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Internal Revenue Service
CC:PA:LPD:PR (REG-117631-23)
Room 5203
P.O. Box 7604, Ben Franklin Station,
Washington, DC 20044

Submitted via the Federal eRulemaking Portal at www.regulations.gov

Re: **REG-117631-23: Section 45V Credit for Production of Clean Hydrogen, Section 48(a)(15) Election to Treat Hydrogen Production Facilities as Energy Property**

Air Company appreciates the opportunity to respond to the US Department of the Treasury ("Treasury") and the Internal Revenue Service (IRS) notice of proposed rulemaking on Section 45V Credit for Production of Clean Hydrogen. We appreciate the Treasury's effort to develop clear guidelines under Section 45V of the Internal Revenue Code. Clear and practicable regulations will provide certainty to the clean hydrogen producers and clean hydrogen consumers and enable nascent clean energy industries to grow and existing carbon intensive sectors to decarbonize.

1. Introduction

In this letter, we focus on electricity sourcing requirements for electrolytic hydrogen projects. We understand the Treasury's rationale for including the so-called "three pillars" associated with electricity procurement, and recognize that the incrementality, temporal matching, and deliverability requirements are designed to mitigate against indirect emissions that could occur when a large number of green hydrogen projects go online. Long-term, including these requirements is reasonable to achieve net zero. However, it is critical to note that the green hydrogen industry is a nascent one, faced with multiple risks and challenges on its path to commercial and widespread scale. The US Department of Energy (DOE), among other US agencies, has been leading the way in accelerating clean energy technology innovation, and can appreciate that to scale a new technology, let alone an entire new industry, it is critical to create favorable conditions for the industry's initial growth by reducing cost and complexity.

In this letter, we express concern with several proposed requirements associated with electricity procurement for production of electrolytic ("green") hydrogen.[1] These requirements are expected to significantly increase the costs of production and complexity of electricity procurement and limit the feasibility of green hydrogen production in the United States, counter to the Biden Administration's goals, the DOE's National Hydrogen Strategy, and Congressional intent. We propose several critical improvements for the Treasury's consideration that will maintain the core tenets outlined in the Notice of Proposed Rulemaking

[1] When discussing green hydrogen in this letter, we imply hydrogen produced from any zero-emissions electricity source, such as wind, solar, hydropower, and nuclear.

(NOPR) on Section 45V Credit for Production of Clean Hydrogen while ensuring that the rules are practicable, relevant to the US context, and recognize the realities of today's carbon-free electricity market. The proposed modifications, if adopted, would truly enable the growth of the green hydrogen industry that's been dubbed a Swiss Army knife solution for its anticipated ability to decarbonize most sectors of the economy, and hard-to-abate sectors in particular.

We urge the Treasury to consider and adopt modifications to the NOPR proposed in this letter to position the US as a leader in green hydrogen and hydrogen-derived fuels and chemicals. Alternatively, the US will not be in the position to meet the US National Clean Hydrogen Strategy and Roadmap objectives, which aim to reduce the cost of clean hydrogen to $1 per 1 kg by 2031 and for hydrogen to play a prominent role in the US reaching net zero by 2050. Moreover, clean hydrogen is expected to play a critical role in enabling the US to meet the SAF Grand Challenge targets as it is a critical feedstock for the power-to-liquid sustainable aviation fuel (SAF) pathway, among other SAFs. The proposed rules, if implemented as proposed, will undermine the US's ability to meet the aforementioned targets.

The implications of this rulemaking are significant because it will determine to what extent the green hydrogen industry is successful in the US. In addition, multiple innovative climate solutions currently in development, such as power-to-X (PtX) technologies, are dependent on cost-effective and readily available clean hydrogen as a feedstock. PtX encompasses carbon conversion technologies that turn clean hydrogen and captured carbon dioxide (CO_2) into carbon-neutral synthetic fuels such as eSAF and e-methanol, as well as an endless array of sustainable drop-in chemicals that can serve as a direct replacement for highly carbon intensive incumbents.

PtX technologies are expected to play a critical role in decarbonizing hard-to-abate modes of transportation, including aviation and maritime shipping. According to the International Air Transport Association (IATA)'s modeling of potential GHG emissions reductions from the use of SAF based on the industry's international net zero target, replacing 80-90% of conventional aviation fuel with SAF would result in a 62% reduction in global aviation CO_2 emissions by 2050, which would require about 40% of the SAF used to be PtL SAF made with CO_2 and green hydrogen as feedstocks.[2] A recent International Energy Agency's report stresses that PtX fuels add to the diversification of decarbonization options for transport, and concludes that green hydrogen-fuels could be scaled rapidly by 2030, but reduction in production costs is key.[3] The US currently has a unique opportunity to become a leader in the PtX technologies and hydrogen-based fuels, but overly complex and stringent requirements for electricity sourcing will significantly hamper this industry's development and growth in the US.

Enforcing stringent requirements on electricity sourcing as proposed in the NOPR will not be conducive to allowing the green hydrogen industry to grow and will mostly lead to the gray hydrogen industry maintaining its market share, while helping the blue hydrogen industry capture the clean hydrogen market (given that the industry can benefit from an established and

[2] Energy and New Fuels Infrastructure Net Zero Roadmap," IATA, https://www.iata.org/contentassets/8d19e716636a47c184e7221c77563c93/energy-and-new-fuels-infrastructure-net-zero-roadmap.pdf

[3] "The Role of E-Fuels in Decarbonizing Transport," International Energy Agency, 2024 https://www.iea.org/reports/the-role-of-e-fuels-in-decarbonising-transport

lucrative 45Q tax credit).[4] This will permanently lock out green hydrogen from the clean hydrogen market, undermine the US transition away from fossil fuels, and set the US behind other leading jurisdictions such as the EU that are prioritizing green hydrogen and hydrogen-based fuels in the coming years.

The US has a unique opportunity to become a world leader in green hydrogen and PtX technologies that enable production of sustainable and drop-in liquid fuels and chemicals that can drive significant GHG emissions reductions in hard-to-abate sectors (e.g., aviation, maritime, chemical manufacturing). All of this is thanks to the transformative 45V tax credit enacted as part of the historic Inflation Reduction Act. Unfortunately, should the regulations be finalized as proposed with no additional flexibility, multiple industries, including PtX will be stymied, and innovation and technology development will shift to other regions, creating a missed opportunity for the US. Meanwhile, the US will continue to subsidize the fossil fuel industry further delaying the clean energy transition and continuing to play a major role in driving global climate change.

In order for the 45V PTC to enable the growth of the green hydrogen industry, we recommend the following changes to the final rule that are discussed in more detail in this letter:

- Incrementality
    - Provide a transition period for incrementality requirements until January 1, 2030, allowing hydrogen projects that begin construction before this date to be exempt from the incrementality requirement and grandfathered for the duration of the 45V tax credit.
        - In particular, the Treasury should allow the 2030 transition and grandfathering for small businesses, pilot and demonstration projects, projects that are producing green hydrogen as a feedstock for further conversion into e-fuels and e-chemicals, and for first-of-a-kind commercial facilities.
    - Allow projects located in states with grid decarbonization targets included in state law, grid intensity <500 lbCO_2/MWh,[5] and with carbon pricing mechanisms in place (e.g., NY, CA, WA) to be considered in compliance with the incrementality requirement.
    - Adopt the formulaic approach and increase it to 10% starting in 2030 (in the context of the proposed transition period).
- Time-matching
    - Include a longer transition period to hourly matching, enforcing it not earlier than 2030, and only for projects that start construction on or after January 1, 2030.
    - Allow projects that start construction before the hourly-matching requirement is in effect to be exempt from the hourly matching requirement for the duration of the 45V PTC to alleviate the uncertainty and cost increases for early movers.
        - At a minimum, a longer transition and grandfathering should be allowed for small businesses, pilot and demonstration projects, projects that are

[4] "Scaling Green Hydrogen in a post-IRA World." Rhodium Group, March 2023, https://rhg.com/research/scaling-clean-hydrogen-ira/

[5] EPA. 2023. "Emissions & Generation Resource Integrated Database (eGRID), 2021" Washington, DC: Office of Atmospheric Protection, Clean Air Markets Division. Available from EPA's eGRID web site: https://www.epa.gov/egrid.

producing green hydrogen as a feedstock for further conversion into e-fuels and e-chemicals, and for first-of-a-kind commercial facilities.

2. About Air Company

Air Company is the leading CO_2 conversion company, creating sustainable fuels and chemicals from CO_2 and green hydrogen. Using carbon-free electricity to power our process, our systems convert captured CO_2 into valuable products such as sustainable aviation fuel (SAF), e-ethanol, and e-methanol. Since 2017, Air Company has been developing CO_2 conversion technologies to offer a scalable solution to hard-to-abate sectors such as aviation. Our carbon conversion process is inspired by and mimics one of the most efficient carbon sequestering processes in nature — photosynthesis — but operates at a much higher rate to convert captured CO_2 and hydrogen to chemicals and fuels. Using hydrogen derived from water electrolysis powered by renewable energy, and captured biogenic CO_2, our process ensures that our products have ultra-low carbon intensity on a full lifecycle basis.

Air Company is a small business working to develop and efficiently scale our carbon conversion technology that can help reduce GHG emissions from hard-to-abate sectors such as aviation, maritime, chemicals manufacturing, among others. We are currently planning several projects in the US that will demonstrate our technology at a larger scale. Air Company's technology does not rely on the legacy Fischer-Tropsch process, and instead utilizes an innovative feedstock conversion pathway with higher energy efficiency. Effective scaling and deploying Air Company's technology, among other PtX solutions, holds an enormous promise for reducing global GHG emissions.[6] One of the key benefits of PtX fuels and chemicals is their deep reduction in carbon intensity (up to 100%) compared to fossil fuel incumbents.[7] The deep CI reduction hinges on carbon-free electricity for production of green hydrogen that serves as the main feedstock for PtX. PtX fuels and chemicals can be used to decarbonize carbon intensive sectors of the economy that face barriers to shifting away from fossil fuels and where other solutions like electrification are not available, which makes it one of the key technologies that will enable the US to achieve deep GHG emissions reductions. Reducing the cost of green hydrogen is the single most impactful factor that will enable the PtX industry to grow in the US and to deliver on this promise.

3. Recommendations for Improvement of the Incrementality and Temporal Matching Requirements

a. Energy Attribute Certificates

We commend the Treasury for allowing the use of Energy Attribute Certificates (EACs) for electrolytic hydrogen producers. The ability to use EACs is paramount as it will significantly de-risk and accelerate the development of new green hydrogen projects. EACs have played a critical role in supporting the growth of the wind and solar industries in the US and accelerated

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[6] "Putting CO_2 to Use – Analysis." *IEA,* Sept. 2019, www.iea.org/reports/putting-co2-to-use.
Bhardwaj, Amar, et al. "Opportunities and Limits of CO_2 Recycling in a Circular Carbon Economy: Techno-Economics, Critical Infrastructure Needs, and Policy Priorities." *Center on Global Energy Policy at Columbia University SIPA,* 4 May 2021, www.energypolicy.columbia.edu/publications/opportunities-and-limits-co2-recycling-circular-carbon-economy-techno-economics-critical/.

[7] "Clean Skies for Tomorrow: Sustainable Aviation Fuel Policy Toolkit." *World Economic Forum*, Nov. 2021, https://www3.weforum.org/docs/WEF_Clean_Skies_for_Tomorrow_Sustainable_Aviation_Fuel_Policy_Toolkit_2021.pdf

the decarbonization of numerous sectors of the economy. As noted in the NOPR, EACs are an established and widely used mechanism for substantiating the purchase of electricity from zero GHG-emitting sources, which will enable the Treasury and the IRS to document electricity inputs for electrolytic hydrogen production.

b. Overarching Concerns with Electricity Sourcing Requirements

The NOPR outlines specific requirements that need to be met for EACs to be eligible for the purposes of 45V, namely the requirements for incrementality, temporal matching, and deliverability.

First, the immediate national-wide incrementality requirement with no phase-in and grandfathering period is particularly concerning as it places the burden for greening the US grid on the nascent green hydrogen industry that is only starting to emerge, and severely restricts where green hydrogen projects can be developed. If the incrementality requirements are finalized as proposed, green hydrogen producers will fall victim to the slow clean energy interconnection queues, which will delay projects and increase green hydrogen costs, defeating the purpose of the 45V tax credit and undercutting the green hydrogen industry before it has an opportunity to emerge. Those requirements will do nothing to drive the decarbonization of the US grid and accelerate the deployment of zero-emitting sources. It has been well documented that projects accounting for more than 2,000 gigawatts (GW) of total generation and storage capacity are now seeking connection to the grid, over 95% of which is for solar, wind, and battery storage.[8] EIA projects that in the US renewable generation will more than triple by 2050, with both wind and solar responsible for most of the growth.[9] At the same time, nearly 100% of electricity project retirements in 2023 were from coal, natural gas, and oil-fired power stations.[10] Therefore, introducing the incrementality requirement as outlined in the NOPR will only undercut the nascent green hydrogen industry, ensuring that the US fails to meet its decarbonization goals, while doing nothing to drive the decarbonization of the US grid that is already underway.

Second, overly stringent temporal matching requirements, if enforced too early, will ensure that the cost of green hydrogen will never reach parity with fossil hydrogen. Requiring hourly temporal matching starting in 2028 will mean that very few projects will be built (and only some of the large, long-existing companies will be able to move forward with projects, limiting innovation in the sector and hurting small businesses), and that the levelized cost of hydrogen (LCOH) from those projects will be significantly higher due to the need to oversize electrolyzers, storage, and overbuild intermittent sources of electricity. It is particularly concerning that the Treasury is proposing hourly matching starting in 2028 with no grandfathering period for first movers, no transition period to monthly matching in the interim, and with no comprehensive analysis of the market readiness for hourly matching.

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[8] "Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection | Electricity Markets and Policy Group." *Emp.lbl.gov,* Energy Technologies Area, Berkeley Lab, emp.lbl.gov/queues.

[9] *"Annual Energy Outlook 2023."* U.S. Energy Information Administration, 2024, www.eia.gov/outlooks/aeo/data/browser/#/?id=16-AEO2023®ion=0-0&cases=ref2023&start=2021&end=2050&f=A&linechart=ref2023-d020623a.25-16-AEO2023~&map=&ctype=linechart&sid=ref2023-d020623a.25-16-AEO2023~ref2023-d020623a.64-16-AEO2023&sourcekey=0. See AEO 2023 at Table 16.

[10] "Coal and Natural Gas Plants Will Account for 98% of U.S. Capacity Retirements in 2023." *U.S. Energy Information Administration,* 7 Feb. 2023, www.eia.gov/todayinenergy/detail.php?id=55439.

We also urge the Treasury to consider the difficulty of securing long-term power purchase agreements for new market entrants, many of which comprise the green hydrogen industry and the innovative sectors such as PtX that rely on green hydrogen. The premature 2028 transition to hourly marching, given the great uncertainty about the market readiness and the pricing of such EACs, with no grandfathering period, will severely hurt new market entrants, small businesses, and innovative companies that will work to scale up their technologies in the next five years as first movers.

While well-intentioned, the proposed electricity sourcing requirements risk undercutting the green hydrogen industry and all other sectors that are either reliant on cost-effective green hydrogen such as the PtX industry, or for which switching to green hydrogen is the only way to decarbonize (e.g., the industrial sector). While stringent electricity sourcing requirements may minimize the initial GHG emissions increases that might be associated with more flexible requirements, the impacts of limiting the green hydrogen industry's growth at its nascency will result in higher emissions long term as the industry will fail to emerge at the needed scale to decarbonize multiple sectors of the economy.

As many sectors move towards electrification (e.g., electric vehicles, industrial sector, built environment, as well as direct air capture (DAC)), the market to secure reliable, clean power becomes far more saturated. Imposing stringent requirements on electricity sourcing for green hydrogen producers alone will ensure that green hydrogen will struggle to secure power purchase agreements (PPAs) in a competitive PPA market, and will be faced with a cost premium unlike other sectors, further delaying the goal of $1 green hydrogen set by the US Administration.

In light of these concerns, sections below discuss recommendations for improvement of these requirements in order to ensure that the final rules can, in fact, enable the growth of the green hydrogen industry in the US and drive the decarbonization of numerous sectors of the economy.

c. Incrementality

The NOPR includes an incrementality provision that would require clean hydrogen producers to procure EACs associated with zero-emitting electricity sources that began commercial operations within 36 months prior to a hydrogen facility being placed in service. We are concerned that such a requirement will restrict the types of zero-emitting electricity sources that can be used in the US for production of hydrogen and severely limit where green hydrogen projects can be developed.

The incrementality requirement will effectively take hydropower and nuclear electricity sources "off the table" for hydrogen producers given that no new hydropower or nuclear power plants are expected to be built in the short term. Hydropower and nuclear energy together supply nearly a quarter of all US zero-emitting electricity; severely restricting the eligibility of the existing zero-emitting sources for the purposes of the 45V tax credit in the early days of the green hydrogen industry will significantly complicate and limit electricity sourcing options for hydrogen projects. It will simultaneously increase the cost premium for wind and solar electricity due to high demand for those resources. As multiple market analyses have recently

shown, PPA prices for wind and solar have been increasing in the US,[11] and limiting the 45V tax credit eligibility to wind and solar will likely further increase PPA costs.

Green hydrogen production is currently several times more expensive than fossil fuels-based hydrogen and is expected to be more expensive than blue hydrogen (since blue hydrogen producers can take advantage of the lucrative 45Q tax credit). The purpose of the progressive (i.e., CI-based) 45V tax credit is to benefit the cleanest types of hydrogen and reduce its cost, which is the hydrogen made from zero-emitting electricity. However, if PPA prices skyrocket because of the incrementality provision in the proposed 45V regulations, it will defeat the purpose of the 45V tax credit enacted to drive cost parity between gray and green hydrogen.

As noted above, it will also direct new hydrogen projects to regions with the least-cost wind and solar electricity, thus limiting well-paying job opportunities and other economic benefits, as well as innovation, to a handful of states. The main value of green hydrogen is in its ability to decarbonize hard-to-abate industries, which are distributed across the country. Given that hydrogen transportation and storage infrastructure is lacking, the incrementality requirements will mean that only some parts of the country can benefit from green hydrogen, severely undercutting the decarbonization potential that green hydrogen holds for the US economy.

Green hydrogen is a critical feedstock for innovative clean energy technologies such as PtX solutions, as noted above. PtX technologies utilize captured CO_2 and hydrogen as the two main feedstocks and produce liquid carbon-neutral fuels and chemicals that can directly displace carbon-intensive incumbents due to the identical chemical composition. Given the nascency of PtX technologies and their significant reliance on green hydrogen as a feedstock, reducing the cost of green hydrogen is a priority for PtX companies. The 45V tax credit, as enacted in the IRA, was expected to significantly reduce the cost of green hydrogen production in the US, subsequently minimizing the green premium for PtX products and de-risking and accelerating PtX projects. However, the proposed incrementality requirements, if implemented in the final rule, will fail to do so, which will significantly harm the emerging PtX industry in the US.

i. Transition Period for the Incrementality Requirement

In light of the considerations discussed above, **we urge the Treasury to introduce incrementality requirements for projects that begin construction after January 1, 2030, allowing hydrogen projects that begin construction before this date to be exempt from the incrementality requirement and grandfathered for the duration of the 45V tax credit.** In particular, the Treasury should allow the 2030 transition and "grandfathering" for small businesses, pilot and demonstration projects, projects that are producing green hydrogen as a feedstock for further conversion into e-fuels and e-chemicals, and for first-of-a-kind commercial facilities. This flexibility will help avoid hampering clean technology innovation in the US, penalizing first movers, and losing competitive advantage to other countries. This flexibility will also enable more innovative projects to progress, and for the PtX industry to start to take off in the US. The NOPR also discusses several specific circumstances for when the incrementality requirement could be considered satisfied. The below subsections discuss our specific recommendations.

[11] Casey, J. P. "LevelTen: North America Solar PPA Prices Rise, While European Prices Fall, in 2023." *PV Tech*, 5 Feb. 2024, www.pv-tech.org/levelten-north-america-solar-ppa-prices-rise-while-european-prices-fall-in-2023/.

ii. State/location approach

As noted in the NOPR, there are circumstances during which "diversion of existing minimal (that is, zero or near-zero) emissions power generation to hydrogen production is unlikely to result in significant induced GHG emissions," including "in locations where grid-electricity is 100 percent generated by minimal-emitting generators or where increases in load do not increase grid emissions, for example, due to State policy capping total GHG emissions such that new load must be met with minimal-emitting generators."

There are, in fact, several states that have codified state grid decarbonization in state law, such as New York, Oregon, and Washington, among others.[12] Those states, among others, have also implemented a version of a cap-and-trade system addressing fossil fuel emitters, mandated an increasing renewable power generation target, and are projected to continue to reduce grid carbon intensity overtime. Importantly, due to the abundant hydropower supply, New York, Oregon, and Washington have seen less development and demand for wind and solar projects. Enforcing the incrementality requirement as proposed will penalize these states that are considered leaders in the clean energy transition and that have some of the cleanest grids in the country. Therefore, we urge the Treasury to allow hydrogen projects in states with mandatory grid decarbonization targets, cap-and-trade mechanisms, and robust existing zero-emitting electricity supply to satisfy the incrementality requirement.

Notably, the NOPR references New York State Energy Research and Development Authority (NYSERDA)'s 2022 "Projected Emission Factors for New York State Grid Electricity" Report Number 22–18 which demonstrates the decreasing emissions intensity trajectory of the New York power grid.[13] This, coupled with the New York State Climate Leadership and Community Protection Act (CLCPA) that mandates a renewable energy target of 70% by 2030 and 100% zero emission electricity by 2040 (or similar in other states), should be sufficient to consider projects developed in the state as satisfying the incrementality requirement. Such states already have enforceable and trackable grid decarbonization goals requiring load serving entities to meet demand using carbon-free electricity, and the risks of increased GHG emissions intensity from development of green hydrogen projects are minimal. Furthermore, ensuring eligibility of existing nuclear and hydropower projects will help support those important projects long-term, avoiding plant retirements witnessed across the country over the past few years and ensuring their relevance to the clean hydrogen economy the US is hoping to build.

We recommend that the Treasury and the IRS in the Final Rule allow projects located in states with grid decarbonization targets included in state law, grid intensity <500 lbCO_2/MWh,[14] and with carbon pricing mechanisms in place (e.g., WA and NY cap-and-

[12] Eleven of the U.S. states that have active renewable or clean energy requirements have 100% requirements for renewable or carbon free generation to serve load in their territories. New York and California have some of the highest amounts of generation from hydropower in the US. Six states (Vermont, Washington, Maine, Oregon, New York, and California) have enforceable goals for 100 percent carbon-free or renewable energy generation to serve load by varying dates.

[13] "Projected Emission Factors for New York State Grid Electricity." *New York State Energy Research and Development Authority (NYSERDA)*, Aug. 2022, www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Energy-Analysis/22-18-Projected-Emission-Factors-for-New-York-Grid-Electricity.pdf. Report Number 22-18.

[14] "Emissions & Generation Resource Integrated Database (EGRID)." *US EPA,* 27 July 2020, www.epa.gov/egrid.

invest, RGGI, California's cap and trade) to be considered in compliance with the incrementality requirement as the risk of incremental emissions in those states is low.

States like New York, California, Oregon, Washington are leaders in the clean energy transition, and they consistently develop and pursue pioneering decarbonization policies. It would be counter-intuitive to effectively penalize such states through the proposed incrementality requirements. The state-based allowance discussed above would avoid arbitrarily restricting where clean hydrogen industry can emerge and allow an equal opportunity to the states reliant on dispatchable zero-emitting electricity sources to participate in the green hydrogen industry take-off.

iii. Formulaic Approach

The NOPR recognizes that formulaic approaches might be needed to allow a percentage of zero-emitting sources to be considered in compliance with the incrementality requirements based on average curtailment rates. Including a formulaic approach will help alleviate the administrative burden on green hydrogen and renewable electricity producers, streamline project development, and enable a share of existing zero-emitting sources, including hydropower and nuclear, to be eligible for the purposes of 45V. A simple formulaic approach applied on a generator's fleetwide basis in the region will reduce the uncertainty for green hydrogen producers and help create a more leveled-paying field for different sources of zero-emitting electricity.

The NOPR suggests a 5% allowance based on average curtailment rates. However, curtailment rates are on the rise and are expected to continue to increase as wind and solar deployment outpaces the buildout of transmission and distribution lines.[15] Therefore, **we recommend increasing the formulaic approach threshold to 10% starting in 2030 (in the context of the recommended transition period for incrementality until 2030).** The implementation of such an approach is expected to be straightforward from a tracking perspective, as each registry would be able to allocate 10% of EACs associated with each zero-emitting electricity producer's portfolio in the region to be marked as compliant with 45V incrementality requirements.

d. Temporal Matching

The proposed electricity sourcing rules include a requirement to transition to hourly temporal matching in 2028. We recognize the importance of temporal matching long-term as the number of commercial green hydrogen projects increases. However, a premature transition to the hourly basis starting in 2028 will be damaging to the emergence of the green hydrogen industry and all industries that depend on clean hydrogen as a feedstock, particularly when paired with stringent incrementality requirements that would eliminate dispatchable sources of carbon-free electricity.

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[15] In 2022, the Electric Reliability Council of Texas (ERCOT), the grid manager for most of Texas, curtailed 5% of its total available wind generation and 9% of total available utility-scale solar generation. By 2035, however, we project wind curtailments in ERCOT could increase to 13% of total available wind generation, and solar curtailments could reach 19%.
The National Renewable Energy Laboratory analysis shows that low-cost wind and solar could pass 10 percent curtailment in the 2030s. https://www.nrel.gov/docs/fy23osti/84327.pdf
https://www.eia.gov/todayinenergy/detail.php?id=57100
The curtailment of wind power in 2022 was 9.2% in the Southwest Power Pool (SPP) according to the U.S. Department of Energy, Land-Based Wind Market Report: 2023 Edition.

i. Cost Increases

Multiple analyses to date demonstrate that introducing hourly matching prematurely will significantly increase the cost of green hydrogen production (estimated to more than double the levelized cost of hydrogen)[16], eliminating the benefits of the 45V PTC, as it will require overbuilding the electrolyzer capacity, reduce electrolyzer efficiency due to the need to curtail electrolyzers when wind or solar generation is not available, and require a significant overbuild of renewable generation coupled with storage capacity.

For consumers of green hydrogen such as PtX technologies, an interrupted flow of hydrogen can be very damaging. In addition, hourly matching, if introduced prematurely, will require hydrogen producers to dynamically ramp an electrolyzer up and down to meet the fluctuations in renewable electricity supply, which can wear down the equipment significantly faster, impacting project CAPEX. Curtailing electrolyzer operations to align with intermittent electricity sources will also significantly increase the cost of products reliant on green hydrogen as a feedstock (by increasing the cost of power and by reducing electrolyzer efficiency), and hamper the technology scale up. As noted above, to mitigate these burdens, hydrogen producers will have to significantly oversize electrolyzer capacity and incorporate battery and hydrogen storage—all significantly increasing the CAPEX and OPEX of green hydrogen projects, increasing LCOH, and reducing the feasibility of green hydrogen and PtX projects.

ii. Lack of Technology Readiness, Necessary Infrastructure

Importantly, the NOPR acknowledges that the hourly EAC market is severely limited. The EPRI study referenced in the preamble acknowledged that "there is virtually no market infrastructure today to match customer load to unit specific CFE generation on an hourly basis." In fact, only two of the nine EAC tracking systems currently recognized under the regulations (PJM-GATs and M-RETs) provide an option for hourly tracking, and also with limited functionality. The Treasury should not impose a requirement for something that is not currently in place and will unlikely develop nation-wide in a functional manner in just four years.

Based on our own engagement with several renewable electricity producers, hourly matching that the NOPR is proposing is incredibly nascent and some renewable power developers are just now starting to pilot such programs. An inclusion of such an uncertain and sweeping requirement expected to be met in a short period of time will introduce enormous project development uncertainties, increase risks for developers and investors, limit funding opportunities, and, as a consequence, dramatically reduce the number of projects that move forward. Given that the hourly EACs market does not currently exist at a sufficient scale, it will be impossible for project developers to estimate the cost of such EACs to include in business models necessary for securing project funding.

We would like to highlight that the European Union (EU) electricity sourcing requirements do not require hourly matching until January 1, 2030, and it appears particularly strange that the US is looking to implement more stringent requirements in a less advanced renewable energy market. In the EU, the temporal matching begins on a monthly basis, in recognition of the "technological barriers to measure hourly matching, the challenging implications for

[16] *Green Hydrogen: An Assessment of Near-Term Power Matching Requirements*. Boston Consulting Group (BCG), Apr. 2023, media-publications.bcg.com/Green-Hydrogen-assessment-of-near-term-power-matching-requirements.pdf.

electrolyzer designs, as well as the lack of hydrogen infrastructure enabling storage and transportation of renewable hydrogen to end users in need of constant hydrogen supply."[17] All of the same considerations apply in the US, which is why we urge the Treasury to allow for a longer transition to hourly matching if 45V is expected to move the needle on the growth of the clean hydrogen industry.

Lastly, hourly matching at a high capacity (e.g., at 90% of all hydrogen production matching with carbon-free electricity) might not be possible in 2028, especially in certain regions of the US, due to the lack of diversity in zero-emitting sources (particularly if the incrementality requirement is enforced but without it as well). Enforcing the hourly matching requirement prematurely will distort the US market by enabling green hydrogen production only in regions with robust wind and solar project pipelines (with storage), which is going to be limited to few ISOs (e.g., SPP, ERCOT) and will benefit fewer industries that are seeking to decarbonize by switching to green hydrogen. Notably, regions like Texas have plans to develop a large capacity of blue hydrogen, which will face fewer project development and funding risks and lower costs, thus enabling it to overtake the market share for clean hydrogen in the region, limiting demand for green hydrogen offtakers. This is likely to unfold in the absence of widespread hydrogen storage and transportation infrastructure should the green hydrogen projects be effectively constrained to just a handful of regions with cheap wind and solar.

iii. Electricity Storage Should be Recognized for the Purposes of Temporal Matching

Electricity storage is not discussed in the NOPR, while it is expected to be needed at a large scale, particularly for hourly temporal matching. We request a clarification in the Final Rule to ensure that electricity storage can be used to comply with the temporal matching requirements, namely:

- Behind-the-meter energy storage should be considered as a load modification to the hydrogen producing facility, where the taxpayer is able to use such storage resources to modify their load in context of higher rates of hourly matched clean electricity. Electricity drawn from the onsite storage should satisfy the temporal matching requirements.
- Similarly, front-of-the-meter energy storage should be considered as part of the portfolio of clean energy resources that a taxpayer can use to achieve high levels of hourly clean energy matching. In the same way that a taxpayer can use a behind-the-meter energy storage resource to match their facility demand to intermittent renewable energy supply, a taxpayer who has contracted electricity dispatch from an offsite energy storage resource will be able to use such electricity to comply with the temporal matching requirements based on the hour when that electricity was utilized (rather than based on when such electricity was generated before being stored).

iv. Longer Transition to Hourly Matching

We urge the Treasury, together with DOE and EPA, to consider the unintended consequences and concerns discussed above that will stem from premature transition to hourly matching that will severely restrict the green hydrogen industry. **We ask the Treasury to include a longer**

[17] "Supplementing Directive (EU) 2018/2001 of the European Parliament and of the Council by Establishing a Union Methodology Setting out Detailed Rules for the Production of Renewable Liquid and Gaseous Transport Fuels of Non-Biological Origin." *Official Journal of the European Union, The European Commission*, 10 Feb. 2023, eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32023R1184. Sub-bullet (16).

transition period to hourly matching, enforcing it not earlier than 2030, **and only for projects that start construction after January 1, 2030.** We request that a comprehensive market analysis study be conducted prior to 2030 to evaluate market readiness for hourly matching, and urge the Treasury to incorporate an avenue for a longer transition to hourly matching depending on the results of said study.[18] Lastly, **it is critical to allow projects that start construction before the hourly-matching requirement is in effect (e.g., before January 1, 2030) to be exempt from the hourly matching requirement for the duration of the 45V PTC to alleviate the uncertainty and cost increases for early movers.** At a minimum, grandfathering should be allowed for small businesses, pilot and demonstration projects, projects that are producing green hydrogen as a feedstock for further conversion into e-fuels and e-chemicals, and for first-of-a-kind commercial facilities.

4. Basis for Hydrogen Carbon Intensity Accounting

The proposed rule requires all clean hydrogen produced at a qualified facility to be calculated and verified as part of an annual average within a taxable year, although the verification of the production and sale or use of such hydrogen may occur in a subsequent tax year. This kind of approach raises concerns in the context of the hourly temporal matching requirements as green hydrogen producers might not be able to match 100% of their hydrogen production with 100% renewable supply, particularly if the hourly matching requirements are introduced prematurely and in tandem with incrementality requirements. In such cases, if a hydrogen producer chooses to continue to run their electrolyzer rather than curtailing it, the carbon intensity for hydrogen produced during times when renewables are not available will be significantly higher. Since the proposed requirements ask for the total volume of hydrogen produced (to determine its CI and subsequently the tax credit value), a lower tax credit value will be available for the entire year.

Instead, it is far more practical if a producer is allowed to submit certain volumes of qualified clean hydrogen so that only the volumes associated with 100% match with zero-emitting electricity sources are used to calculate the value of the tax credit. It is estimated that averaging the value of the tax credit based on the total annual carbon intensity will limit the benefits of the 45V PTC much more than if the producers are allowed to submit only “batches” of cleanly produced hydrogen at the end of the year that would then qualify for the maximum tax credit.

5. Conclusion

We thank the US Treasury, DOE, and EPA for working to develop clear rules for the taxpayers on the clean hydrogen production tax credit. The importance of the green hydrogen industry take-off for the decarbonization of the US economy cannot be understated. Implementing clear and practicable rules for the green hydrogen producers is critical for driving investment in this nascent industry, ensuring that projects move forward, and for facilitating the uptake of green hydrogen across sectors of the US economy.

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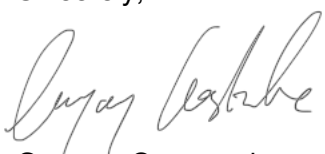
[18] A similar study is required to be conducted and submitted to the European Parliament and the Council in the EU prior to the hourly matching requirement coming into force “assessing the impact of the requirements set out in this Regulation, including the impact of temporal correlation, on production costs, greenhouse gas emission savings and the energy system.”

We urge the Treasury to consider the importance of cost-effective and readily available green hydrogen for a myriad of other technologies (such as PtX) and sectors (aviation, maritime shipping, chemical manufacturing and other industrial processes). We ask the Treasury to adopt the proposed transition period for the incrementality and temporal matching requirements in order to avoid stymieing the green hydrogen industry in its nascency and delaying the US transition to net zero.

Sincerely,



Gregory Constantine
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