transfer capacity, the emissions impact of installing an additional amount electricity generation capacity can vary substantially by location. For example, new renewable generation would drive greater emissions reductions when deployed in regions with limited interregional transfer capacity where coal generation units tend to operate on the margin. For this reason, the geographic location of additionally deployed clean electricity generation can result in major differences in attributable and consequential emissions and could and should be accounted for in offset mechanisms by ensuring that additional clean electricity procured by a hydrogen producer to offset grid emissions is "deliverable" to the location of electricity consumption.

Given the complexity and variability of transmission and interconnection characteristics across the country, the Department of Energy should be consulted to help determine an appropriate timeline and approach for defining "deliverability." For example, the Department of Energy could begin by requiring that clean electricity procured to offset grid emissions is generated in the same balancing authority as the electricity consumed for hydrogen production. A "deliverability" standard defined by the Department of Energy could then be used to identify regions to exempt from the co-location requirement.[4]

(3) Temporal matching

The greenhouse gas emissions impact of additional electricity demand in the US can vary vastly over time given that the overall generation mix and the generating units running on the margin change throughout the day. Accordingly, the real-time emissions resulting from grid-powered electrolytic hydrogen production can range from single digits to double digits in kg CO2e/kg H2 on a given day. For this reason, ensuring that the CI of grid-powered hydrogen is truly below the statutorily prescribed 4kgCO2e/kg H2 requires accounting guidelines to approximate the emissions associated with the source of power generation as close as possible to the moment in time the electrolyzer was running on grid power. Such temporal matching requirements can be required in increments ranging from hourly to quarterly to annually. Generally, the smaller the increment, the more accurate the estimate of CI associated with the grid power.

That said, there are significant challenges that make certain intervals of matching infeasible and costly today. Perhaps most importantly, no harmonized and consistent national accounting standard and tracking system for 24/7 hourly matching exists today. Though limited regional examples exist, it will take a considerable amount of time to establish a new accounting system for temporal matching and for these standards to gain acceptance. For this reason, a phase-in period for this level of stringency may help ensure a balance between supporting electrolyzer deployment and ensuring high-integrity CI assessments of grid-powered hydrogen. It would be appropriate for the Department of Energy to help design and determine a feasible phase-in schedule for stringent requirements.

Some level of concern exists that forgoing the highest level of stringency from the outset will result in the rampant deployment of "dirty" hydrogen. However, it is important to note that the deployment of

[4] Concepts such as a "minimum transfer capacity" have been discussed by FERC for assessing power market connectivity between regions. See: https://www.niskanencenter.org/ferc-is-coalescing-around-the-idea-of-minimum-transfer-capacity-but-needs-data-and-definitions/.

electrolytic hydrogen may not be as fast or aggressive as simple cost modeling might lead us to believe, given challenges scaling up the nascent industry and its associated supply chains. The Department of Energy has noted that numerous key vulnerabilities exist across the electrolyzer supply chain, including the immaturity of electrolytic hydrogen markets, the need for electricity to produce hydrogen and market structures to access that electricity, a lack of sufficient hydrogen infrastructure to support market growth, a lack of electrolyzer and fuel cell manufacturing capacity, energy and environmental justice issues for key materials, and a need for workforce development.[5] Given these practical constraints that could impact initial market development, it may be appropriate to increase requirements on temporal electricity matching over time and as an adequate methodology develops.

(As an example, while no global consensus has emerged on this topic, the European Parliament is likely to adopt a quarterly matching requirement through 2028 and hourly matching thereafter.[6])

- **(In response to Question 6c) Treasury should narrowly interpret a "facility," such that an industrial plant site with multiple independent facilities could qualify for both the 45Q credit and the 45V credit**, applied to two different facilities on the site. 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 CO2 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.

- **(In response to Question 4f) Emerging technology startups that use novel natural-gas based clean hydrogen production pathways may face greater challenges obtaining physical delivery of biogas or low-leakage certified gas.** Allowing credits for virtual delivery for facilities that the Department of Energy determines are using novel hydrogen production pathways would help ensure less mature clean hydrogen technologies have access to the tax credit under 45V. However, not all third-party certification programs for responsibly-sourced gas are equally reliable. Guidance on minimum standards for responsibly-sourced gas certification methodologies may be needed, including, for example, requiring leakage-based certification programs to incorporate direct measurement requirements.[7]

Section 45Z (Clean Fuel Production Credit)

- **Treasury should clarify that GREET is a qualifying greenhouse gas (GHG) emission accounting methodology.** As prescribed under 45Z, lifecycle GHG emissions can either be determined in accordance with the criteria set forth by the International Civil Aviation Organization's Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA) or based on "any similar methodology which satisfies the criteria under section 211(o)(1)(H) of the Clean Air Act." Treasury should clarify that the GREET model, which is already allowed under other associated tax credits (e.g., 45V) is an acceptable methodology. GREET is widely adopted in the US for various federal and state policies. Thus, its utilization would help ease of implementation of new clean fuel tax credits (this should also be the case for the new sustainable aviation fuel blenders tax credit.) In addition, given the evolving understanding of lifecycle assessment methodology, we recommend Treasury work with the Department of Energy and Argonne National Laboratory (the developers of GREET) to consider applying the findings and recommendations developed by the National Academies of Sciences to

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[5] Department of Energy. 2022. Water Electrolyzers and Fuel Cells Supply Chain. https://www.osti.gov/biblio/1871559.

[6] https://www.euractiv.com/section/energy/news/leak-long-awaited-eu-rules-on-renewable-hydrogen-expected-15-dec/

[7] EDF. 2022. Certification of Natural Gas With Low Methane Emissions: Criteria for Credible Certification Programs. https://blogs.edf.org/energyexchange/files/2022/05/EDF_Certification_White-Paper.pdf

further improve and refine GREET in subsequent years. [8]

- **Treasury should develop a clear and efficient process for establishing provisional emissions rates.** Where an emissions rate is not established, 45Z indicates that a taxpayer may file a petition with the Secretary for determination of the emissions rate with respect to its fuel. Such a process should be clear, transparent, and allow for producer-specific values to develop provisional emissions rates that are demonstrated to have accurate, high-integrity reporting and low-CI scores supported by the best available science. (While not included in this request for comments, a similar process is required under the 40B blenders tax credit and should be harmonized with 45Z standards.) Liquid fuel innovation, particularly for jet and other heavy transport applications, is expected to further evolve in the coming decades. Thus, any system put in place to satisfy this requirement should anticipate continued development of emerging technologies, feedstocks, and production pathways that may not be reflected in existing LCA methodologies and processes. In sum, producer-specific lifecycle GHG calculations are an important mechanism to unlock rapid deployment of clean alternatives that will help decarbonize the transportation sector.

[8] National Academies of Sciences, Engineering, and Medicine. 2022. Current Methods for Life Cycle Analyses of Low-Carbon Transportation Fuels in the United States. Washington, DC: The National Academies Press. https://doi.org/10.17226/26402.