The Taxation of Energy Transitions: Clean Hydrogen Production

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In this article, Matlock and Chai examine the section 45V credit for clean hydrogen production and the proposed regulations under section 45V.

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Hydrogen is a key component of the global energy evolution story. It has a potential role as a large-scale and long-duration energy storage medium and can act as a flexible energy generation center. Many governments, investors, industry groups, and other organizations are now moving at a rapid pace to identify how best to invest in hydrogen.

Hydrogen is one promising alternative energy source gaining attention in conjunction with the Infrastructure Investment and Jobs Act, enacted November 15, 2021, and the Inflation Reduction Act of 2022, enacted August 16, 2022. As we will discuss, hydrogen has the potential for many energy-intensive applications, while emitting only water and oxygen as byproducts when burned. Together the acts lay a foundation for hydrogen as an alternative energy source in the United States and encourage domestic hydrogen production.

The new section 45V credit for hydrogen production, first introduced with the enactment of the IRA,[1] is a leading incentive for the U.S. production of clean hydrogen. The section 45V credit and other hydrogen-focused programs (such as the Regional Clean Hydrogen Hubs Program launched by the Department of Energy[2]) reflect the government's commitment to scale up domestic clean hydrogen production in furtherance of a long-term goal of 100 percent clean electricity by 2035.[3]

I. How Hydrogen Production Works

It is estimated that hydrogen accounts for approximately 90 percent of all atoms in the universe, making it the most abundant chemical element.[4] Further, it is viewed as clean because it emits only vapor and oxygen when used.[5] However, since hydrogen does not exist freely in nature, it must be produced from other sources. There are many sources of hydrogen and many methods to produce hydrogen based on these sources, and a spectrum of colors has been adopted to classify produced hydrogen based on its source.

Today the most widely used option, "gray" hydrogen, is produced through natural-gas-fueled steam-methane reforming (processes that produce greenhouse gas emissions).[6] However, when gray hydrogen is combined with carbon capture use and sequestration technologies, the carbon footprint of the produced hydrogen is reduced, and the resulting hydrogen is considered "blue" hydrogen.[7] Separately, there are promising opportunities around "green" hydrogen, which is produced using renewable energy (for example, solar, wind) in the electrolysis of water (H_2O) (that is, separating hydrogen (H_2) from oxygen (O)).[8] Also, there are encouraging opportunities from "pink," "red," and "purple" hydrogen production processes, which leverage nuclear energy (electrical and thermal) to produce hydrogen by incorporating the hydrogen production processes into the existing energy facilities.[9] The energy industry continues to explore and innovate to produce hydrogen at scale while producing net-zero emissions.

II. Section 45V Hydrogen Production Credit

The section 45V credit applies to certain qualified clean hydrogen produced after December 31, 2022, and it has a 10-year credit term, which begins on the date a qualified clean hydrogen facility is placed in service for federal income tax purposes.[10]

For section 45V purposes, the term "qualified clean hydrogen production facility" means a facility that (1) the taxpayer owns, (2) qualified clean hydrogen is produced in, and (3) the taxpayer begins construction on before January 1, 2033.[11] The term "qualified clean hydrogen" means hydrogen that has a life cycle greenhouse gas emissions rate of 4 kilograms or less of carbon dioxide equivalent per kilogram of hydrogen.[12] The qualified clean hydrogen must be produced (1) in the United States or a possession of the United States, (2) in the ordinary course of a trade or business of a taxpayer, and (3) for sale or use,[13] and the production and sale or use of that hydrogen must be verified by an unrelated party.[14]

In the case of an existing facility that was originally placed in service before January 1, 2023, and did not produce qualified clean hydrogen, the facility may be modified to produce qualified clean hydrogen and be treated as being originally placed in service on the date the property required to complete the modification is placed in service.[15] The amounts paid or incurred for that modification must be properly chargeable to the capital account of the taxpayer.[16]

Moreover, in connection with a blue hydrogen project, the section 45V credit cannot be stacked with the section 45Q carbon sequestration credit for the same facility.[17] Stated differently, if any taxpayer

has claimed the section 45Q credit for the current year or any prior year for a facility that produces qualified clean hydrogen and includes carbon capture equipment, the taxpayer is disallowed from claiming the section 45V credit for that facility.[18]

III. Section 45V Credit Amount

The section 45V credit rate is $0.60 per kilogram of qualified clean hydrogen (adjusted for inflation) multiplied by an applicable percentage.[19] The applicable percentage depends on the life cycle greenhouse gas emissions rate, which is measured in kilograms of CO_2 equivalents per kilogram of hydrogen and is shown in Table 1.[20]

Table 1. Section 45V Applicable Percentages

Life Cycle Greenhouse Gas Emissions Rate	Applicable Percentage
2.5-4	20%
1.5-2.4	25%
0.45-1.4	33.4%
Less than 0.45	100%

Taxpayers may determine the life cycle greenhouse gas emissions rate of the applicable hydrogen production pathway by either using the most recent Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation model (commonly referred to as the GREET model) developed by the Argonne National Laboratory[21] or filing a petition to receive a provisional emissions rate.[22] Section 45V requires the life cycle assessment using a well-to-gate framework, meaning only emissions associated with the production of the qualified clean hydrogen are used for the life cycle greenhouse gas emissions rate.[23] A provisional emissions rate petition is appropriate in the case of hydrogen for which a life cycle greenhouse gas emissions rate has not been determined under the most recent GREET model.[24]

IV. Increased Section 45V Credit Amounts

Taxpayers that meet certain prevailing wage and apprenticeship (PWA) requirements are eligible for an increased credit rate that equals an amount that is five times the base credit rate.[25] Therefore, taxpayers that satisfy the PWA requirements may claim a maximum increased credit rate of $3 per kilogram of qualified clean hydrogen.[26]

The PWA requirements state that all laborers, mechanics, and workers employed by the taxpayer, contractors, or subcontractors must be paid, at minimum, the prevailing rates for similar work in the locality where the qualified facility is located during project construction and for the applicable period (that is, 10 years for section 45V purposes) after the facility is placed in service for repairs and alteration.[27] Also, each contractor or subcontractor that employs at least four individuals to perform construction, alteration, or repair work must employ at least one qualified apprentice to perform that work.[28] Qualified apprentices must perform an applicable percentage of total labor hours for project construction, alteration, or repair work, including the work performed by any contractor or subcontractor.[29] The applicable percentages for projects beginning construction before 2023, in 2023, and after 2023 are 10 percent, 12.5 percent, and 15 percent, respectively.[30] Taxpayers are also subject to the apprentice-to-journey worker ratio requirements of the Department of Labor or the applicable state.[31]

Importantly, any qualified clean hydrogen production facility the construction of which began before January 29, 2023,[32] is deemed to have satisfied the PWA requirements.[33]

V. Proposed Section 45V Regulations

On December 26, 2023, Treasury and the IRS published much-anticipated proposed regulations on section 45V and section 48(a)(15).[34] Before the final regulations are published, taxpayers may rely on the proposed regulations for years beginning after December 31, 2022, so long as the proposed regulations are followed in their entirety and in a consistent manner.[35] Although the proposed regulations touch on a variety of topics, and a full discussion of the entirety of the proposed regulations is outside the scope of this article, certain key components are discussed below.

A. Qualified Clean Hydrogen Facility

For section 45V purposes, a "facility" means a single production line that is used to produce qualified clean hydrogen.[36] The proposed regulations provide that a facility does not include equipment used to condition or transport hydrogen beyond the point of production or electricity production equipment used to power the hydrogen production process, including specific assets.[37]

Further, a "single production line" includes all components of property that function interdependently to produce qualified clean hydrogen.[38] Components of property are functionally interdependent if the placing in service of each component is dependent on the placing in service of each of the other components to produce qualified clean hydrogen.[39] Components that have a purpose in addition to the production of qualified hydrogen may be part of a facility if those components function interdependently with the other components to produce qualified clean hydrogen.[40]

B. GREET Model

The "most recent GREET model" means the latest version of 45VH2-GREET developed by the Argonne National Laboratory that is publicly available on the first day of the taxpayer's tax year in which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced.[41] However, if a version of 45VH2-GREET becomes publicly available the same year but after the first day, the taxpayer, in its discretion, may treat that version as the most recent GREET model.[42]

45VH2-GREET 2023 evaluates various production methods and technologies; the following technologies may be applied in 45VH2-GREET 2023: steam-methane reforming of natural gas with potential carbon capture and sequestration (CCS), autothermal reforming of natural gas with potential CCS, steam-methane reforming of landfill gas with potential CCS, autothermal reforming of landfill gas with potential CCS, coal gasification with potential CCS, biomass gasification with potential CCS, low-temperature water electrolysis using electricity, and high-temperature water electrolysis using electricity or heat from nuclear power plants.[43]

"Emissions through the point of production" means the aggregate life cycle greenhouse gas emissions related to hydrogen produced at a hydrogen production facility during the tax year through the point of production. This includes emissions associated with feedstock growth, gathering, extraction, processing, delivery to a hydrogen production facility, and the hydrogen production process, inclusive of the electricity used by the hydrogen production facility and any capture and sequestration of carbon dioxide generated by the hydrogen production facility.[44]

C. Energy Attribute Certificates

For purposes of determining the life cycle greenhouse gas emissions rate, the proposed regulations indicate that taxpayers may use qualifying energy attribute certificates (EACs) and retire those EACS to treat the hydrogen production facility's source of electricity as being from a specific electricity generating facility rather than being from the regional electricity grid.[45] The term EAC means a tradeable contractual instrument, issued through a qualified EAC registry or accounting system, that represents the energy attributes of a specific unit of energy produced.[46] A qualifying EAC must meet the following three requirements: (1) incrementality, (2) temporal matching, and (3) deliverability.[47] Further, the fulfillment of these requirements must be verified by a qualified verifier.[48]

The incrementality (or additionality) requirement provides that a qualifying EAC must represent incremental source electricity; this means that the corresponding unit of energy must be produced from an electricity generating facility with a recent commercial operations date.[49] A "recent" commercial operations date must fall within 36 months before the hydrogen production facility for which the EAC is retired is placed in service.[50]

Temporal matching requires that retired qualifying EACs represent electricity produced in the same period in which the hydrogen production facility consumes electricity in the production of hydrogen.[51] Generally, an EAC satisfies the temporal matching requirement if the electricity represented by the EAC is generated in the same hour that the taxpayer's hydrogen production facility uses electricity to produce hydrogen.[52] However, the proposed regulations provide for a

transitional rule for this requirement for electricity before January 1, 2028, under which the requirement would be met if the electricity represented by the EAC is generated in the same calendar year that the taxpayer's facility uses electricity to produce hydrogen.[53]

Lastly, the deliverability requirement (also known as the geographic correlation requirement) provides that a qualifying EAC must represent electricity that was produced by an electricity generating facility that is in the same region as the relevant hydrogen production facility.[54]

D. Certain Other Clarifications

The proposed regulations provide that the storage of hydrogen before its sale or use would not disqualify the hydrogen from being considered produced for sale or use for section 45V purposes.[55] Further, the proposed regulations contain extensive rules for the verification requirements (that is, the sale or use of qualified clean hydrogen must be verified by an unrelated party).[56] Finally, the proposed regulations have asked for comments on many items, including the interplay of hydrogen with renewable natural gas.

VI. ITC Election in Lieu of Section 45V

Under section 48(a)(15), taxpayers may elect to claim the section 48 investment tax credit in lieu of the section 45V credit for a clean hydrogen production facility.[57] Upon making the election, any qualified property that is part of a specified clean hydrogen production facility will be treated as energy property for section 48 purposes.[58]

The ITC rate for a specified clean hydrogen production facility is based on the life cycle greenhouse gas emissions rate of the produced qualified clean hydrogen measured in kilograms of CO_2 equivalent per kilogram of hydrogen. Taxpayers may qualify for the increased ITC rate, which amounts to five times the base ITC rate if applicable PWA requirements are fulfilled.[59] (See Table 2.)

The IRA also amended section 48 to include stand-alone energy storage technology as energy property; "energy storage technology" includes property (other than transportation or electricity producing property), in the case of hydrogen, that stores energy and has a nameplate capacity of at least 5 kilowatt-hours.[60] The ITC rate for energy storage technology is 6 percent of the eligible basis and increases to 30 percent if the taxpayer meets the applicable PWA requirements.[61]

Table 2. ITC Rate for Clean Hydrogen

Life Cycle Greenhouse Gas Emissions Rate	Base ITC Rate
2.5-4	1.2%

Life Cycle Greenhouse Gas Emissions Rate	Base ITC Rate
1.5-2.4	1.5%
0.45-1.4	2%
Less than 0.45	6%

VII. An Evolving Market

Section 45V and the potential for building large-scale hydrogen facilities in the United States have attracted global attention. How effective the United States is in leveraging section 45V to attract global capital is a key factor in determining the pace by which the benefits of hydrogen will be realized in the coming years across the states and sectors.[62]

FOOTNOTES

[1] *See* IRA, section 13204.

[2] *See* Department of Energy, "Regional Clean Hydrogen Hubs" (last accessed Feb. 2024).

[3] *See* Department of State and the Executive Office of the President, "The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050" (Nov. 2021).

[4] *See* National Center for Biotechnology Information, PubChem Element Summary for AtomicNumber 1, "Hydrogen" (last accessed Mar. 5, 2024).

[5] *See* Massachusetts Institute of Technology, Climate Portal, "Hydrogen" (June 23, 2021).

[6] *See* Energy Information Administration, "Hydrogen Explained: Production of Hydrogen" (June 23, 2022).

[7] *See id.*

[8] *See id.*

[9] *See id.*

[10] *See* section 45V(a)(1).

[11] *See* section 45V(c)(3).

[12] *See* section 45V(c)(2)(A).

[13] *See* section 45V(c)(2)(B)(i)

[14] *See* section 45V(c)(2)(B)(ii).

[15] *See* section 45V(d)(4).

[16] *See* section 45V(d)(4)(B)(ii). So long as the applicable requirements are met, the facility will be deemed to have been originally placed in service as of the date that the property required to complete the modification is placed in service for federal income tax purposes.

[17] *See* section 45V(d)(2).

[18] *See id.*

[19] *See* section 45V(b)(1).

[20] *See* section 45V(b)(2).

[21] *See* section 45V(c)(1).

[22] *See* section 45V(c)(2)(C).

[23] *See* section 45V(c)(1)(B).

[24] *See* section 45V(c)(2)(C).

[25] *See* section 45V(e)(1).

[26] *See id.*

[27] *See* section 45V(e)(3)(A).

[28] *See* section 45(b)(8)(C).

[29] *See* section 45(b)(8)(A).

[30] *See* section 45(b)(8)(A)(ii).

[31] *See* section 45(b)(8)(B).

[32] *See* Notice 2022-61, 2022-52 IRB 560.

[33] *See* section 45V(e)(2)(A)(i).

[34] *See* REG-117631-23.

[35] *See id.*

[36] *See* prop. reg. section 1.45V-1(a)(7)(i).

[37] *See* prop. reg. section 1.45V-1(a)(7)(ii).

[38] *See* prop. reg. section 1.45V-1(a)(7)(i).

[39] *Id.*

[40] *See* prop. reg. section 1.45V-1(a)(7)(iii).

[41] *See* prop. reg. section 1.45V-1(a)(8)(ii).

[42] *See id.*

[43] *See* United States Department of Energy, "Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways Using 45VH2-GREET 2023" (last accessed Feb. 2024).

[44] *See* prop. reg. section 1.45V-1(a)(8)(iii).

[45] *See* prop. reg. section 1.45V-4(d)(1).

[46] *See* prop. reg. section 1.45V-4(d)(2)(iv).

[47] *See* prop. reg. section 1.45V-4(d)(3).

[48] *See* prop. reg. section 1.45V-4(d)(2)(iv).

[49] *See* prop. reg. section 1.45V-4(d)(3)(i).

[50] *See* prop. reg. section 1.45V-4(d)(3)(i)(A).

[51] *See* prop. reg. section 1.45V-4(d)(3)(ii).

[52] *See* prop. reg. section 1.45V-4(d)(3)(ii)(A).

[53] *See* prop. reg. section 1.45V-4(d)(3)(ii)(B).

[54] *See* prop. reg. section 1.45V-4(d)(3)(iii).

[55] *See* prop. reg. section 1.45V-1(a)(9)(ii).

[56] *See* section 45V(c)(2)(B)(ii).

[57] *See* section 48(a)(15).

[58] *See* section 48(a)(15)(A)(i).

[59] *See* section 48(a)(15)(A)(ii).

[60] *See* section 48(c)(6)(A).

[61] *See* section 48(a)(9)(A)(i). The ITC rate could also be increased if the project otherwise meets certain additional requirements.

[62] The views reflected in this article are those of the authors and do not necessarily reflect those of Ernst & Young LLP or other members of the EY organization. The information in this article is provided solely for the purpose of enhancing knowledge. It does not provide accounting, tax, or other professional advice.

END FOOTNOTES