ANTORA

SUBMITTED ELECTRONICALLY

Internal Revenue Service
CC:PA:LPD:PR (Notice 2022-58)
Room 5203
P.O. Box 7604, Ben Franklin Station
Washington, DC 20044

December 2, 2022

Re: Notice 2022-58 | Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production

On behalf of Antora Energy, I respectfully submit the attached comments to the Department of the Treasury and the Internal Revenue Service's Request for Comments on Credits for Clean Hydrogen and Clean Fuel Production (Notice 2022-58).

We appreciate the opportunity to respond and would welcome the opportunity to participate in any stakeholder engagement as the agency further crafts this important guidance. Thank you for your time and your consideration.

Sincerely,

Justin Briggs, PhD
Co-Founder and Chief Operating Officer

<u>Background on Antora Energy</u>

Antora Energy has active projects under development with multiple clean fuel producers to decarbonize their manufacturing processes. We welcome the opportunity that §45Z could provide to incentivize deeper decarbonization in this field; however, §45Z guidance could have the adverse effect of stymieing decarbonization projects if not carefully executed. Therefore, we are presenting comments informed by our experience developing clean fuel decarbonization projects.

Antora Energy provides a solution to decarbonize the heat and power of clean fuel production facilities using a thermal battery. Antora is a portfolio company of leading venture capital firms, including Lowercarbon Capital and Breakthrough Energy Ventures, the investment platform through which Bill Gates invests in companies that are helping to reduce greenhouse gas emissions and stop climate change.

.02 Clean Fuel Production Credit (§ 45Z).

> ***Question (7) Please provide comments on any other topics related to § 45Z credit that may require guidance.***

Clarify that Facilities Should be able to Transition Between the 45Z and 45Q Credits without Violating Double Benefit Provisions:
Under § 45Z(d)(4), the term "qualified facility" is defined as a facility used for the production of transportation fuels, but does not include "any facility for which one of the following credits is allowed under section 38 for the taxable year...." Among the credits listed under § 45Z(d)(4) is the credit for carbon oxide sequestration under § 45Q. Antora's understanding is that this double-benefit prohibition would not apply in the case of a facility that foregoes the § 45Q credit and instead claims the § 45Z credit during the 2025, 2026, and 2027 taxable years, but may claim the § 45Q credit for taxable years before and after the 3-year § 45Z credit period. Antora has appended a legal briefing paper prepared by our legal team that evaluated the existing statutory language and legal precedence in support of this conclusion (Appendix A). We seek confirmation from the Treasury that an otherwise qualified facility is not precluded from claiming 45Z and 45Q in separate taxable years.

Renewable Process Electricity Should Qualify Only if Local Grid and Time Matched:
Antora requests that the Treasury Department and IRS issue guidance to clarify that grid-sourced electricity calculations for 45Z emissions rates incorporate measurements and/or estimates of the hourly average emissions intensity of electricity for the local grid.

Specifically, we recommend clarifications of emission rate calculations of Scope 2 greenhouse gas emissions, namely that the emissions rate account for Scope 2 emissions resulting from grid-sourced electricity using either hourly electricity grid emissions data or renewable energy certificates from temporally- and spatially-matched low-carbon generation (i.e. certificates specifying when and where low-carbon power is generated).

Failure to use such hourly emissions or tightly matched certifications could result in false claims of emission reductions and in many cases even directly subsidize dramatic increases in greenhouse gas emissions. For instance, an industrial facility could simply replace a natural gas boiler with an electric boiler and run it using grid-sourced electricity during hours when coal and natural gas are the predominant source of electricity generation and harvest the tax credits, despite not actually reducing overall emissions. A recent study from Princeton's ZERO Lab presented a similar case for hydrogen production with grid-connected electrolysis that confirms this analysis that a lack of hourly and spatial matching could directly incentivize large increases in CO_2 emissions (Appendix B).

As such, we respectfully suggest that:

1. Scope 2 emissions measurement for grid-sourced electricity be based on **hourly average emissions factors**; and that
2. Indirect (i.e. book-and-claim) accounting mechanisms are limited to **hourly-matched generation from a local generator**.

Using this type of hourly carbon intensity accounting properly captures the actual emissions intensity of a given industrial or manufacturing facility and will incentivize investments in infrastructure that actually reduce emissions.

For grid-sourced electricity, we recommend that guidelines are established that incorporate measurements and/or estimates of the hourly average emissions intensity of electricity for the local grid. We recommend an hourly basis for accounting as it incorporates sufficient resolution to capture the important time-variable features of a grid with significant generation from variable wind and solar resources. An hourly accounting basis is also tractable from a compliance standpoint and further increases in temporal fidelity beyond hourly resolution are unlikely to yield meaningful benefit but impose additional compliance complexity. Multiple methodologies for assessing hourly electricity emissions intensity are in use and being developed in national laboratories, universities, and industry. While in years past an annual average carbon intensity of electricity, reflective of the varying sources of electric power, was suitable for Scope 2 emissions assessments, the grid is rapidly changing, and this approach is no longer adequate. In parts of the grid where renewable power is abundant, average emissions factors at times may be at or near zero, whereas at times when renewables are not available, emissions may be significantly higher than the annual average. Requiring an hourly emissions factor to calculate emissions reflects the strong and increasing importance of the temporal variance of emissions on the grid. Preserving this signal of variable emissions factors will properly incentivize investment in production strategies that align power consumption with low-carbon power generation and ultimately reduce greenhouse gas emissions.

Likewise, requiring any indirect or book-and-claim accounting mechanisms (such as renewable energy certificates or zero-carbon energy certificates) to meet hourly matching requirements from a local resource will ensure carbon reduction claims match reality and preserve the incentive to invest in systems that align power consumption with low-carbon power generation. Ignoring such an hourly matching requirement would be harmful, and could even result in facilities increasing net emissions while claiming public funding intended to reduce emissions.

No "Additionality" Requirement Should be Imposed on Renewable Electricity:
We respectfully request that the Treasury Department reject calls for an "additionality" rule that seeks to exclude energy produced by existing renewable generators from qualifying as a source of zero-carbon energy under sections 45V and 45Z.

The Inflation Reduction Act—as enacted by Congress—includes no such additionality rule. Existing zero-carbon generators in the country constitute hundreds of billions of dollars of invested capital. Restricting this large class of zero-carbon generation from participating equally in incentives authorized under this Act represents a question of vast economic significance.

Sections 45V and 45Z, and the energy provisions of the Inflation Reduction Act as a whole, show a clear intent to use differentiated incentives to direct the economy toward investments in certain sectors and in certain types of technologies. The clean hydrogen and clean fuel production standards of sections 45V and 45Z exist specifically to promote innovation in and production of these fuels, not to promote construction of new renewable generation which are specifically dealt with separately in the Act. Artificially adding barriers regarding new-build electricity generation to qualifying hydrogen or vehicle fuel production as low carbon would subvert the congressional intent of providing a specific and separate incentive to promote production of these fuels.

An additionality rule would be particularly harmful if applied to 45Z given the three-year period for which the 45Z credit is authorized. Typical development cycles for renewable generation, given the current state of interconnection queues, are 5-7 years. Behind-the-meter projects also face multi-year backlogs in transformer procurement, and (in the case of wind) Federal Aviation Administration permitting. Given these incompatible timelines, any such additionality rule applied to 45Z would prevent any investments in integrating renewable electricity into renewable fuel production processes.

Adoption of an additionality requirement would undermine beneficial projects currently underway to use existing and underutilized renewable electricity generation to decarbonize process heat and power for renewable fuel producers. These projects are additional despite using existing generation in that they deploy new capital to firm renewable electricity supply and convert renewable electricity to process heat. An additionality requirement would stifle investment in these novel electrification / decarbonization projects. At minimum, any additionality requirement should recognize that projects that invest in energy storage or renewable power-to-heat equipment are additional even if using existing generation sources.

Filing for Provisional Pathways Should Be Allowed after Guidance is Issued:

Section 45Z(b)(1)(D) allows the taxpayer to file a petition with the Secretary for determination of the emissions rate for a transportation fuel which has not been established. Notice 2022-58, sec. 3.02(3)(a), 2022-47 IRB 1, requests comments on the application of this provision and asks: "At what stage in the production process should a taxpayer be able to file a petition for a provisional emissions rate?" As the statute and Notice 2022-58 recognize, the GREET model includes a limited number of pathways and does not measure many potential inputs and applications. It is imperative that the guidance allow taxpayers to file a petition for a provisional emissions rate at the earliest possible point. Importantly, taxpayers should have the opportunity to file a petition during the development phase of a project and obtain some level of assurance with respect to their projects and the future credit amounts in advance of substantial investments being made. Such surety will in many cases be necessary to mobilize the investment in clean fuel production that Congress intends to incent. Having this surety early in the process is particularly important given the relatively short time horizon for which the credit is authorized. The guidance should incorporate procedures to allow taxpayers to immediately file for a provisional emissions rate after the guidance is issued.

Individual Plant Pathways Should Be Permitted:

Further, by developing a technology neutral credit, it is clear that Congress intended to encourage innovative applications and pathways to carbon emissions reduction beyond those presently found in the GREET model. If alternative pathways are not allowed on an individual plant basis, individual producers will not benefit from investing in innovative emissions reductions technologies and the credit will fail to achieve Congress's intent. The guidance should incorporate procedures to allow taxpayers to file for individualized production pathways to preserve Congress's intended incentives. We note that Congress in § 45Z affords substantial discretion to the Secretary to develop guidance and procedures to implement the statutory intent. Specifically, § 45Z(b)(1)(B)(ii) refers to the GREET model or a successor model "as determined by the Secretary." Likewise, § 45Z(e) specifically authorizes and indeed mandates that the Secretary issue guidance on the "calculation of emissions factors for transportation fuel." The Secretary can and should adopt flexible and timely procedures on individualized production pathways under this mandate. Should the Treasury determine individual plant pathways present an unacceptable administrative burden, at minimum, individual plants should be able to modify their emissions factor using their specific degree of incorporation of renewable energy. For example, a plant receiving 50% of their electricity from a renewable source should be able to calculate and receive a commensurate credit to their fuel emissions factor. This could be implemented using a simplified calculator based on the GREET model without the complexity and administrative burden of full individual pathways.

Clarify That Negative Emissions Factors Can Result in Per Gallon Production Credits Greater than the Applicable Amount:

Assuming the qualified facility satisfies the prevailing wage and apprenticeship requirements, the "applicable amount per gallon" is $1.00. This amount is multiplied by an "emissions factor" that is calculated under § 45Z(b). The emissions factor for a transportation fuel is expressed as "an amount equal to the quotient of—(I) an amount equal to—(aa) 50 kilograms of CO_{2e} per mmBTU, minus (bb) the emissions rate for such fuel, divided by (II) 50 kilograms of CO_{2e} per mmBTU." § 45Z(b)(1)(A). The emissions rate is determined under § 45Z(b)(1)(B)(ii) on the basis, generally, of the GREET model. Under the GREET model, certain pathways and inputs with respect to upstream energy sources (e.g., renewable natural gas) and downstream carbon oxide capture and sequestration from biogenic sources may yield a negative emissions rate under the model. In this scenario, the numerator of the quotient in § 45Z(b)(1)(A) would be higher than 50 kilograms of CO_{2e} per mmBTU and the resulting emissions factor resulting from the quotient would be higher than 1. The negative emissions rate, thus, may produce an applicable amount per gallon that is, in effect, more than $1.00 per gallon. A recent report from Informed Sustainability Consulting shows how ethanol production can achieve net negative emissions through GREET modeling using existing technologies to decarbonize process energy and sequester biogenic emissions.[1] Congress clearly intended this result (i.e., a higher credit amount per gallon), by using the mathematical formulation that it used in the statute. Congress knows how to cap a credit rate when it intends to do so, but did not include any cap on the credit amount for the § 45Z credit. The Guidance should confirm this straight-forward application of the statute and the GREET model.

Liquid Fuels Should Be Measured on a Volumetric Gallon Basis:

Section 45Z(a) provides for a clean production credit that is calculated on the basis, in part, of "the applicable amount per gallon (or gallon equivalent) with respect to any transportation fuel" produced at a qualified facility and sold by the taxpayer within a taxable year. Section 45Z does not otherwise define the terms "gallon (or gallon equivalent)." In the case of the production and sale of a transportation fuel in a liquid form, including low-emission ethanol, the term "gallon" should be defined according to its plain and commonly-understood meaning – as a unit of liquid capacity equal to 231 cubic inches or four quarts. The term "gallon equivalent" should be applied with respect to any nonliquid alternative fuels that are not measured in gallons, such as compressed natural gas. The guidance should confirm that the term "gallon" is applied to liquid fuels such as low-emission ethanol, and "gallon equivalent" is applied to nonliquid alternative fuels.

Renewable Process Heat Should Qualify Only Via Direct Use:

Unlike electricity, process heat is typically produced through onsite combustion of fossil fuels and is not delivered over a common network. Because low-emissions heat generated in one location is not associated with heat used elsewhere due to the lack of a connecting network, indirect accounting mechanisms for low-carbon heat should not be allowable. Further, no recognized standard for thermal renewable energy certificates or other widely accepted indirect accounting mechanisms currently exist. Exceptions to this principle should only be allowable in

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[1] Pathways to Net-Zero Ethanol: Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050, Isaac Emery, Ph.D., of Informed Sustainability Consulting LLC, February 14, 2022, https://d35t1syewk4d42.cloudfront.net/file/2146/Pathways%20to%20Net%20Zero%20Ethanol%20Feb%202022.pdf

situations in which heat is delivered to multiple end-users over a common network and in such cases qualification as a low-carbon resource should require hourly matching as we recommend for imported electricity.

CO2 Utilization Should Qualify as Reduction In Lifecycle Emissions:

The majority of CO2 used in industry currently is sourced from underground reservoirs and results in a net increase in CO2 emissions to the atmosphere. Qualifying facilities that capture and use CO2 from their process should be afforded the same benefits of sequestration from a lifecycle emissions accounting perspective because the use of this CO2 offsets the need to release CO2 from these reservoirs. If utilized CO2 is not deducted from the lifecycle emissions of a qualifying facility, Treasury may incent facilities to stop utilizing CO2 in favor of sequestration to generate more tax credits and thereby require CO2 consumers to turn to geologic sources of CO2. In this arrangement, the Treasury would be incentivizing an inefficient process of burying CO2 at one location and digging it up in another simply to maximize credit value. Treasury should clarify that CO2 utilization qualifies as emissions reduction in lifecycle analysis.

Clarify Whether 45Z Credits Can Be "Stacked" When a Transportation Fuel is Used In Production of Another Transportation Fuel:

Section 45Z(d)(4)(B) restricts the availability of the § 45Z credit in certain circumstances where credits other than that credit are allowed. However, it does not appear that § 45Z imposes any restriction on the availability of § 45Z credits at separate points in the chain of production of transportation fuels. For example, assume a taxpayer produces low-carbon ethanol which satisfies the definition of a "transportation fuel" under § 45Z(d)(5)(A) because it is suitable for use as a fuel in a highway vehicle. The ethanol is sold to an unrelated person in a manner described in § 45Z(a)(4). The unrelated person uses the low-carbon ethanol to produce a sustainable aviation fuel (within the meaning of § 45Z(a)(3)(B)) that likewise is a "transportation fuel" under § 45Z(d)(5)(A). In this example, it would appear that the initial production and sale of the low-carbon ethanol and the subsequent production and sale of the sustainable aviation fuel each qualify for a § 45Z credit. Stated differently, it does not appear that § 45Z imposes any restriction on the multiple credits to the separate taxpayers and fuel production in those circumstances. To be clear, we do not take a position on this issue. However, we believe the guidance should address this issue.

Clarify that the GREET Model Qualifies for use with Aviation Fuels as a "Similar Methodology"

Section 45Z mandates use of Argonne National Laboratory's GREET model to assess the lifecycle emissions intensity of non-aviation fuels. Aviation fuels, however, may use either CORSIA or "any similar methodology" that meets other statutory requirements. Our understanding is the GREET model would meet the requirements of a statutorily satisfactory similar methodology, and we request that the Treasury explicitly clarify that the GREET model is an acceptable methodology for calculating emissions rates for aviation fuels. The GREET model represents the best available science for calculating emissions rates and consistent application of the GREET model across aviation and non-aviation fuels would provide certainty for project development and allocate capital to projects with the greatest emissions reduction impact.

.01 <u>Section Credits for Clean Hydrogen</u>

> ***(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 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?***

Renewable Process Electricity Should Qualify Only if Local and Time Matched

Please reference our section response above to **.02 Clean Fuel Production Credit (§ 45Z)** ***"Question (7) Please provide comments on any other topics related to § 45Z credit that may require guidance."***

Antora also shared similar comments with the U.S. Department of Energy (DOE) during the public comment period for the development of the Clean Hydrogen Production Standard.

We found that failure to use such hourly emissions or tightly matched certifications could result in false claims of emission reductions and in many cases even directly subsidize dramatic increases in greenhouse gas emissions. For example, a hydrogen producer might contract for additional renewable electricity that is produced at times or locations where renewable electricity has already saturated the grid, resulting in renewable generation that fails to produce additional emissions reductions. At the same time, the same company could serve the incremental electric load for hydrogen production by increasing generation from emissions-intensive electricity at the times and locations where the hydrogen load actually occurs. Given the desire to operate hydrogen electrolyzers at high load factors and that baseload power prices are lowest in regions of the U.S. with coal-based electric production, it is likely that significant hydrogen production will occur in a way that increases emissions in this manner. A recent study from Princeton's ZERO Lab on hydrogen production with grid-connected electrolysis rigorously confirms this intuition that a lack of hourly and spatial matching could directly incentivize large increases in CO2 emissions (Appendix B).

No "Additionality" Requirement Should be Imposed on Renewable Electricity

Please reference our section response above to **.02 Clean Fuel Production Credit (§ 45Z)** ***"Question (7) Please provide comments on any other topics related to § 45Z credit that may require guidance."***

Appendix A: Hunton, Andrews Kurth Briefing Paper (Nov 14, 2022), “Comments in Response to Notice 2022-58 Section 45Z Clean Fuel Production Credit Claiming 45Q and 45Z Credits”.

HUNTON
ANDREWS KURTH

Briefing Paper
Comments in Response to Notice 2022-58
Section 45Z Clean Fuel Production Credit
Claiming 45Q and 45Z Credits

November 14, 2022

The Inflation Reduction Act of 2022, Pub. L. 117-169 ("IRA") provides a new tax credit for the production of a transportation fuel that satisfies certain emissions requirements under § 45Z of the Internal Revenue Code ("Code").[1] Under § 45Z(d)(4), the term "qualified facility" is defined as a facility used for the production of transportation fuels, but does not include "any facility for which one of the following credits is allowed under section 38 for the taxable year...." Among the credits listed under § 45Z(d)(4) is the credit for carbon oxide sequestration under § 45Q. Taxpayers require guidance on the application of this double-benefit provision in the case of a facility that foregoes the § 45Q credit and instead claims the § 45Z credit during the 2025, 2026, and 2027 taxable years, but may claim the § 45Q credit for taxable years before and after the 3-year § 45Z credit period (this issue is referred to herein, as the "Guidance").

Background

This paper address the situation where an owner of an ethanol production facility installs carbon capture equipment at an ethanol facility to capture CO_2 associated with the production process. The captured CO_2 will be permanently sequestered in a secure geological formation according to the requirements of the § 45Q credit. Subject to satisfying all of the requirements, the § 45Q credit is available for CO_2 captured and sequestered for 12 years from the date that the carbon capture equipment is placed in service. The carbon capture equipment will be placed in service in 2024 (or potentially in a later taxable year before 2028). By capturing and sequestering the CO_2 from the ethanol production, the lifecycle greenhouse gas emissions rate of the low-carbon ethanol is expected also to satisfy the requirements for a qualifying transportation fuel within the meaning of § 45Z. The ethanol production facility, inclusive of the carbon capture equipment, would potentially qualify for both the § 45Q credit and § 45Z credit.

The expanded § 45Q credit provides a taxpayer, who uses carbon capture equipment to capture carbon oxide emissions and sequester or utilize such carbon oxide, with a credit for each metric ton of carbon oxide sequestered or used. § 45Q(a). Prior to enactment of IRA, the § 45Q credit required that construction of a qualified facility and construction of the carbon capture equipment generally begin before 2026. IRA extended the begun-construction deadline to December 31, 2032, increased the credit amount for each metric ton captured and sequestered or utilized, and reduced the threshold amount of carbon oxide required to be captured.

Effective for fuel produced and sold after December 31, 2024, the new § 45Z credit generally provides a taxpayer who produces and sells qualifying transportation fuel with a credit of an applicable amount, calculated as an emissions factor multiplied by the gallons (or gallons equivalent), produced at a qualifying facility and sold in a qualifying manner. § 45Z(a)(1).

[1] All Section (§) references to the Code are as amended by the Inflation Reduction Act of 2022, Pub. L. 117-169.

By its terms, the § 45Z credit is only available for a qualified facility with respect to (i) qualifying transportation fuel produced after December 31, 2024, and (ii) sold by December 31, 2027. On the other hand, the § 45Q credit is available to be claimed at the qualified facility for the 2024 taxable year when the equipment is placed in service and for 12 years after the placed in service date. However, with respect to the 45Z credit, a "qualified facility" does not include any facility for which a § 45Q credit, among other specified credits, is allowed for the taxable year. § 45Z(d)(4)(B), (B)(iii). This definition of qualified facility for purposes of the § 45Z credit, thus, prohibits claiming both the § 45Q credit and the § 45Z credit under certain circumstances. Section 45Q does not impose any double-benefit restrictions on claiming the § 45Z credit in any taxable year for which the § 45Q is claimed. Thus, it is § 45Z(d)(4) that is relevant here.

Discussion

This briefing paper addresses the following interrelated issues: (1) Whether the term "is allowed" in § 45Z(d)(4) may preclude the use of the § 45Z credit because of the potential allowance of the § 45Q credit for the 2024 taxable year, assuming the taxpayer's facility and carbon capture and sequestration process is otherwise qualified for the 45Q credit; and (2) whether a taxpayer may claim the § 45Q credit for subsequent taxable years after claiming the § 45Z credit during the 2025, 2026, and 2027 taxable years, with respect to the same facility.

As explained in more detail below, the statutory language supports claiming the § 45Q credit in the taxable years beginning when the carbon capture equipment is placed in service and the § 45Z credit is not available. In other words, based on the above assumptions, the taxpayer may claim the § 45Q credit beginning on the date that the carbon capture equipment is placed in service through December 31, 2024, then claim the § 45Z credit for the 2025-2027 taxable years, and resume claiming the § 45Q credit on January 1, 2028, even though the § 45Q credit is allowable for those same taxable years and is claimed for the 2024 taxable year and taxable years after 2027. The Guidance should confirm this understanding.

The new § 45Z credit is effective for transportation fuel produced after December 31, 2024, and sold on or before December 31, 2027. § 45Z(g). As such, the credit may be claimed in taxable years within the 3-year period between the effective date and the termination date – i.e., during 2025, 2026, and 2027. As a starting point, the § 45Q credit is available for a 12-year period from the date the carbon capture equipment is placed in service, while the § 45Z credit is only available for a 3-year period. Because an ethanol facility may qualify for both tax credits, it may be preferable to apply the § 45Z credit during its applicable period and the § 45Q credit during its applicable period, excepting taxable years where the other credit has been claimed.

The omission of a double-benefit denial provision to the overall investment appears to be intentional based on the statutory language and based on other double-benefit denial provisions Congress has used both in the IRA and previously in the Code. In other words, Congress knows how to draft a prohibition against the application of the two credits in separate taxable years with respect to the same facility. For example, in IRA, Congress specifically added a double-benefit denial provision in § 45V for clean hydrogen production with respect to claiming the § 45Q credit at the same facility. Section 45V(d)(2) provides:

Coordination with credit for carbon oxide sequestration. No credit shall be allowed under this section with respect to any qualified clean hydrogen produced at a facility which includes carbon capture equipment for which a credit is allowed to any taxpayer under section 45Q *for the taxable year or any prior taxable year*. [Emphasis added.]

The § 45V tax credit for clean hydrogen cannot be claimed if the § 45Q credit was claimed for the same facility by any taxpayer for the taxable year in question or any prior taxable year. Thus, Congress is able to succinctly and expressly prohibit a double-benefit option to an investment—when it so intends. In contrast, in its definition of "qualified facility," § 45Z provides that a "qualified facility" does not include any facility for which a § 45Q credit is allowed for the taxable year. § 45Z(d)(4)(B), (B)(iii) (emphasis added.) First, it is important to note the use of the phrase "taxable year" in this provision. Section 45Z expressly limits its own definitional limitation to a single taxable year – i.e., the taxable year in question. By negative inference and by using the term "taxable year,"[2] Congress invites an analysis of credits on a taxable-year basis rather than a facility-by-facility basis. Based on a plain language reading of the applicable statute, § 45Z, a taxpayer may claim § 45Q tax credit in one taxable year without precluding its ability to claim the § 45Z tax credit in a separate taxable year, with respect to the same facility.

Further, the "qualified facility" definition in § 45Z(d)(4)(B) precludes a taxpayer from claiming the § 45Z credit when the § 45Q credit "is allowed" for the same taxable year and at the same facility. As explained below, Congress' use of the term "allowed" means that the § 45Z credit is not available in a taxable year if the § 45Q credit is actually claimed for the same facility for the same taxable year.

It is well established in the tax law that the term "allowed" means actually claimed, while the term "allowable" means could be claimed. In certain provisions of the Code, Congress has used the terms "allowed" and "allowable" to describe deductions and credits. The distinction between these two terms is best illustrated by § 1016 (and its predecessor provisions) – which deals with adjustments to tax basis from depreciation and other tax allowances. Under § 1016, "the cost or other basis of property shall be decreased ... by the greater of the following two amounts: (a) the amount <u>allowed</u> as deductions in computing taxable income, to the extent resulting in a reduction of the taxpayer's income taxes, or (b) the amount <u>allowable</u> for the years involved." Treas. Reg. § 1.1016-3(a) (emphasis added). This provision reflects the disparate use of the term "allowed" versus the term "allowable" and means that basis is reduced by the greater of the amount of depreciation "allowed," i.e., actually claimed, or the amount of depreciation "allowable," i.e., could be claimed but not actually claimed. This distinction between "allowed" and "allowable" was explained by the U.S. Supreme Court in *Virginia Hotel Corp. of Lynchburg*, 319 U.S. 523, 525-528 (1943). There, the Supreme Court explained that § 1016 "makes plain that the depreciation basis is reduced by the amount 'allowable' each year whether or not it is claimed." On the other hand, the Supreme Court explained that the term "allowed" connotes "a grant" – i.e., it is actually claimed on a tax return.

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[2] The term "taxable year" is defined, under IRC § 7701(a)(23), as "the calendar year, or the fiscal year ending during such calendar year, upon the basis of which the taxable income is computed under subtitle A [and] includes, in the case of a return made for a fractional part of a year under the provisions of subtitle A or under regulations prescribed by the Secretary, the period for which such return is made."

The Tax Court has cogently explained this distinction and the accepted meaning of the term "allowed," as follows:

> Generally, courts have held that words with a fixed legal or judicially settled meaning must be presumed to have been used in that sense. Throughout the Code, a distinction is made between the terms "allowable deduction" and "allowed deduction" which distinction is not insignificant. Unfortunately, as with many terms of art in the area of tax law, these terms are often interchanged with one another causing confusion. We must rely on the words of the statute as generally understood and to do otherwise would be to redraft the statute. "Allowed" and "allowable" have fixed meanings in the tax arena, and we interpret statutes using these terms in light of their understood meanings except where to do so would create absurd results. "Allowable deductions" generally refers to a deduction which qualifies under a specific Code provision whereas "allowed deduction," on the other hand, refers to a deduction granted by the Internal Revenue Service which is actually taken on a return and will result in a reduction of the taxpayer's income tax. Respondent in fact defined the terms "allowable" and "allowed" in I.T. 2944, XIV-2 C.B. 126 (1935), as follows:
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> > The word "allowable" designates the amount permitted or granted by the statutes, as distinguished from the word "allowed" which refers to the deduction actually permitted or granted by the Bureau. Thus, one might have an item of expense which is allowable as a deduction; however, the deduction is not allowed. In *Day v. Heckler*, [735 F.2d 779, 784 (4th Cir. 1984)], for example, it was noted that certain land clearing expenses were an "allowable deduction" under the Code; however, such deduction would not be "allowed" unless the taxpayer made an election to take such deduction.

Lenz v. Commissioner, 101 T.C. 260, 265 (1993) (citations omitted). These principles are well-established and longstanding.[3]

As applied to the scenario described in the Background section, while the § 45Q credit will be <u>allowable</u> for the taxable years in which the § 45Z credit is available (i.e., during the 2025-2027 taxable years), the § 45Q credit will <u>not</u> have been <u>allowed</u> for those taxable years unless it is actually claimed in those years. The difference in this case is the distinction between credit eligibility (allowable) and a claimed credit (allowed). Thus, the provision in § 45Z requires that the § 45Q credit actually be claimed for the qualified facility for the same taxable year in which the taxpayer seeks to claim a § 45Z credit before the taxpayer is precluded from claiming the § 45Z credit.

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[3] *See, e.g., U.S. v. Hill*, 506 U.S. 546, 557 (1993); *U.S. v. Ludey*, 274 U.S. 295 (1927); *Day v. Heckler*, 735 F.2d 779, 784 (4th Cir. 1984); *Kilgroe v. U.S.*, 664 F.2d 1168, 1170 (10th Cir. 1981); *Hinckley v. Comm'r*, 410 F.2d 937 (8th Cir. 1969); *U.S. v. Koshland*, 208 F.2d 636 (9th Cir. 1953); *Fidelity-Philadelphia Trust Co. v. Comm'r*, 47 F.2d 36 (3d Cir. 1931); *Spencer v. Comm'r*, 110 T.C. 62, 88-89 (1998); *Reinhardt v. Comm'r*, 85 T.C. 511, 515-516 n.6 (1985); *Las Cruces Oil Co., Inc. v. Comm'r*, 62 T.C. 764, 768 n.9 (1974); *Collins v. Comm'r*, 18 T.C. 99 (1952), aff'd. 203 F.2d 565 (6th Cir. 1953); *Hodgkins v. Comm'r*, T.C. Memo. 1996-53; *Brock v. Comm'r*, T.C. Memo. 1994-177; Rev. Rul. 67-451, 1967-2 C.B. 267.

Furthermore, the same statutory analysis applies to a taxpayer claiming the § 45Q credit for a prior taxable year – in this case, for the 2024 taxable year – but later claiming the § 45Z credit for the 2025-2027 taxable years. The double-benefit restriction in § 45Z(d)(4)(B) prevents a taxpayer that prefers to claim the § 45Z credit from also claiming the § 45Q credit for the 2025-2027 taxable years, but does not preclude a taxpayer from claiming the § 45Z credit for those taxable years or the § 45Q credit in other separate taxable years.

Requested Guidance: The Guidance should confirm that a taxpayer is permitted to claim the § 45Z credit during the 2025, 2026, and 2027 taxable years – provided the taxpayer does not claim the § 45Q credit during those same taxable years. The Guidance should further confirm that the taxpayer may claim the § 45Z credit during the 2025, 2026, and 2027 taxable years, even if it claimed the § 45Q credit in a prior taxable year (i.e., 2024) and/or claims the § 45Q credit during the remaining credit period under that section after 2027.

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David S. Lowman, Jr.
Timothy L. Jacobs
Jennifer Potts Seybold

Appendix B: Ricks, Xu, and Jenkins. Princeton University Zero Lab Policy Memo (Sep 20, 2022), "Cost and Emissions Impacts of Hydrogen Production Tax Credit Implementations".

PRINCETON UNIVERSITY

ZERO LAB

Zero-carbon Energy Systems Research and Optimization Laboratory

POLICY MEMO

Cost and Emissions Impacts of Hydrogen Production Tax Credit Implementations

Wilson Ricks, Qingyu Xu and Jesse D. Jenkins
Princeton University | September 20, 2022

Executive Summary

- **Depending on its implementation, the Inflation Reduction Act's low-carbon hydrogen production tax credit could directly incentivize large *increases* in electricity grid CO_2 emissions.**
- **Embodied emissions from grid-connected hydrogen electrolysis could be two times worse than conventional 'grey' hydrogen.**
- **Requiring hydrogen producers to procure carbon-free electricity matching their annual consumption does not reduce emissions.**
- **Only hourly matching of electricity use with clean energy procurements can ensure low-carbon hydrogen production.**
- **Hourly matching requirements raise the cost of hydrogen but are unlikely to make it uneconomic.**

Introduction

With the passage of the Inflation Reduction Act, the United States introduced robust new subsidies for production of low-carbon hydrogen (Internal Revenue Code Section 45V). Hydrogen produced through a process with less than 4 $kgCO_{2e}$ per kgH_2 well-to-gate lifecycle emissions will receive a production tax credit (PTC) of at least \$0.60/kg, and up to \$3/kg for lifecycle emissions less than 0.45 $kgCO_{2e}/kgH_2$. By comparison, the current cost of producing 'grey' hydrogen via steam methane reforming is roughly \$1/kg, with lifecycle emissions of 10 $kgCO_{2e}/kgH_2$. The new IRA subsidies will be particularly relevant for 'green' hydrogen – produced via electrolysis using carbon-free electricity inputs – which can achieve very low embodied emissions rates but currently has much higher production cost than grey hydrogen. By providing financial incentives for large-scale electrolysis deployment, the hydrogen PTC can help drive down the cost of these systems and catalyse a robust clean hydrogen economy in the United States.

Although the IRA statute specifies the emissions thresholds necessary to receive subsidies, and even a standard tool for accounting (ANL's GREET model), **there is still a significant gap in the emissions accounting methodology for green hydrogen that must be filled by federal policymakers.** The lifecycle emissions of hydrogen electrolysis are extremely sensitive to the embodied emissions in the input electricity, and how the cleanliness of input electricity will be scored under the IRA has yet to be determined. This is not a significant problem when electrolysis is performed only using 'behind-the-meter' clean electricity, but accounting for emissions becomes much more complex when electrolyzers are connected to the electricity grid. **Current average grid electricity emission rates are far too high to enable hydrogen production below even the minimum PTC emissions intensity threshold specified by the IRA.** Hydrogen producers may still seek to reap the benefits of a grid connection, which enables higher utilization rates and lower levelized production costs, while claiming clean electricity inputs by signing power purchase agreements (PPAs) with zero-carbon generators or purchasing of energy attribute certificates (EACs) from the same.

In implementing 45V the IRS, with technical input from DOE and other federal agencies, must determine the conditions under which producers with such arrangements will or will not qualify to receive the hydrogen PTC. **A lifecycle emissions accounting method that is too simplified may directly subsidize hydrogen production that *increases* carbon emissions relative to the current baseline, though a method that puts too much burden on hydrogen producers runs the risk of disincentivizing electrolysis deployment.**

In this memo we present an analysis quantifying the cost and emissions trade-offs of a range of possible implementations of the hydrogen PTC, with the aim of supporting policymakers in their determination of an appropriate path forward.

Approach

We used the GenX electricity system optimization model to evaluate the emissions impacts of hydrogen production via grid-connected electrolysis under several possible implementations of the IRA clean hydrogen PTC. We used a six-zone model of the US Western Interconnection (Figure 1) as an example system, and optimize electricity system investments and operations using a methodology designed to replicate the outcomes that would be seen under a competitive electricity market. We model system outcomes for the year 2030, taking into account new IRA subsidies for electricity technologies and all existing state policies.

To explore the impacts of grid-based hydrogen production we added a single large hydrogen load to the southern California zone. This example hydrogen producer can adjust its production based on electricity prices to maximize its revenue, and it can contract individually with local clean energy and storage resources (via PPAs or EACs) to meet any policy requirements. We evaluate the emissions intensity of this hydrogen production in all cases via two approaches:

1. **Attributional Emissions:** The share of total emissions that would be attributed to hydrogen under a typical EPA-style evaluation. Emissions intensity at a given hour is the net of electrolysis consumption and contracted clean generation, multiplied by the local grid's current emission rate.
2. **Consequential Emissions:** The true electricity system-level emissions impact of hydrogen production, relative to a counterfactual scenario in which the hydrogen production does not occur.

In addition to emission rates we also assess the impacts of various policies on the cost of hydrogen production. Policy scenarios analysed include: **No Requirements**, in which hydrogen demand is added without any required offsets; **100% Annual Matching**, in which hydrogen producers must procure enough carbon-free electricity production to completely offset their annual consumption; and **100% Hourly Matching** (also called '24/7 CFE'), in which producers must match their consumption with procured carbon-free generation at every hour of the year. We vary several other parameters to explore possible outcomes, including the hydrogen sale price, hydrogen production capacity, and the definition of the 'local' zone within which the hydrogen producer can source clean electricity.

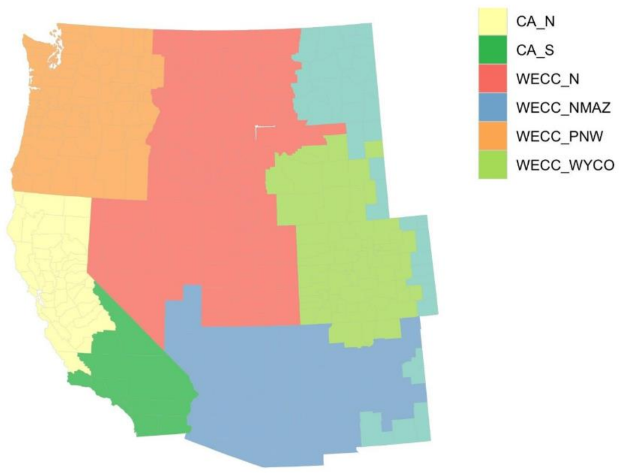

Figure 1: Illustration of the modeled WECC electricity system and its component zones.

Findings

The emissions intensity of hydrogen produced via electrolysis in a 2030 California grid is too large to qualify for the PTC. With no offsets, both attributional and consequential emissions from

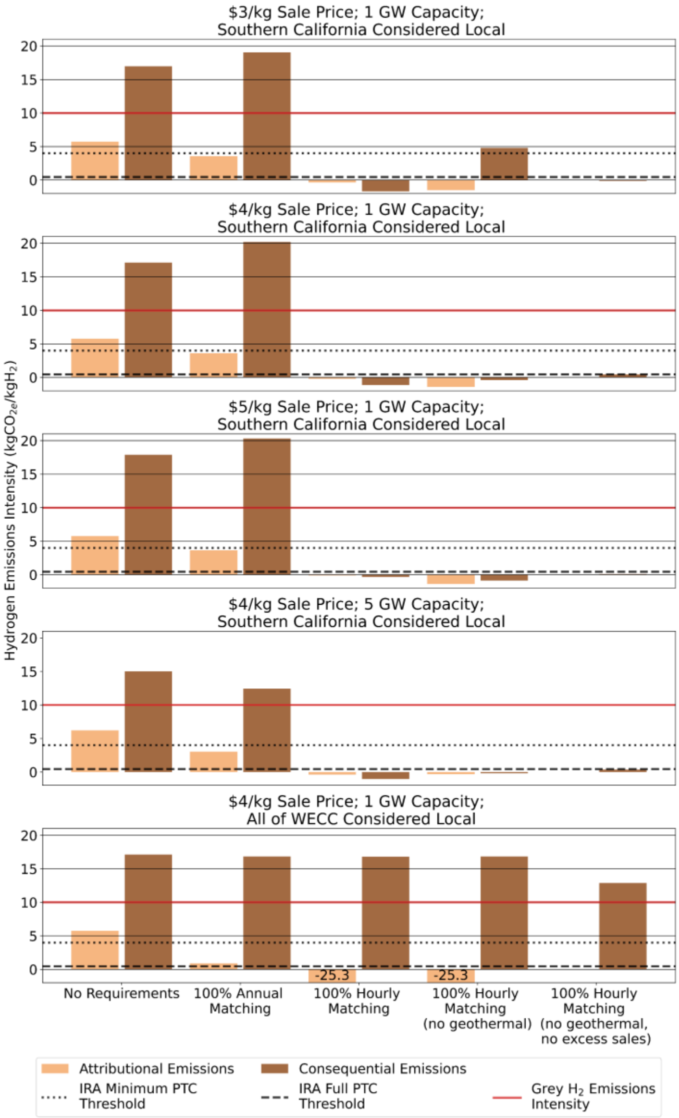

Figure 2: Attributional (left) and Consequential (right) emissions rates from grid-produced hydrogen under a range of policy options and other scenarios.

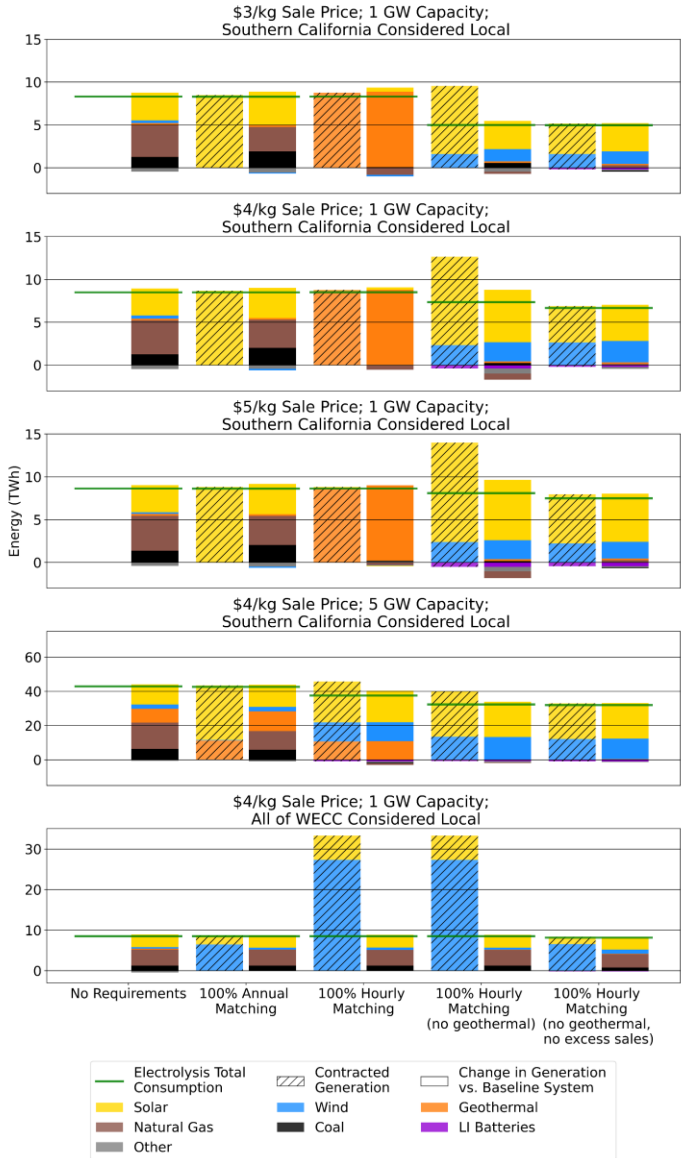

Figure 3: Total electricity consumption by hydrogen producers (green lines), compared with procured clean generation (left) and the actual observed changes in generation used to supply the additional hydrogen demand (right), under the same scenarios shown in Figure 1.

hydrogen production are greater than the minimum PTC threshold (see Figure 2). This is despite ~78% clean electricity in the southern California grid. Consequential emissions are larger than those of even grey hydrogen. As shown in the leftmost column Figure 3, the presence of an additional hydrogen load in the system incentivizes a mix of additional generation consisting of some renewables, but nearly equal amounts of gas and coal. As California is likely to be one of the cleanest grid regions in the country by 2030, it is probable that the emissions impact of hydrogen production from bulk grid electricity (i.e., without new clean generation dedicated to supply hydrogen production) will be even worse elsewhere.

100% Annual Matching does little to nothing to reduce hydrogen embodied emissions. In scenarios where 100% Annual Matching is required, attributional emissions fall only slightly, and consequential emissions even *increase* relative to simply purchasing bulk electricity. In the worst cases, the global emissions impact of hydrogen production with 100% Annual Matching is double that of grey hydrogen, and more than 40 times the full PTC threshold. As shown in the second column of Figure 3, hydrogen producers required to match 100% of their annual demand do so primarily with solar power, the lowest-cost carbon-free energy

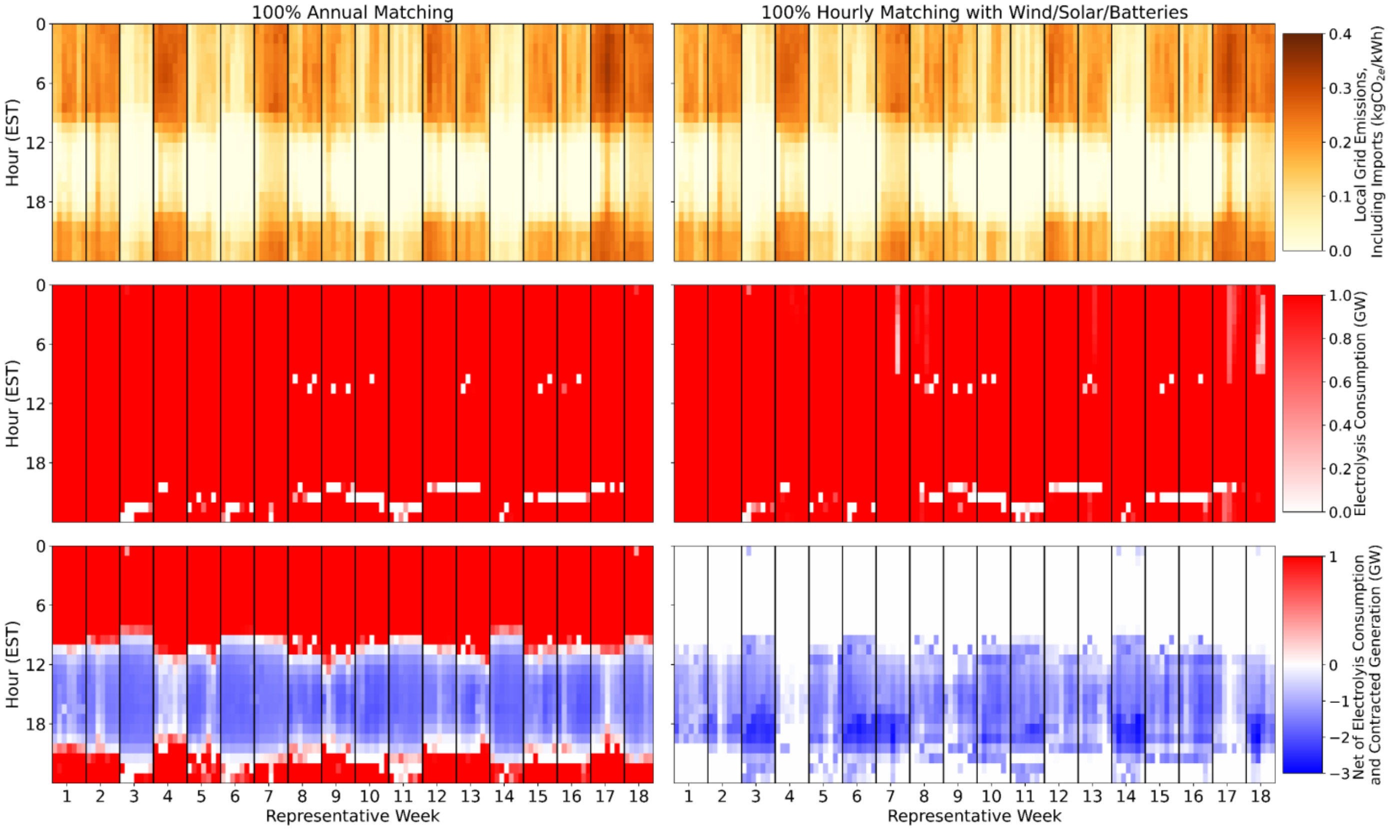

Figure 4: Time series data showing local grid emissions (top), hydrogen electrolysis electricity consumption (middle), and electrolysis consumption minus procured clean generation (bottom), for both 100% Annual Matching and 100% Hourly Matching scenarios. Grid emissions rates are generally much higher at night, while excess procured generation occurs during daytime hours.

source available in the region. Despite these procurements, the actual additional generation mix used to meet the additional hydrogen demand in the system is nearly identical to that of the No Requirements case. This is to say, the 100% Annual Matching renewable energy procurements provide nearly zero additionality. Even under accounting procedures where these procurements are assumed to be additional (i.e. the Attributional accounting method), they still fail to fully offset emissions from hydrogen production. This is because average grid emissions are generally much higher during times when hydrogen demand exceeds procured clean supply than they are during times when the opposite is true (see Figure 4).

Requiring 100% Hourly Matching leads to near-zero additional emissions from hydrogen production, as long as hydrogen production and time-matched clean electricity resources are located in the same grid region. 100% Hourly Matching requirements lead to massively reduced attributional and consequential emissions compared to No Requirements and 100% Annual Matching cases, as long as both the hydrogen production and procured resources are located in southern California. As shown in Figure 2, **the choice to enforce a 100% Hourly Matching requirement reduces emissions by on the order of 10-20 $kgCO_{2e}$ per kg of hydrogen produced in the system relative to a 100% Annual Matching requirement.** Procured generation in 100% Hourly Matching cases very closely matches the actual observed change in the generation mix due to electrolyzer consumption (Figure 3), implying that hydrogen producers are in fact procuring all the additional carbon-free generation needed to match their demand at all times.

Sales of excess clean electricity can sometimes lead to additional emissions. In one observed case where hydrogen producers are allowed to sell excess clean electricity to the grid, market interactions resulting from these sales lead to greater coal generation in another model zone. These interactions are unpredictable (and can

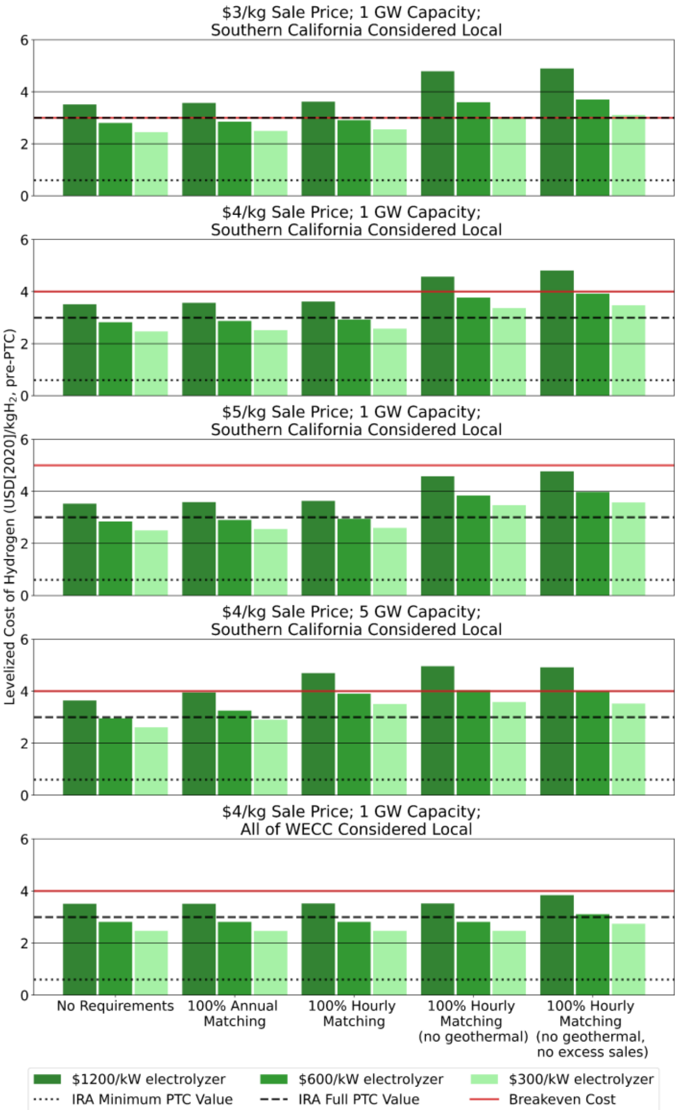

Figure 5: Levelized cost of hydrogen (LCOH) under the same scenarios shown in Figures 1 and 2, compared with potential sales prices. LCOH calculations assume a 10-year payback period, 8% WACC, annual O&M costs equal to 5% of CAPEX, and an $85/kW-yr transmission interconnection cost.

sometimes lead to net-negative emissions impacts from excess clean electricity sales) but can be eliminated by forbidding excess sales. This is the most restrictive policy option and the one most certain to have a near-zero global emissions impact.

Allowing resource procurement over large geographic areas leads to significant emissions from hydrogen production, even if 100% Hourly Matching is enforced. In cases where all of the Western Interconnection is considered 'local', allowing the hydrogen producers in southern California to (for example) procure wind power in Wyoming to meet their requirements, even a 100% Hourly Matching policy cannot guarantee low emissions intensities (see Figures 2 and 3, bottom row). This is because transmission constraints between model regions prevent procured resources in distant locations from actually injecting additional energy into the region where hydrogen production occurs. Instead, with a 100% Hourly Matching policy in place, these contracted resources simply displace other clean options in their own zones while fossil resources provide the additional generation needed to meet hydrogen demand in southern California. This finding implies that resources subject to significant transmission constraints cannot be relied on to eliminate emissions from hydrogen production. **Unlike the model system used here, the real grid is not divided neatly into well-connected zones, and transmission bottlenecks of varying severity exist at all spatial scales.** It will therefore be the job of policymakers to limit the qualifying procurement of clean electricity by hydrogen producers to a geographic area that is not overly restrictive, but that avoids any large transmission bottlenecks likely to inhibit emissions reductions.

Stricter policies lead to moderately increased hydrogen costs. Figure 5 shows the levelized cost of hydrogen (LCOH) under the same scenarios shown in Figures 1 and 2, for installed electrolyzer system costs of $1200/kW (an upper bound on the current cost), $600/kW (a 'moderate' possible cost in 2030), and $300/kW (a 'low' possible cost in 2030). The cost differences between cases with No Requirements, 100% Annual Matching, and 100% Hourly Matching show that enforcing a 100% Hourly Matching requirement generally adds between $0-1 to the LCOH. The additional costs are near-zero when clean firm resources like geothermal are available for procurement. Even in cases where only wind, solar and batteries can be relied on, it is likely that hydrogen produced under a 100% Hourly Matching requirement will still be financially viable. For sales prices of $1/kg or greater (assuming an additional $3/kg subsidy), which would slightly undercut traditional grey hydrogen, green hydrogen producers are likely to break even or make a profit on their investments.

Summary

The choice of how to implement the IRA hydrogen PTC will have significant emissions consequences. With the very real possibility of millions of tons per year of domestic hydrogen production supported by billions of dollars in PTC subsidies by 2030, the additional GHG emissions resulting from this production could be significant. We have found that requiring hydrogen producers to match their consumption of electricity with locally procured clean generation on an hourly basis, rather than allowing annual matching or enforcing no requirements, can reduce real GHG emissions by up to 20 $kgCO_{2e}$ per kg of hydrogen produced. Meeting this requirement will come at an additional cost to hydrogen producers, but the full PTC subsidy will likely be large enough to support investment. The logistics of implementing a strict 100% Hourly Matching requirement will be more challenging, as markets for time-based PPAs or EACs do not currently exist in the United States. The government may therefore wish to adopt a phased approach to enforcing a strict time-matching requirement while directly supporting development of the required accounting standards and market mechanisms to enable the creation, tracking, and trade of time-based energy attribute certificates (T-EACs). Such efforts would also support the Biden Administration's Executive Order 14057, which establishes the goal to power Federal facilities with 100 percent carbon pollution-free electricity (CFE), including at least 50 percent on a 24/7 basis.