Incentivizing Hydrogen – Tax Credits for Clean Energy

Center Forward Basics

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Overview

Hydrogen's flexibility as a fuel source across the transportation, industrial, and power generation sectors, coupled with its efficient storage capabilities, positions it as a critical component in achieving net-zero global emission goals. The production of clean hydrogen is supported by the Section 45V tax credit, which was established under the Inflation Reduction Act (IRA) of 2022. The 45V credit aims to accelerate the deployment of clean hydrogen production. Congress intended for these credits to be technology-neutral and provide financial incentives for qualifying facilities to promote greenhouse gas emission reductions across the energy production and supply chain, also known as the energy value chain. This Basic will review hydrogen and its uses before turning to recently proposed regulations to incentivize the rollout of this potential energy source.

Hydrogen and its Uses

As the world pursues decarbonization technologies, hydrogen stands out as a promising, versatile fuel with the potential to significantly reduce carbon emissions across multiple sectors of the economy. The Department of Energy (DOE) estimates clean hydrogen could reduce up to 25% of CO2-related emissions around the globe.

Center Forward Basics

Center Forward brings together members of Congress, not-for profits, academic experts, trade associations, corporations and unions to find common ground. Our mission: to give centrist allies the information they need to craft common sense solutions, and provide those allies the support they need to turn those ideas into results.

In order to meet our challenges we need to put aside the partisan bickering that has gridlocked Washington and come together to find common sense solutions.

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Hydrogen is adaptable and can be directly implemented across various industries or used for power storage for solar and wind energy, reducing emissions across the energy value chain. Hydrogen's only byproduct when used to fuel transportation, generate power, heat buildings, or in manufacturing processes, is water.

However, the specific production process impacts hydrogen's life-cycle emissions—or carbon intensity—which varies on a facility-by-facility basis. Specifically, carbon intensity is determined by the production technology and feedstocks used to produce the hydrogen. The most prominent production methods include:

- Steam Methane Reformation (SMR) uses steam to split natural gas into a hydrogen-rich synthetic gas, or syngas. 95% of hydrogen produced and used today is derived from SMR. Hydrogen is separated and stored for later use. The carbon intensity of SMR can be reduced by using lower carbon intensity natural gas, also known as differentiated gas, renewable natural gas (RNG), or pairing SMR with carbon capture and storage (CCS).
- Autothermal Reforming (ATR) combines the steam reforming process with a partial oxidation process (POX), which boosts hydrogen production. The primary difference between ATR and SMR is how heat is used to activate the reaction. Like SMR, ATR can use lower carbon intensity natural gas, RNG, or be paired with CCS to reduce carbon intensity.
- Electrolysis uses electricity with a device called an electrolyzer to split water into hydrogen and oxygen. With this production method, carbon intensity is dependent largely on the source of electricity. For example, an electrolyzer powered by coal-fired electricity would have a higher carbon intensity compared to an electrolyzer powered by renewables, nuclear, or hydro.
- Gasification converts organic material – like coal or biomass – into a hydrogen-rich syngas using high temperatures, without combustion. The carbon intensity varies based on the organic material used and whether the process is paired with CCS.

What are Clean Hydrogen Production Tax Credits

In 2022, the IRA established the Clean Hydrogen Production Tax Credit (Section 45V) to support the production and adoption of low-carbon intensity hydrogen. These incentives were designed to encourage innovation across the energy industry, driving down costs and fostering a competitive market.

The IRA created a tiered incentive system for the production of clean hydrogen. For qualifying hydrogen production facilities, the credits range from $.60 per kilogram (kg) of hydrogen produced to $3 per kg, depending on the life-cycle emissions of production. Specifically, the largest incentive is provided to producers generating 1 kg of hydrogen with less than .45 kg of CO2 emissions, while hydrogen with over 4 kg of CO2 emissions per 1 kg of hydrogen is not eligible for the credit. Clean hydrogen producers will also need to meet prevailing wage and apprenticeship requirements to qualify for the highest incentive values.

IRS Proposed Regulations

In December 2023, the Treasury Department issued proposed regulations detailing the requirements for the 45V tax credit qualification. Notably, these credits underscore the federal government's desire to accelerate the hydrogen economy's development and mitigate climate change through investing in processes that reduce greenhouse gas (GHG) emissions.

Under Section 45V, tax credits would support the production of qualified clean hydrogen for up to 10 years if the facility has begun construction by 2033. The Treasury's tiered credit system requires producers to calculate lifecycle greenhouse gas emissions using the 45VH2-GREET model. Section 48 would allow companies to qualify for investment tax credits, rather than the production tax credits under Section 45V. Investments must be made in specified clean hydrogen production facilities and produce clean hydrogen that results in a life-cycle emissions reduction rate specified in the annual verification report.

GREET Models

The DOE's Argonne National Laboratory created GREET (Greenhouse gasses, Regulated Emissions, and Energy use in Technologies) models to assess the life-cycle environmental impacts – total energy consumption, fossil fuel use, greenhouse gas emissions, air pollutant emissions, and water consumption – across a product or power system's supply chain.

Currently, Treasury's proposed 45VH2-GREET would determine emissions associated with feedstock growth, gathering, extraction, processing, and delivery of hydrogen to a production facility to calculate the carbon intensity of the hydrogen produced and determine eligibility for the Section 45V production tax credit. However, there are restrictions to the 45VH2-GREET model. Only eight hydrogen production pathways currently exist in the model, leaving out many feedstocks and technologies that can be used to produce hydrogen today. Producers can petition for a provision emission rate (PER) determination for a technology or feedstock that is not included in the 45VH2-GREET model.

Additionally, to determine the carbon intensity of the hydrogen produced, the 45VH2-GREET model relies on fixed parameters or default numbers known as "background data" provided by the DOE for certain inputs. Background data generally relies on national averages, disadvantaging hydrogen produced with feedstock or technology with a lower carbon intensity than the average default value. This restriction negatively impacts hydrogen produced with natural gas and CCS technologies. By using a proposed industry average for upstream emissions for all hydrogen produced with natural gas, industry leaders fear the proposed rule fails to account for significant investments in upstream emissions reductions. These reductions can be verified through various data management processes, emissions monitoring systems, aerial surveys and satellites, and verification methods that some natural gas producers employ to reduce the GHG emissions associated with their natural gas production. Pursuing an industry average instead of project-specific emissions rates may remove a market incentive for spurring GHG emissions reductions in natural gas production.

The Future of Hydrogen

Tax credits play a pivotal role in propelling the hydrogen sector towards a future of widespread adoption, emission reductions, and sustainable economic growth. A Clean Hydrogen Production Tax Credit that accounts for a wide variety of feedstocks has the potential to serve as a catalyst for innovation and investment that would rapidly scale hydrogen production. The Section 45V credit, if implemented with flexibility, could help reduce the cost barriers associated with clean hydrogen, as well as encourage research and development into more sustainable and scalable production methods in order to meet the country's emissions reduction goals. The Section 45V regulatory comment period ended on February 26, 2024, and a public hearing on the proposed regulations is noticed for March 25, 2024.

The IRA was intended to prioritize emission reductions and encourage further investment in scalable, low-carbon production methods—all of which hydrogen produced with natural gas and CCS provides. Careful consideration across regulatory agencies is required to ensure regulations are written in a way to incentivize innovation and accelerate growth while achieving the GHG emissions reduction results desired.

Links to Other Resources

- American Chemistry Council – Hydrogen and the Chemical Industry
- Argonne National Laboratory – Six things you might not know about hydrogen
- Department of Energy – Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit
- Department of the Treasury – U.S. Department of the Treasury, IRS Release Guidance on Hydrogen Production Credit to Drive American Innovation and Strengthen Energy Security
- McDermott Will & Emery – IRS Leans "Green": Much-Awaited Section 45V Guidance Creates New Opportunities For Hydrogen Markets
- Office of Energy Efficiency & Renewable Energy – GREET
- Senate Committee on Environment and Public Works – Carper's Statement on Treasury's Proposed Guidance for Clean Hydrogen Tax C
- World Economic Forum – Grey, blue, green – why are there so many colours of hydrogen?
- Zurich – Fueling the future: How blue and green hydrogen can help solve the climate crisis