Comments on Credits for Clean Hydrogen and Clean Fuel Production

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.01 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?

Answer: the "qualified clean hydrogen" needs to be defined using clear emissions analysis boundaries, appropriate handling of co-products, and deep analysis of the feedstock/fuel supply chain.

(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?

Answer: the "well-to-gate" boundary can include the below steps:

1) Emissions from feedstock/energy production should include both fuel combustion emissions associated AND fugitive emissions of gases with radiative forcing impacts (e.g. CH_4, H_2) across the supply chain. Specific examples of different pathways include: a) emissions from mining/oil/gas feedstock manufacturing; fugitive emissions from fossil energy supply chain; petroleum refineries co-products allocation for fossil-feedstock/energy; b) emissions from forest/farm/land management; biomass plantation; feedstock harvest; bio-genic carbon credit for biomass application for bio-feedstock/energy; c) emissions from surface/ground/sea water resources; water treatment facility construction and decommission; water treatment; reservoirs for water-feedstock; d) emission from electricity plant construction and decommissioning; well-to-gate electricity generation emissions; co-products allocation for electricity; and e) emissions from heat sources management; construction and decommission for heat application; co-product allocation for heat-energy.

2) Emissions for feedstock/energy transportation to the hydrogen production plant should be included.

3) Emissions for hydrogen plant construction and decommission should be considered. Example sources of emissions include: a) construction material flow, supplies, production, and deliveries; b) equipment manufacturers and building construction; c) construction waste management and recycling; and d) decommission packs and delivery

4) Onsite emissions for hydrogen production
5) Total emissions allocation or displacement to co-products

(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.
Answer: Methods based on life cycle analysis that consider the treatment of co-products should be considered. Generally, these include: a) allocation of emissions based on relative value of co-products and b) displacement approaches that take account for credit/burden of co-products

displacing other forms of supply of co-products. Depending on the size of the market for the co-product and its alternative production sources, one of the above methods may be more suitable. For example, in the case of steam, whose market demand may be limited due to inability to store for a long period and transport for long distances, allocation methods that based on the exergy or energy considering temperature may be more suitable. For more fungible products like electricity, displacement methods that presume credit for sold electricity can be considered. Other possible co-products of clean hydrogen production and their disposition include: a) element carbon allocation according to energy when the carbon is used as energy source; b) element carbon allocation according to market value when the carbon is sold in the market, and c) oxygen allocation according to market value when the oxygen is sold in the market.

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

Answer: System expansion, energy-based allocation, and mass/market-based allocation can be used to allocate emissions to the co-products. A common direction should be generated according to the co-products' characteristics. For example: a) system expansion can be used for retrofit plants such as carbon capture and storage and hydrogen by-produced from refineries processes; b) energy-based allocation can be used for energy co-products, but some energy co-product such as steam need to be considered according to the steam temperature; and c) mass-based approach is an allocation method, but for products with market values, allocated based on market value may be more attractive.

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

Answer: Allocation rules should be developed to guide the appropriate allocation methods that differ by by-product types, energy quality, and market values

(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?

Answer: System expansion is the easiest way for the clean hydrogen by-product from the retrofit of current industrial processes

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

Answer: In industrial practice, most of the byproduct hydrogen such as in chlor-alkali production or petrochemical cracking is burned onsite for heat and power supplement.

(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?

Answer: The facility should be eligible to claim the § 45V credit only for the qualified clean hydrogen it produces

(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?

Answer: GREET is a powerful tool to qualify the lifecycle greenhouse gas emissions for clean hydrogen production processes. But the users should modify the routes for energy delivery to account for specific supply chain emissions

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

Answer: All emissions for other specific energy sources application can be accounted for in the stages for feedstock/fuel production and transportation. All the carbon credits such as biogenic carbon, carbon capture, and storage for the energy sources productions can also be accounted for in the stages for feedstock/fuel production and transportation to avoid double-accounted.

(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?
Answer: For the original tax setup, the annual average of energy inputs can be used. The other time matching based on hourly resolution should be introduced over a period time as data on marginal emissions factors for electricity consumption becomes readily available. Placing hourly time-matching requirements in the near-term could be prove to be too onerous to initiate this nascent industry.

(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 CO_2-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?

Answer: The hydrogen plant construction and decommissioning should be accounted for in the definition of clean hydrogen. The well-to-gate analysis should also be accounted for the special supply chain of the feedstocks/energy consumptions for hydrogen production.

(3) Provisional Emissions Rate. 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?

Answer: All the well-to-gate stages should be accounted for, with accurate evaluation of onsite emissions and uncertainty range for the other stages.

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

Answer: It can be set at the rate for the most similar known process with documentation that supports this. Common emission factors are needed to evaluate the emissions rate of greenhouse gases of CO_2, CH_4, and N_2O and the fugitive emissions rate of gases CH_4, H_2.

(4) Recordkeeping and Reporting.

(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?

Answer: Taxpayers should maintain and create a provisional document with all input parameters stated to be examined by a qualified consultant.

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

Answer: The monitoring can focus on onsite greenhouse gas emissions. For the other stages of emissions, the emissions can be evaluated using GREET according to the feedstock/energy supply chain.

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

Answer: GREET can be used for emissions evaluation of electricity supply, but the clean hydrogen production facility needs to supply detailed electricity consumption rate and total supply assumptions.

(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?

Answer: The taxpayer who serves as both the clean hydrogen producer and the clean hydrogen user can separate the hydrogen production and utilization part to show the emissions data for hydrogen production. The hydrogen utilization emissions allocation can use System expansion method.

(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?

Answer: The location may be more important than time and vintage at the current credit plan.