Internal Revenue Service (IRS): Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production (Notice 2022-58)

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Stakeholder Feedback:

Introduction

Koloma is a venture-backed startup pioneering a data-driven approach to exploration for hydrogen in the earth's subsurface ("geologic hydrogen"). Geologic hydrogen presents an incredible opportunity to meet both US and global demand for hydrogen production and storage within this decade. Specifically, hydrogen produced from the subsurface will be a domestically-sourced, very low carbon impact, 24/7/365 stable resource that is decoupled from both natural gas and intermittent renewables. We're further encouraged by the positive energy security implications of both geologic hydrogen and the potential for co-produced helium.

Operationally, Koloma is currently drilling our initial exploration wells to confirm our projected locations of subsurface hydrogen reservoirs. We are doing this using the best safety and environmental practices from the subsurface exploration and hydrogen handling industries. We've had two independent third parties conduct lifecycle analyses of our prospects and expect to produce hydrogen with emissions below 0.45 g CO2e/g H2.

We believe it is critical that:

1) Purity standards include room for non-greenhouse gas (non-GHG) inert gases (lest the PTC would disincentivize otherwise valuable helium production).
2) Well-to-gate scope is clearly defined for geologic hydrogen to include discovery through processing.
3) Claims for 45V and 45Q are tied to the molecules, not the facilities, to maximize decarbonization and prevent "double dipping" of credits.
4) Third party audit requirements are clear and standardized for all hydrogen producers.

Section 1: Credit for Production of Clean Hydrogen

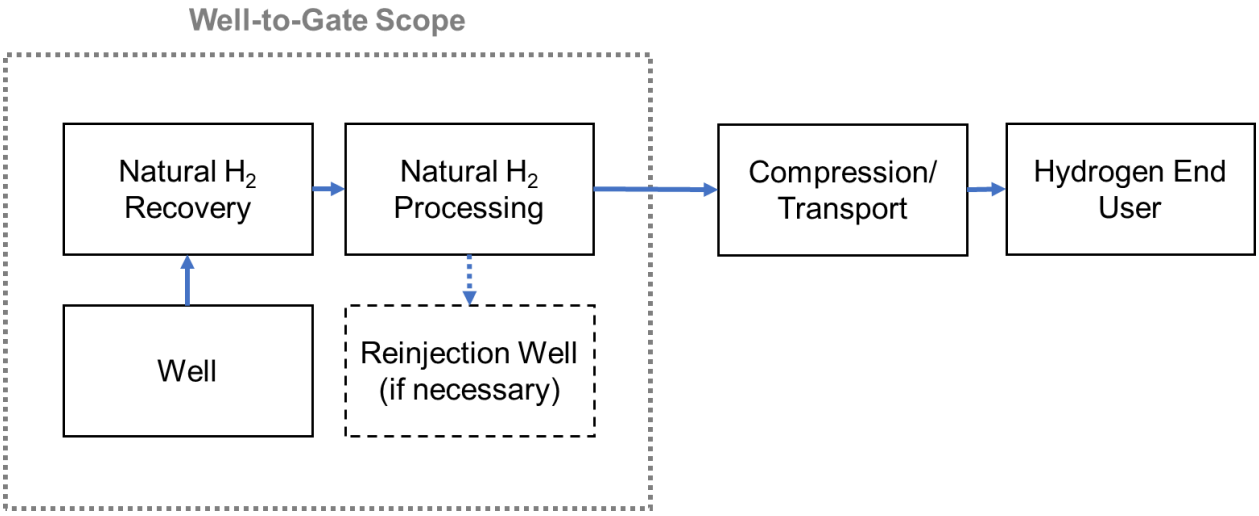
1. **Clean Hydrogen. Section 45V provides a definition of the term "qualified clean hydrogen." What, if any, guidance is needed to clarify the definition of qualified clean hydrogen?**

The definition of Clean Hydrogen should allow hydrogen compositions with up to 10% non-GHG inert gases (e.g., nitrogen, helium). The presence of non-GHG inert gases does not contribute to the carbon intensity of hydrogen and is unlikely to have a negative impact on downstream GHG emissions.

We recommend this because there are many emerging demand segments for clean hydrogen which do not require high purity (99.9+%) hydrogen and would not be adversely impacted by the presence of non-GHG inert gases. In some cases, it is likely to be better both economically and environmentally to *not* remove non-GHG inert gases from the hydrogen stream prior to use. Clarifying this point in the definition would add flexibility and maximize economic efficiency by not inadvertently excluding alternative, new clean hydrogen production pathways that still contribute to the goal of decarbonizing hydrogen production.

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?

For geologic hydrogen, the commonly accepted well-to-gate boundary as described in GREET for natural gas should be applied, as pictured below:



The specific inputs include:

- Energy required to recover the hydrogen from the well (expected to be 0 because the well is pressurized).
- Processing emissions corresponding to fuel use and methane leaks from the hydrogen purification process.
- Methane and other impurities that are removed from the hydrogen product and may be injected back into a reinjection well to provide pressure support.

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.

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

b. (iii) What considerations support the recommended approaches to these issues?

Allocation methods are a critical component of life cycle analysis, as energy inputs and emissions are distributed towards other products and co-products thereby reducing the carbon intensity of hydrogen. The life cycle analysis method should reflect the environmental impact of the production process which is described in the ISO standards cited by DOE.

Many allocation methods are considered within LCA frameworks. These include substitution or displacement as well as mass, energy, or economic allocation and even consequential LCA. Given the reference to GREET in the IRA, the frameworks within GREET would be appropriate choices for allocation methods. This constraint eliminates consequential LCA approaches such as those used under the EPA RFS which are controversial and complicated to evaluate. The ISO standards recommend avoiding partitioning/allocating elements of the system that produce multiple products and instead "expanding the product system to include the additional functions related to the co-products" (ISO 14044, sec. 4.3.4.2). Note that this ISO recommendation is the same approach described above as "substitution or displacement".

The system expansion or substitution approach is recommended under ISO 14044 because it most closely represents the environmental impact of the co-product. Challenges to the substitution method include situations where the life cycle of the co-product is unknown. The co-product must be sold or productively used for a substitution credit to be valid. The constraint regarding sales of co-products has been implemented under the California Low-Carbon Fuel standard (LCFS) where evidence of sales of electric power, corn distillers grains from ethanol, and glycerin from biodiesel are required. Note that factoring co-products into allocation methods also requires the productive use of the material. The substitution method is implemented in numerous pathways in GREET as well as regulatory frameworks. Most notably corn DGS as well as export electric power from sugarcane ethanol receive substitution credits under the LCFS and this approach is the primary method available in the GREET model.

The analysis effort should allow for useful co-products from hydrogen production such as steam, electric power, high value chemicals, elemental carbon, and exotic materials such as helium. Upstream life cycle data for materials that are not in GREET are available from commercial life cycle databases.

However, carbon dioxide should be excluded from being considered a useful co-product if its downstream uses are intended for fuel production (e.g., synthetic fuel production, sustainable aviation fuel production, enhanced oil recovery) where the carbon dioxide will ultimately be emitted into the atmosphere. Using captured carbon dioxide emissions from hydrogen production to produce fuels merely shifts the carbon emissions outside the 45V LCA system boundary, thereby giving a lower apparent carbon intensity for hydrogen. Preference should be given for non-fuel uses of carbon dioxide from hydrogen production that do not produce downstream emissions, in alignment with the spirit of the production tax credit.

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?

Credits should be awarded to only the qualified clean hydrogen production (as determined on a monthly basis), even if qualified clean hydrogen was only produced during part of a taxable year. A facility's hydrogen production from a given month should be designated as "qualified clean hydrogen" if the hydrogen's average carbon intensity from the same month is below 4 kilograms of CO2-e per kilogram of hydrogen. This will prevent intentional time shifting of carbon impact from high carbon intensity to low carbon intensity. As an example, one could envision a scenario where a taxpayer produces qualified clean hydrogen for 10 days, capturing the carbon dioxide and storing it onsite, and releasing the carbon dioxide on the eleventh day when it is no longer producing hydrogen.

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?

i. How might clean hydrogen production facilities verify the production of qualified clean hydrogen using other specific energy sources?

We support the integration of independent third-party auditors, much like in the accounting industry, to measure and validate company reporting for all 45V-related variables.

2. <u>Alignment with the Clean Hydrogen Production Standard</u>. 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?

This will vary based on production technology. Please see 1.a above re: Geologic Hydrogen.

3. <u>Provisional Emissions Rate</u>. For hydrogen production processes for which a lifecycle greenhouse gas emissions rate has not been determined for purposes of § 45V, a taxpayer may file a petition with the Secretary for determination of the lifecycle greenhouse gas emissions rate of the hydrogen the taxpayer produces.

a. At what stage in the production process should a taxpayer be able to file such a petition for a provisional emissions rate?

In order to drive continued investment of capital, talent, and resources into qualified clean hydrogen development, the taxpayer should be able to file such a petition as soon as it is clear that a lifecycle greenhouse gas emissions rate has not been determined for their prospective production methodology or site the purposes of 45V. After a petition is filed, the Secretary should provide a methodology and eligibility evaluation letter within 6 months.

It will be necessary for the taxpayer to have assurance from the Secretary of the alterative methodology in order to justify the capital expenditure to develop the technology and/or build the

facility. Without such assurances, development/deployment of improved or novel hydrogen production technologies would be significantly curtailed, access to investment capital severely diminished, creation of new jobs reduced, and the Administration's broader climate goals hindered.

The Secretary would reserve the right to modify the determination based on the final details of the production technology deployment.

Finally, clarity regarding whether this determination is made by the Secretary of Energy or Secretary of the Treasury is necessary.

b. What criteria should be considered by the Secretary in making a determination regarding the provisional emissions rate?

The Secretary should consider the following:

1) Does this production method differ in an appreciable way from a GREET pathway or assumption?
    a. Does GREET offer a pathway and complete assumption set to evaluate this technology or site?
    b. Could an existing GREET pathway be adapted for the purpose of evaluating this technology or site?
2) Are there other generally accepted models available to analyze the LCA of this technology or site which could reasonably be relied upon?

To this end, it is worthwhile to note: GREET is a powerful tool to measure success in our adoption of new hydrogen technologies to decarbonize the planet. GREET should provide the opportunity to add or create additional pathways for emerging technologies not currently included or represented. A transparent format or structure for such pathways - and a clear timetable for the submission and acceptance/rejection of said additional pathways – would be beneficial to project developers, investors and to our nation's climate goals. Additionally, a mechanism with which to show GREET equivalence for external models should be created. Taken together, this would greatly reduce the need for the Secretary to make separate determinations.

4. <u>Recordkeeping and Reporting.</u>

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?**

Koloma can maintain weekly records of all input variables which are required to determine the LCA in GREET, and we would expect such records would be annually audited by an independent third party. Koloma recommends that such record keeping be required of all producers for 45V eligibility.

b. What technologies or methodologies should be required for monitoring the lifecycle greenhouse gas emissions rate resulting from the clean hydrogen production process?

For simplicity, GREET-based averages with the option to adjust such averages through detailed monitoring and verification programs make the most sense. Auditors should conduct periodic system-level spot checks to update and solidify such averages and determine whether they are appropriate or require adjustment.

For geologic hydrogen, three parallel approaches can be used to monitor greenhouse gas emissions:

1) onsite spectroscopic monitors (e.g., IR, FLIR) to directly monitor emissions/releases on site;
2) satellite spectroscopic monitoring of gas releases; and
3) gas chromatographic/mass spectrometric validation of localized leaks to ground-truth spectroscopic sensors.

In addition to monitoring greenhouse gas emissions from the well, audit-compliant metering equipment can be deployed to quantify emissions associated with onsite equipment which use primary energy sources such as electricity or natural gas.

d. What procedures or standards should be required to verify the production (including lifecycle greenhouse gas emissions), sale and/or use of clean hydrogen for the § 45V credit, § 45 credit, and § 48 credit?

For production, all producers should keep records of all energy inputs and emissions which are audited by a third party. Producers should be allowed and encouraged to update their LCA values with empirical emissions data on an annual basis.

For sale, all producers should keep sales records which are audited by an independent third party and submitted with tax credit filings. This should be the primary mechanism to report volume.

For use, please see (e) below.

e. If a taxpayer serves as both the clean hydrogen producer and the clean hydrogen user, rather than selling to an intermediary third party, what verification process should be put in place (for example, amount of clean hydrogen utilized and guarantee of emissions or use of clean electricity) to demonstrate that the production of clean hydrogen meets the requirements for the § 45V credit?

First, production should be measured with a commercially available gas flow device, which should be calibrated and audited to ensure compliance. Second, verification of beneficial use (i.e., records of the sale of an end product created using clean hydrogen) should also be provided to prevent taxpayers from producing and then venting the hydrogen merely to claim the credit or producing and utilizing hydrogen to supplement grid electricity in an electrolyzer. The end result in both cases would be no hydrogen ever leaving the plant gate and the sole revenue from the operation coming from the hydrogen PTC.

f. Should indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions (also known as a book and claim system), including, but not limited to, renewable energy credits, power purchase agreements, renewable thermal credits, or biogas credits be considered when calculating the § 45V credit?

Yes, for renewable energy credits, power purchase agreements, or other market structures with common-sense restrictions that prevent double crediting and that prevent producers from pushing the carbon impact of electricity on a regional grid to other users. Recommended restrictions could include the following:

(1) RECs should be available for renewable power produced in real time. Given the variability inherent in electricity supply and the high cost of electricity storage, RECs should not be bankable across hours in the same grid (i.e., a H2 facility should not be able to buy solar RECs and consume the power at midnight without accounting for storage).

(2) RECs should be available only on the basis of "additionality" – if a new electrolyzer is constructed consuming 100 MW, then RECs should be used if 100 MW of renewable capacity is added to the grid to supply it with power.

(3) RECs should only be available within the same balancing region, for example, wind power added in Wyoming should not be available for use by an electrolyzer in Florida.

Unrestricted and overly flexible use of renewable energy credits reduces the financial incentive to develop geologic hydrogen storage sites, which ultimately will impact the energy resilience of communities across the United States. The value of geologic hydrogen storage is that it can store energy for much longer timescales, up to seasonal durations, similar to how natural gas storage is utilized. These proposed restrictions will lead to a more rational hydrogen economy where the criticality of hydrogen storage is appropriately valued; otherwise, the burden of a very challenging problem would simply be shifted to grid operators, ultimately driving up the cost of power for the public.

No, for carbon offsets that aim to net-out a taxpayer's effective greenhouse gas emissions by claiming emissions reductions or avoided future emissions from an independent and unrelated process. Carbon offset markets today are not verifiable, rarely lead to emissions reductions, and lack standardization. For simplicity and robustness, carbon intensity of a hydrogen production process should reflect the emissions associated directly with the process.

g. If indirect book accounting factors that reduce a taxpayer's effective greenhouse gas emissions, such as zero-emission credits or power purchase agreements for clean energy, are considered in calculating the § 45V credit, what considerations (such as time, location, and vintage) should be included in determining the greenhouse gas emissions rate of these book accounting factors?

See response in 4.f.

5. <u>Unrelated Parties</u>

a. **What certifications, professional licenses, or other qualifications, if any, should be required for an unrelated party to verify the production and sale or use of clean hydrogen for the § 45V credit, § 45 credit, and § 48 credit?**

Many firms who conduct emissions or energy audits are comprised of individuals with professional certifications such as Professional Engineer, Professional Geologist, Qualified Environmental Professional (QEP). Many of the firms are also qualified by ISO, CDP, Rocky Mountain Institute, or other non-profit organizations. To our knowledge, there is not clear guidance from regulatory agencies regarding the certifications required for renewable energy production, emissions monitoring, and similar audit reporting. We believe that the above-mentioned credits can be verified by parties that meet similar general standards as other energy reporting industries use and that a separate qualification process for 45V and other credits need not be put in place initially.

b. What criteria or procedures, if any, should the Treasury Department and the IRS establish to avoid conflicts of interest and ensure the independence and rigor of verification by unrelated parties?

All submissions, including LCA values and volumes, should be audited by an independent third party in the same way that financials are audited.

Further, Treasury and IRS should establish an anonymous abuse reporting/whistleblower program for all available credits.

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?

Taxpayers should use recognized industry practices for measuring volumes of gas produced and used. Where the use of hydrogen is concerned, the burden should be on the taxpayer to make clear what the use of hydrogen is and how it relates to a product sold outside the gate.

6. Coordinating Rules.

b. Coordination with § 48.

ii. What factors should the Treasury Department and the IRS consider when providing guidance on whether a facility is "designed and reasonably expected to produce qualified clean hydrogen?"

The Treasury Department and the IRS should consider the facility's ability to produce qualified clean hydrogen, and then realization of the production capacity within a reasonable time period, as determined by the agency. A letter from a qualified, independent third party should be provided stating that the facility is reasonably expected to be able to produce qualified clean hydrogen.

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?

As is stated in the legislation, 45Q and 45V credits cannot, at any point in the value chain, be applied to the produced hydrogen. This is ultimately a prohibition regarding molecules, not

facilities. The law does not preclude a facility from doing both. It is possible that a subsurface reservoir could be used for many purposes, including but not limited to hydrogen production, hydrogen storage, and carbon capture. Each are independent from one another and should be treated as such.