

Internal Revenue Service
United States Department of the Treasury
Ben Franklin Station
P.O. Box 7604, Room 5203
Washington, D.C., 20044

February 23, 2024

Re: REG-117631-23 Request for Comments on Section 45V Credit for Production of Clean Hydrogen

Dear Secretary Yellen and Commissioner Werfel:

On December 22, 2023, the U.S. Treasury Department and Internal Revenue Service (Treasury) issued a Notice of Public Rulemaking (NPRM), proposing guidance for how entities can claim the Section 45V Clean Hydrogen Production Tax Credit established by the Inflation Reduction Act of 2022 (IRA). The IRA specifies emissions thresholds that impact the amount of tax credit hydrogen producers can claim, up to \$3 per kilogram for the cleanest hydrogen. Treasury has the difficult task of creating rules to accurately measure emissions associated with electricity used in electrolysis, one of the few commercialized ways to make truly clean hydrogen that would qualify for the \$3/kg incentive.

Measuring the emissions intensity of electricity is a dynamic and complex endeavor that depends on real-time electricity system dynamics, making it necessary to develop new systems for accurate measurement. An overly complex measurement system risks becoming impossible to manage, exceeding agency capacity to administer the rules and making qualification for tax credits unpredictable. In its rule design, Treasury must balance (1) the **accuracy** with which the rules judge hydrogen production against the IRA's statutorily required greenhouse gas (GHG) emissions thresholds with (2) the **administrability** of the rules, such as having a sufficiently simple design to provide business clarity and ensure Treasury can expeditiously verify compliance. Additionally, Treasury must be mindful of Congress' implied intent for 45V to grow the clean hydrogen industry—that is, Congress created the credit in order to spur the development of clean hydrogen.

In our assessment, Treasury has thus far achieved a workable balance between administrability and accuracy in its draft rules. We stand by our original comments from December 2022 and commend Treasury for proposing strong yet readily implementable guardrails for electrolytic hydrogen, including criteria for incrementality, deliverability, and time-matching (the “three pillars”).¹ A wealth of studies published over the last year affirm that this framework is essential for ensuring a reasonable level of accuracy in determining electrolytic hydrogen production's GHG emissions, while industry statements and experience abroad indicate these rules are sufficiently clear in how projects can demonstrate compliance.

¹ <https://www.regulations.gov/comment/IRS-2022-0029-0145>

Treasury's framework also supports the growth of low-carbon hydrogen production, both in the near term and long after the tax credit expires. Substantial analytical and real-world evidence demonstrates that electrolysis projects meeting Treasury's criteria will be financially viable. These rules also provide the nascent clean hydrogen industry with integrity—protecting against higher climate-warming emissions, exacerbated harmful air pollution, and increased energy prices—that it will need to keep its social license to operate and avoid becoming mired in obstacles driven by public opposition. Lastly, this framework trains the industry to innovate on flexibility, setting it up to adapt to a post-45V world rather than remain dependent on subsidy extensions or face early retirement.

Treasury's NPRM requests comment on various aspects of its rules, such as whether and how to design options to qualify electrolytic hydrogen production that would not induce upstream GHG emissions yet does not fit neatly within the three-pillars framework. In these comments, we share our assessment of various exemption options identified by Treasury, generally recommending that Treasury either establish targeted guardrails designed to capture specific circumstances or not include exemptions at all. Treasury's three-pillars framework already qualifies the vast majority of electrolysis that would meet the statutory emissions threshold and does so with a high degree of accuracy. We find few options exist to achieve a reasonable degree of accuracy within the proposed exemptions, and each comes at the high risk of undermining this accuracy and thereby greatly increasing GHG emissions in proportion to the size of the exemption. Furthermore, our previous research and comments show none of the exemptions is necessary to promote robust, cost-effective growth of domestic clean hydrogen.

These comments predominantly focus on hydrogen produced via electrolysis. They are intended to help Treasury finalize its 45V guidance in a manner that ensures the rules support the development of a robust, truly clean hydrogen industry that satisfies the IRA's requirements. The comments are organized in three parts:

1. A **preface** commending and defending Treasury's draft guidance, offering new analysis and real-world evidence to the record that supports maintaining strong rules that include the current iteration of the three-pillars framework;
2. A **set of responses** to specific Treasury questions, focusing primarily on exemptions that aim to target clean energy curtailment, avoided clean power plant retirements, and binding emissions caps; and
3. An **Appendix** that attaches our stand-alone public analysis assessing potential exemptions to Treasury's "incrementality" requirement in far greater detail.

Energy Innovation Policy & Technology LLC® is a nonpartisan climate policy think tank delivering high-quality research and original analysis to help policymakers make informed energy policy choices. We appreciate the opportunity to comment on this rulemaking that is so crucial to achieving U.S. climate goals and creating a safe, habitable planet and thriving economy for generations to come.

Part 1 – Evidence Supporting Treasury Draft Guidance

This section reaffirms the necessity of the core components of Treasury's NPRM—namely, its inclusion of incrementality, deliverability, and time-matching requirements for electrolyzers—by using new analysis and real-world evidence to demonstrate how these components (1) strike the right balance between accuracy and administrability and (2) support the clean hydrogen industry's robust growth.

Balancing accuracy with administrability

We commend Treasury for striking the right balance between accuracy and administrability in its NPRM. Namely, we support the following proposed decisions:

- Requiring electrolyzers to use tradable energy attribute certificates (EACs) meeting criteria for incrementality, deliverability, and time-matching at an appropriate degree of stringency (e.g., phasing in hourly time-matching no later than 2028 and without grandfathering) and level of detail (e.g., paying attention to the impact of transmission line losses on the quantity of EACs an electrolyzer must procure from distant clean energy resources).²
- Basing the value of the 45V credit on the lifecycle GHG emissions rate of all hydrogen produced at a given facility over an entire year (i.e., disallowing the cherry-picking of hours, which would cross-subsidize hours of dirty hydrogen production using tax credits earned during hours of clean hydrogen production).³
- Providing an anti-abuse rule to disqualify hydrogen produced for the sole purpose of earning tax credits and used in a wasteful manner, such as using electricity generated from hydrogen combustion to electrolyze more hydrogen.⁴

Accuracy

Hydrogen electrolyzers can draw clean electricity from new, dedicated, off-grid resources, which ensures a high level of accuracy in meeting 45V's emissions thresholds. However, they can also buy power from the grid (or divert power at the source from existing clean energy resources that currently feed the grid). Because the grid is a dynamic system, changes in one area affect the whole and have non-intuitive impacts. Thus, accurately measuring the emissions impacts of using grid power is more complicated and requires some proxy for emissions intensity to make administering the 45V tax credit possible.

Since Treasury closed its first comment period in December 2022, a range of research firms, consultancies, and universities have published studies assessing electrolyzers' impact on the power grid.⁵ The evidence overwhelmingly agrees with the U.S. Department of Energy's (DOE) own assessment that electrolyzers would induce substantial upstream GHG emissions without guardrails in place.⁶ The evidence also shows that EACs are a practical tool for evaluating marginal emissions impacts on the grid and that a strong three-pillars framework

² Proposed Section 1.45V-4(d)(3).

³ Proposed Section 1.45V-4(a).

⁴ Proposed Section 1.45V-2(b)(1).

⁵ For example, see: (1) <https://energyinnovation.org/publication/smart-design-of-45v-hydrogen-production-tax-credit-will-reduce-emissions-and-grow-the-industry/>; (2) <https://zenodo.org/records/10041735>; (3) <https://www.evolved.energy/post/45v-three-pillars-impact-analysis>; (4) <https://about.bnef.com/blog/us-hydrogen-guidance-be-strict-or-be-damned/>; (5) <https://www.epri.com/research/products/000000003002028407>; and (6) <https://energy.mit.edu/wp-content/uploads/2023/04/MITEI-WP-2023-02.pdf>

⁶ Specifically, the DOE concludes: "If hydrogen producers acquire and retire EACs whose attributes meet these criteria, it would be reasonable to treat induced grid emissions as zero and for hydrogen producers to deem their GHG emissions from electricity to be the lifecycle GHG emissions associated with the specific generators from which the EACs were purchased and retired." See: https://www.energy.gov/sites/default/files/2023-12/Assessing_Lifecycle_Greenhouse_Gas_Emissions_Associated_with_Electricity_Use_for_the_Section_45V_Clean_Hydrogen_Production_Tax_Credit.pdf

can provide reasonable evidence that electrolyzers purchasing compliant EACs are not inducing upstream GHG emissions.

More recent assessments published since Treasury issued its NPRM further conclude that loosening these rules—such as by making undiscerning exemptions for existing clean energy to qualify as zero-emissions—would be almost certain to worsen GHG emissions well beyond statutory thresholds.⁷ In fact, a book-and-claim system that permits EACs to eschew any of the three pillars would allow hydrogen to receive the maximum 45V credit even when it results in greater GHG emissions increases than steam-methane-reformed hydrogen—that is, worse than the status quo and far above statutory thresholds. Backtracking on any of the three-pillars provisions would fundamentally undermine the accuracy of Treasury’s accounting rules and the efficacy of Congress’ intent to stimulate truly clean hydrogen production.

Administrability

In its three-pillars framework, Treasury landed on an approach that is nuanced in its ability to assure low GHG emissions while being relatively simple to demonstrate and verify compliance. It approaches every pillar with some accommodations for practical concerns. For example, incrementality includes a 36-month look-back provision for when clean energy must come online for an electrolyzer to use its electricity rather than requiring projects be exclusively co-located and off-grid. Deliverability includes fairly large regions tied to the DOE’s expert assessment of transmission bottlenecks (although accuracy could still be improved in a practical manner by restricting projects to the zonal or nodal level for regions with organized power markets). And time-matching stops at the hourly rather than 5-minute level while allowing a brief phase-in period to fully develop and socialize the needed registry software across the entire U.S.

Each of the accommodations above affects the accuracy of the accounting, but they also represent a fair middle ground to ensure the rules create predictable market conditions and do not require ex post accounting adjustments for every project. For example, incrementality rules are vintage-based and not contract-based, meaning the hydrogen electrolyzer is barred from obvious violations of the principle (e.g., drawing power from clean energy resources built before 45V was even established) but may not be responsible for actually driving new clean energy resources onto the grid. The transmission planning zones similarly prevent many clear instances where deliverability would be highly unlikely but remain large enough to create discrepancies in marginal emissions when regional transmission systems are congested. Treasury cannot let the perfect be the enemy of the good, and its proposed rules do not do so.

Treasury and potential hydrogen producers can take heart that the stringency of these proposed rules roughly matches that of the recently adopted European Union definition of renewable hydrogen.⁸ While there has been substantial pressure from electric utilities and developers to weaken Treasury’s rules, many developers are also openly advocating for the three-pillars framework.⁹ Given that the EU—which has a complex multinational bureaucracy—has passed and begun to administer similar rules, and given that developers are investing in projects in the EU and U.S. alike that are three-pillars compliant, there is already substantial evidence that Treasury’s proposed rules strikes the right balance between accuracy and administrability.

⁷ See: (1) the attached Appendix; and (2) <https://rhg.com/research/clean-hydrogen-45v-tax-guidance/>; and (3) the “Research_Addendum_NOPR_Proposals.pdf” file at <https://zenodo.org/records/10689836>

⁸ https://energy.ec.europa.eu/news/renewable-hydrogen-production-new-rules-formally-adopted-2023-06-20_en

⁹ For example, see: <https://hystoreenergy.com/hydrogen-industry-support-of-strong-45v-rules/>

Supporting the clean hydrogen industry's robust growth

Treasury's final rules will have a monumental impact on the development of the clean hydrogen industry. Our April 2023 report on 45V guidance design showed that the excellent renewable energy resources in the U.S. mean there will be ample opportunities to produce competitively priced clean hydrogen under the three-pillars framework.¹⁰ The three pillars won't work for all stakeholders, but Congress' intent through this statute was not to subsidize every conceivable hydrogen production project—it was to promote the growth of truly clean hydrogen and to delegate the metrics on which this was based to Treasury. Treasury's proposed guidance accomplishes this goal and should be preserved.

Beyond general research, real-world evidence suggests Treasury's three-pillars framework will (1) spur **rapid deployment** of truly clean electrolytic hydrogen production; (2) garner the **public support** necessary to avoid lengthy project delays and cancellations; and (3) set the industry up for **lasting success** and growth once the 45V credit expires.

Rapid deployment

The U.S. can look to clean hydrogen market activity in the EU since its three-pillars framework was finalized in June 2023 to understand likely domestic market impacts.¹¹ The EU's rules include similar incrementality, deliverability, and time-matching requirements, with the "incrementality" definition in particular going even further than Treasury's NPRM by requiring long-term contracts with new unsubsidized clean energy resources. Since the EU finalized its rules, it has continued to experience high levels of investment in electrolyzers,¹² with evidence suggesting investment has increased rather than declined following the decision.¹³ As one example, Shell announced Europe's largest renewable electrolysis project in 2022 before the EU rules had been decided.¹⁴ More recent reporting from November 2023 shows the project has continued development despite finalization of the three-pillars framework; further, far larger renewable electrolysis projects have since been announced.¹⁵

In the U.S., and within the context of 45V's specific design, recent analytical evidence shows electrolysis projects would be financially viable under a three-pillars framework.¹⁶ Many hydrogen and renewable energy developers agree, mobilizing around the need for strong rules as demonstrated by a range of industry sign-on letters,

¹⁰ <https://energyinnovation.org/publication/smart-design-of-45v-hydrogen-production-tax-credit-will-reduce-emissions-and-grow-the-industry/>

¹¹ https://energy.ec.europa.eu/news/renewable-hydrogen-production-new-rules-formally-adopted-2023-06-20_en

¹² For example, see (1) this announcement from the European Climate, Infrastructure, and Environment Executive Agency, which notes "132 bids were placed in the first-ever Innovation Fund auction for renewable hydrogen":

https://www.linkedin.com/posts/ruudkempener_if23auction-staytuned-innovationfund-activity-7162152875870113794-1AXE/; and (2) this International Energy Agency dashboard of clean hydrogen production projects:

<https://www.iea.org/data-and-statistics/data-tools/hydrogen-production-projects-interactive-map>

¹³ <https://twitter.com/JesseJenkins/status/1712889119498817734>

¹⁴ <https://www.shell.com/media/news-and-media-releases/2022/shell-to-start-building-europes-largest-renewable-hydrogen-plant.html>

¹⁵ <https://www.portofrotterdam.com/en/news-and-press-releases/planned-800-mw-eneco-electrolyser-brings-the-target-of-25-gw-hydrogen>

¹⁶ <https://zenodo.org/records/7948769#.ZGZ7n3bMLo8>

statements, and announcements.¹⁷ For example, just one group of developers has stated an intent to invest in upwards of 50 gigawatts of new electrolyzers while urging Treasury to “be skeptical of claims that proposed strong guidance will kill the industry” and stating that such claims are “demonstrably false.”¹⁸ Beyond declaring this appetite for investment, these companies insist strong rules would drive “a sprint to success for the U.S. electrolytic hydrogen market” and “enable sustainable industry growth.”

A range of renewable energy and hydrogen developers have also announced specific projects that will meet Treasury’s proposed rules.¹⁹ In general, however, it’s likely many groups will hold off on other project announcements until they have business certainty from final rules, as this will determine whether they pursue investments in projects that would raise GHG emissions—which might earn more 45V credits under a looser framework—or move ahead with truly clean electrolysis projects. In any case, Treasury is not obligated to make every possible hydrogen project pencil out, and research suggests its three-pillars framework would have little impact on the volume of clean hydrogen production—only the emissions intensity.²⁰

Public support

As a new industry, hydrogen has thus far lived outside of the general public’s awareness. However, if the hydrogen industry is allowed to grow in a manner that worsens climate pollution, raises consumer energy prices,²¹ and wastes taxpayer money (by using funds intended for clean hydrogen in a manner that drives far dirtier production), it risks destroying its integrity and quickly forfeiting its social license to operate.

Already, many public stakeholders are mobilizing to demand Treasury sets rules that promote—with a high level of confidence—truly clean hydrogen production.²² To achieve liftoff, especially in the context of the DOE’s hydrogen hubs, the industry will need to avoid costly lawsuits, demonstrations, and other roadblocks that could waste valuable time and limited money. Developers are stressing that they are concerned about this, noting loose rules would “engender public backlash and stymie our industry’s growth.”²³ Avoiding this detrimental outcome will mean building and maintaining public trust and support, and this will only happen if the industry

¹⁷ For example, see: (1) <https://greenh2catapult.com/2023/11/06/joint-letter-on-45v-implementation/>; (2) <https://s3.documentcloud.org/documents/23854072/hourly-matching-industry-letter-final.pdf>; (3) <https://www.taxnotes.com/research/federal/other-documents/irs-tax-correspondence/group-urges-hourly-matching-implementation-for-hydrogen-credit/7h1c6>; and (4) <https://content.govdelivery.com/accounts/USTREAS/bulletins/381482f?reqfrom=share>

¹⁸ <https://hystoreenergy.com/hydrogen-industry-support-of-strong-45v-rules/>

¹⁹ Many announcements are organized here, though this list is not exhaustive:

<https://www.canarymedia.com/articles/hydrogen/the-biden-administration-has-a-chance-to-do-clean-hydrogen-right>

²⁰ <https://www.evolved.energy/post/45v-three-pillars-impact-analysis>

²¹ <https://energyinnovation.org/wp-content/uploads/2023/11/Consumer-Cost-Impacts-of-45V-Rules-2.pdf>

²² For example, see: (1) <https://www.nrdc.org/sites/default/files/2023-11/climate-groups-3-pillars-wh-20230616-letter.pdf>;

(2) <https://subscriber.politicopro.com/f/?id=0000018b-d509-deac-a19b-f58907a60000>; (3)

<https://static.politico.com/2f/90/1afdd26e4561918c93caaf53fa83/feb-2024-45v-advocates-letter-to-gov-newsom.pdf?nname=california-climate&nid=00000189-315c-d8dd-a1ed-797dc9f10000&nrid=ad1ab22e-203c-479d-8d76-dd580beb334e&nlid=2745178>; (4) <https://energynews.us/wp-content/uploads/2024/02/Midwest-Advocates-Letter-to-MachH2-February-2024.pdf>; (5) <https://www.citizen.org/wp-content/uploads/Consumer-Advocates-45V-Letter.pdf>; (6)

https://www.ncelenviro.org/app/uploads/2023/06/State-Legislative-Sign-On-Letter-re_-IRA-45V-Clean-Hydrogen-Tax-Credit-Revised.pdf; (7) <https://www.nrdc.org/sites/default/files/2023-11/hydrogen-implementation-3-pillars-senators-letter-to-irs-20230525.pdf>; and (8) <https://www.whitehouse.senate.gov/news/release/whitehouse-merkley-heinrich-call-on-treasury-to-swiftly-implement-strict-clean-hydrogen-tax-credit-rules>

²³ <https://hystoreenergy.com/hydrogen-industry-support-of-strong-45v-rules/>

grows in a high-fidelity manner—one that leads to truly clean hydrogen production with minimal collateral damage to consumers and communities.

Lasting success

While near-term growth is essential to build a new industry, it's similarly crucial to consider whether the industry will collapse or continue its growth trajectory when its supportive policy expires. Treasury's three-pillars framework establishes the guardrails needed to train an industry capable of long-term success. Loosening these rules in one or more ways would chip away at this durability, increasing the risk of stranding individual projects or developing an ecosystem too fragile to transition to a subsidy-free world.²⁴

Specifically, Treasury's framework would promote innovation in flexible electrolyzer technologies capable of rapidly adjusting to changes in variable renewable energy output. It would also drive investment in midstream infrastructure, like pipelines and storage, that can smooth gaps in electrolyzers' output. When 45V expires, these projects would be ready to adjust to a situation in which electrolyzers must flexibly operate only during periods of sufficiently low electricity prices and in which midstream infrastructure is built and ready to handle fluctuations in production. This framework would also support other socially beneficial outcomes like improving grid reliability (by helping to integrate renewable energy resources into the system).

By contrast, loosening Treasury's rules along any dimension would cut into this flexibility incentive. For example, developers who can earn the full 45V credit around the clock, such as by being permitted to qualify electricity procured from existing nuclear power plants, will have little reason to innovate—purchasing the cheapest, least-flexible electrolyzer would maximize profitability despite failing to advance the technologies needed to stand up an industry that can sustain itself in a post-subsidy world. Such a scenario would also cut the incentive to invest in hydrogen storage, as hydrogen production would be much more consistent (albeit at the cost of being far more likely to have a high GHG emissions intensity).

In sum, Treasury's proposed framework sets clean hydrogen up for long-term success, while loose rules would risk building an industry that would remain dirty and require perpetual subsidies to avoid stranded assets and lost jobs.

Part 2 – Responses to Treasury Comment Requests

This section directly responds to specific requests for comment laid out in Treasury's NPRM. For ease of reference, we cite the page number where each request can be found in the Federal Register version of the NPRM.²⁵

Requests primarily related to incrementality

Treasury makes many specific requests for comment around whether and how to offer exemptions from incrementality in circumstances that, in theory, would not induce GHG emissions impacts despite the use of existing clean energy. Given these requests' interrelated nature, we wrote and published a stand-alone analysis

²⁴ <https://energyinnovation.org/publication/smart-design-of-45v-hydrogen-production-tax-credit-will-reduce-emissions-and-grow-the-industry/>

²⁵ Federal Register, Vol. 88, No. 246, Tuesday, December 26, 2023: <https://www.govinfo.gov/content/pkg/FR-2023-12-26/pdf/2023-28359.pdf>

assessing these considerations and offering detailed recommendations. This analysis is also attached as the Appendix to these comments. Below, we offer some additional thoughts on a subset of specific Treasury requests, but we strongly encourage reviewing the Appendix for our full set of recommendations.

Request being addressed (page 89230): “The Treasury Department and the IRS seek comment on whether to recognize an avoided retirements approach that would treat EACs from an existing electricity generating facility as satisfying the incrementality requirement if the facility is likely to avoid retirement because of its relationship with a hydrogen production facility.”

Response: We recommend Treasury not offer an exemption intended to support clean energy resources that might retire if not for support from 45V, as there is little evidence this is needed, and any attempt to capture such circumstances is far more likely to induce substantial GHG emissions (by overestimating facilities’ revenue requirements) and market manipulation. If Treasury nonetheless decides to create such an exemption, we propose two options that can help mitigate these adverse impacts. Please refer to the Appendix for details.

Request being addressed (page 89231): “The Treasury Department and the IRS seek comment on whether to provide an opportunity to demonstrate zero or minimal induced grid emissions through modeling or other evidence under specific circumstances.”

Request (continued): “The Treasury Department and the IRS request comments on this demonstrated or modeled minimal-emission approach, including: (i) the circumstances in which it should be available and the criteria that are appropriate to evaluate and determine whether those circumstances occur;”

Response: There is one circumstance in which incremental power demand for clean hydrogen production is met with existing non-incremental clean electricity generators without increasing overall grid emissions. That circumstance is if both demand and clean supply are in the same transmission region or pocket during a period when the marginal producer is a clean energy resource. Typically, this happens when:

- (a) The overall region is saturated with clean electricity generation such that any incremental demand will be met by such generation.
- (b) Both the clean electricity consumer and the clean electricity generators are located in the same transmission pocket behind constrained transmission facilities such that incremental consumption can only be met by the local clean generation facility.
- (c) Incremental consumption at the location of the electrolyzer allows for the redispatch of the generation fleet (within a system of transmission constraints) such that some dirtier units are turned down and some cleaner units are turned up in a way that maintains or even lowers overall emissions on the grid without necessarily involving extra generation from any specific clean electricity generators.

Note that all evidence points to (b) being a much more frequent occurrence than (a) or (c) in today’s power systems (see Appendix). In the absence of locational marginal emissions (LME) data, locational marginal prices (LMPs) are most appropriate for determining whether these circumstances occur (see Appendix).

Request (continued): “(ii) who should apply under this approach, the electricity generation facility, the hydrogen producer, or both;”

Response: In case (a) above, it seems possible for an electric generating facility to qualify for an exemption from the incrementality criteria. The situation in a particular interval for the overall system is easy to validate in one of the existing power markets (which cover more than two-thirds of all U.S. consumers). Unfortunately, situation (a) is not that frequent (well below the 5 percent levels referred to by Treasury) and is unlikely to provide a steady-enough source of EACs for potential electrolyzers looking to qualify for 45V. Qualifying EACs under scenario (a) are also likely to be of lower value to existing generators, as the system will be flush with clean power at those times (though can still serve as a useful supply of incrementality-exempt credits to the EAC market in these hours).

For the more common case (b) and the rarer case (c), the actual location of the electrolyzer and time of consumption are essential elements. Hence, no electricity generation facility could apply on its own to produce an incrementality-exempt EAC for a given deliverability zone. In addition, a given hydrogen producer would also not be able to demonstrate its eligibility without data from its local grid operator and balancing authority—typically a utility, transmission operator, independent system operator (ISO), or regional transmission operator (RTO)—about the operating conditions of all relevant generation, storage, and transmission assets during the period of interest.

In the Appendix, we detail how Treasury could work with ISOs/RTOs in current power markets to employ LMEs or LMPs to qualify compliance towards the 45V tax credit by specific hydrogen producers via the use of EACs from existing zero-emission assets. If Treasury chooses to follow this approach for “Zero or Minimal Induced Grid Emissions Through Modeling or Other Evidence,” we strongly encourage Treasury to leverage the expertise of these third-party expert entities (overseen by the Federal Energy Regulatory Commission, or FERC).

Finally, we believe that the most practical implementation path for including existing generation in providing power to the hydrogen producer qualifying under 45V is not to focus on a particular generator or producer but on specialty tariffs, either from a utility or market operator (each with tariffs regulated at public utility commissions and/or FERC) that could guarantee producers 45V-compliant supply with a mixture of existing and incremental clean supply modeled to have zero or low emissions.

For example, California’s proposed Senate Bill 993 envisages a new tariff for California utility customers that would be exclusively offered to certain classes of new customers, including those “producing hydrogen using an electrolysis of water” and would “provide hourly time-matched renewable or zero-carbon energy that would meet the requirements of the Clean Hydrogen Production Tax Credit (26 U.S.C. Section 45V) so that program participants could rely on the delivered electricity to meet those requirements.”²⁶ Utilities offering this tariff would be looking to guarantee 45V-compliant supply to hydrogen producers. They would be the ones tasked with finding ways to include existing generation via verifiable modeling, rather than their customers.

Request (continued): “(iii) what data or modeling should be submitted;”

Response: As mentioned, most opportunities to qualify existing generation through modeling and other evidence will require data about the state of the grid. Such data could be used to inform models that demonstrate that a proposed arrangement will result in zero or minimal induced grid emissions either for some future period (likely involving integration with an integrated resource plan) or in real time

²⁶ https://leginfo.ca.gov/faces/billNavClient.xhtml?bill_id=202320240SB993

(qualifying supply in real time). This information would need to be submitted by whichever entity is providing a specialty tariff allowing customers to buy certified 45V-compliant power like in the California example above or providing a criteria (like an LMP or LME) to help hydrogen producers qualify for the 45V tax credit.

Request (continued): “(iv) best practices for making such demonstrations, including for ensuring the impartiality and replicability of calculation approaches;”

Response: In a situation where the main modeler or producer of evidence is an independent third party like an ISO/RTO, they should be presumed impartial (given that they are usually transparent, have active stakeholder processes, and must answer to FERC)—at least when it comes to real-time criteria like LMPs and LMEs with replicable and transparent calculation approaches.

For other parties like vertically integrated utilities, we would not presume impartiality. Such parties might have a commercial interest either on the generation side or on the hydrogen production side that undermines the perception of impartiality. They may also be regulated by entities like a public utility commission that are more responsive to implementing state policy than federal policy like the IRA. In such cases, Treasury would be best served by looking to a federal agency like the DOE and its national laboratories (the National Renewable Energy Laboratory is likely the best positioned) to validate modeling and other evidence. If these entities create protocols or replicable calculation approaches that multiple parties intend to use, these should be validated by a peer review panel.

Request (continued): “(v) how an administrator of such a program would validate the accuracy of applicant submissions;”

Response: We do not think Treasury should get involved in validating models or other evidence tied to complex grid management issues. Treasury should leverage existing bodies instead to qualify specialty tariffs or specific supply agreements along the lines noted above.

Request (continued): “(vi) under what circumstances, if any, it would be appropriate to deem generation to satisfy the incrementality requirement without modeling, and what documentation should be provided in these cases;”

Response: We believe that ISOs/RTOs—or perhaps federal Power Marketing Administrations or neutral third parties—could produce criteria (LMPs or LMEs for a node tied to a specific hydrogen facility, or system-wide marginal emissions factors to qualify a generic zero-emission electric generation facility) without any incremental modeling besides their existing dispatch and optimization tools (such as the Security Constrained Economic Dispatch that produces LMPs). We think hourly LMPs or LMEs would be sufficient.

In other cases, such as a vertically integrated investor-owned utility interested in supplying incrementality-exempt zero- or low-emission power to a hydrogen producer, we think more detailed grid modeling and hourly emissions forecasts will need to be submitted with third-party validation as mentioned above.

Request (continued): “(vii) the process by which eligibility for this approach should be determined and any related administrability considerations;”

Response: Demonstrating zero or minimal induced grid emissions from existing facilities through modeling or other evidence is a task requiring expert knowledge of electricity grids and specific knowledge about existing infrastructure and operational conditions. This is well beyond scope for what Treasury (or even the DOE) could practically administer on their own, and Treasury would be well served by working with independent expert bodies. In our Appendix, we detail how Treasury could work with ISOs/RTOs (which manage the large majority of U.S. power consumption) with minimal effort on Treasury's part.

Request (continued): "(viii) the period during which any determination of incrementality would be maintained before a new showing would be required;"

Response: For a real-time approach to qualifying EACs as exempt from incrementality (a special vintage flag) or using marginal emissions criteria to exempt some hydrogen producers' consumption from an incrementality test tied to the commercial operations date, validation will be happening in real time (loosely speaking, as we recommend an hourly approach) and the showing will be automatic. There may be a need to periodically audit the methodology of the administering market or entity.

For specialty tariffs offered to interested hydrogen producers that use modeling and other evidence to pre-qualify a supply of energy, an annual showing should be made that the modeling and other evidence still stands up, perhaps with a penalty scheme if there are large deviations from previously predicted emissions.

Request (continued): "(ix) the circumstances and capability of EACs and tracking systems to track and verify energy attributes from such sources."

Response: The system of EACs and tracking systems that will be developed to track and verify energy attributes for the three-pillars approach should be sufficient to implement a practical scheme for using modeling and other evidence to exempt some minimal emitting electricity generation from an incrementality requirement because of zero or minimal induced grid emissions. However, to catch the broad majority of opportunities in this space, additional specialty tariffs focused on emissions intensity will be needed to complement the tracking system approach. See the Appendix for more detail and examples.

Request (page 89232): "The Treasury Department and the IRS seek comments on this five percent-allowance approach, including the merits of this approach compared to the targeted pathways described, particularly with respect to balancing administrative feasibility and burden with accuracy of identifying circumstances with a low risk of induced grid emissions. The Treasury and the IRS also seek comments on whether 5 percent is the appropriate magnitude for an allowance. [...] The Treasury Department and the IRS also seek comments on: (i) how a five-percent allowance should be tracked, allocated, and administered and how feasible it is for EAC tracking systems to incorporate data on such an allowance; (ii) whether the five percent should apply to all existing minimal-emitting electricity generators in all locations or a subset and for what reasons; (iii) whether such an allowance should be assessed at the individual plant level or across an operator's fleet within the same deliverability region; (iv) any other administrability considerations."

Response: In the attached Appendix, we explain that a general carve-out exempting 5 percent of existing clean energy generation from the incrementality requirement is extremely misaligned with the factors used to justify that allowance (e.g., curtailment). The balance between accuracy and administrability is completely thrown off

by using too broad a brush, with our findings backed up by rigorous modeling from Princeton University and Rhodium Group.²⁷ If Treasury decides to pursue an approach that includes existing generators under justifiable circumstances, there are more granular, targeted approaches that could be applied without sacrificing too much accuracy on upstream GHG emissions impacts of hydrogen production. See the Appendix for detailed recommendations on this 5 percent allowance approach and other, more targeted approaches to qualifying existing clean energy.

Request (page 89232): “The Treasury Department and the IRS seek comments specifically on whether and how the ‘averaging’ approach of a proxy appropriately captures the circumstances in which generation is incremental or does not generate induced grid emissions.”

Response: As we show in the Appendix, the “averaging” approach of this proxy—which we understand to mean basing the percent allowance on the national average occurrence of circumstances like curtailed clean energy—is effectively irrelevant since the vast majority of curtailment cannot be economically captured and certainly will not be under a broad, indiscriminate exemption for existing clean energy.

Request (page 89232): “The Treasury Department and the IRS also seek comments on how and whether the targeted alternative approaches or the other proxy approaches described subsequently [...] might replace the five-percent allowance or might be coordinated with the allowance.”

Response: We strongly recommend Treasury forgo the 5 percent allowance approach either outright or in favor of targeted approaches. We also recommend Treasury not implement both types (general and targeted) of allowances. With the right guardrails in place, targeted approaches would do a better job managing the issues justifying an allowance at any level, and adding broad allowances on top is likely to do much more harm (increased emissions) than good (capturing opportunities for drawing power from existing resources in a manner that wouldn’t increase emissions). Mixing both would further undermine the basis for a general 5 percent carve-out in the first place. See the Appendix for more discussion, including our conclusions of the appropriate guardrails necessary to make targeted exemptions workable, as well as Princeton University’s analysis of the GHG emissions impacts of both a 5-10 percent carve-out and an inadequately-designed emissions cap program.²⁸

Requests primarily related to deliverability

Request (page 89227): “The Treasury Department and the IRS seek comments on whether a different treatment would be more appropriate to account for transmission and distribution line losses.”

Response: We agree with Treasury that the correct approach for accounting for line losses is to require a hydrogen production facility to match each consumed megawatt hour (MWh) with $[1 / (1 - \text{line losses})]$ qualifying EACs. For example, using the DOE/GREET national line loss value of 4.9 percent would require

²⁷ See: (1) the “Research_Addendum_NOPR_Proposals.pdf” file for Princeton University’s analysis here <https://zenodo.org/records/10689836> and (2) Rhodium Group’s analysis here <https://rhg.com/research/clean-hydrogen-45v-tax-guidance/>

²⁸ See the “Research_Addendum_NOPR_Proposals.pdf” file for Princeton University’s analysis: <https://zenodo.org/records/10689836>

1.05 EACs per MWh consumed. In the case of co-located, directly connected projects, this provision should be waived.

Request (page 89233): “Proposed § 1.45V–4(d)(3)(iii) would provide that an EAC meets the deliverability requirements if the electricity represented by the EAC is generated by a source that is in the same region (as defined in proposed § 1.45V– 4(d)(2)(vi)) as the relevant hydrogen production facility. This approach provides reasonable assurances of deliverability of electricity because the regions, as defined earlier, were developed by the DOE in consideration of transmission constraints and congestion and, in many cases, match power-systems operation. The Treasury Department and the IRS recognize that transmission limitations also exist within these specified regions but are not aware of readily administrable options to reflect those grid constraints.”

Response: Most of the regions defined within the NPRM are administered by ISOs/RTOs and could use a more granular notion of grid constraints and deliverability regions that would in fact be readily administrable (especially in collaboration with ISOs/RTOs). A natural regional and readily administrable sub-unit for these market regions is the regional hub or zone. Following from the DOE’s National Transmission Needs Study (cited as a reference for the regions picked in the NPRM), market price differentials are an established way to examine and administer the question of deliverability.²⁹ It would be in Treasury’s interest to collaborate with ISOs/RTOs to define measures of deliverability within and between these regional hubs. For the former, this would improve consequential accounting for emissions; for the latter, it would help eliminate the threat of grid imbalance driven by the huge opportunity cost (low or double- to triple-digit negative prices or price differentials with their ultimate customers) that zero- or low-emissions generators would be willing to take on to maintain the ability to sell EACs.

Request (page 89233): “The DOE has generally found that interregional transmission constraints tend to be greater than within-region constraints.”

Response: Significant within-region constraints do exist and persist for a material amount of times in specific cases. For example, consider a new wind or solar project built in the ERCOT West Zone of Texas (high resource quality) and a new electrolyzer contracting with that project built in the ERCOT Houston Zone (closer to existing hydrogen customers). Real-time 15-minute prices for the ERCOT West and Houston Zones (see Appendix for a detailed graphic) reveal there was some congestion (i.e., price differential greater than zero) in 73 percent of intervals in 2023, significant congestion (above \$20/MWh) 11 percent of the time, and even higher levels (above \$40/MWh and \$60/MWh) 3 percent and 2 percent of the time, respectively. Keep in mind that the highest-value 45V tax credit will provide on the order of \$60/MWh for qualifying electrolytic hydrogen producers. This points to some serious potential consequential emissions if trading hubs are not disaggregated. Given that the ISOs/RTOs present a ready potential partner and solution finder, with sophisticated tools at their disposal, it would be wise to consider taking advantage of their expertise to create more accurate compliance metrics.

Request (page 89233): “The Treasury Department and the IRS request comments on whether there are additional ways to establish deliverability, such as circumstances indicating that electricity is actually deliverable

²⁹ “Although the regional calculation of the Market Price Differential metric (see Figure IV-9) provided some indication of the need for interregional transmission, we can more directly assess the value of transmission across regions and interconnections by determining the average hourly difference in pricing between regional hubs. One indicator of the value of new transmission is the energy arbitrage potential, that is, the difference in price between two locations.” DOE National Transmission Needs Study p.36: https://www.energy.gov/sites/default/files/2023-10/National_Transmission_Needs_Study_2023.pdf

from an electricity generating facility to a hydrogen production facility, even if the two are not located in the same region or if the clean electricity generator is located outside of the United States.”

Response: Treasury should collaborate with balancing areas, ISOs/RTOs, and FERC to establish criteria for when electricity is actually deliverable between regions.³⁰ For example, ISOs/RTOs monitor and publish in real time the available transfer capacity with other regions, especially ISOs/RTOs. If capacity is available on an inter-regional interface between two regions during a given time interval, then EACs from one region should become valid in the other during that time interval. If Treasury decides to adopt regional hubs within ISOs/RTOs as deliverability regions, it could work with each ISO/RTO to determine deliverability criteria between regions within the ISO/RTO.

Requests primarily related to time-matching

Request being addressed (page 89233): “Given the state of tracking systems, the expected responses to this proposed rule, and the impact of demand to drive development of the tracking systems, the Treasury Department and the IRS anticipate that the proposed duration of the transition rule would allow sufficient time for systems to develop hourly tracking mechanisms and for the associated trading markets to develop. The Treasury Department and the IRS acknowledge uncertainty in the timing of implementing an hourly matching requirement, however, and request comments on the appropriate duration of this transition rule to hourly matching, including specific data regarding current industry practices, the predicted timelines for development of hourly tracking mechanisms, and the predicted timeline for market development for hourly EACs.”

Response: Our review of the prevailing evidence gives us confidence that a 2028 phase-in date for the hourly matching requirement would provide plenty of time for EAC registries to test and scale hourly tracking systems across the U.S. We point to EnergyTag’s comment submission as the best compilation of evidence and recommendations on these questions.

In our previous comments to Treasury, we recommended a 2026 phase-in date. By proposing a 2028 date, Treasury is already granting a concession in favor of easier administrability over higher accuracy in GHG emissions accounting, which Rhodium Group finds would drive a cumulative GHG emissions impact on the order of 23 to 54 million metric tons (MMT) of CO₂.³¹ While this may be reasonable to give developers little doubt that hourly tracking systems will be ready by the time Treasury’s requirement kicks in, there is little evidence that more time (beyond 2028) is needed. Rather than push the transition date to a later year, Treasury may choose to review tracking registries’ progress in developing the needed software by 2026 or 2027 and, if necessary, delay the transition by one year at a time (rather than preemptively assume systems will not be ready).

We also recommend Treasury hold firm on its decision to not “grandfather” projects built (or commencing construction) before 2028 into a permanent annual-matching framework. On this issue, Rhodium Group finds grandfathering would “lead to systemwide cumulative emissions increases, counter to the goal of using hydrogen as a decarbonization goal” and violating 45V’s statutory emissions threshold.³² Specifically, Rhodium Group finds a cumulative GHG emissions impact from 2024 to 2035 of as much as 685 MMT CO₂ should Treasury

³⁰ For example, PJM includes an appendix on “Methodology to Assess Transfer Capability” through identified “flowgates” in the Open Access Transmission Tariff it files with FERC. For more details on the methodology, see:

www.pjm.com/pub/oasis/ATCID.pdf

³¹ <https://rhg.com/research/clean-hydrogen-45v-tax-guidance/>

³² <https://rhg.com/research/clean-hydrogen-45v-tax-guidance/>

allow grandfathering. All hydrogen electrolysis projects should be planning to meet an hourly matching requirement from day one, with the transition period merely giving tracking registries enough time to scale for verification purposes.

Other requests

Request being addressed (page 89234): “The Treasury Department and the IRS request comments on whether there are additional safeguards that the regulations could adopt to prevent this or similar types of abusive section 45V credit claims, including section 45V credit claims arising if such circular arrangements are coordinated among multiple parties.”

Response: While it is not possible to anticipate (and thus prevent) every possible abuse of 45V credit claims, one simple requirement that could mitigate abuse is to forbid a hydrogen production facility from receiving 45V credits for hydrogen produced at the same time that electricity is generated from hydrogen-to-power equipment that is physically connected via pipeline. In our previous comments to Treasury, we demonstrated that even in the use case of hydrogen as short-term storage for electricity, the majority of revenue would stem from 45V credits (for hydrogen that would never be sold elsewhere) as opposed to valuable services like electricity generation time arbitrage.³³ Thus, Treasury could consider imposing some minimum time between hydrogen production and power generation within an interconnected system of some specified geographical scope (e.g., hydrogen cannot be used to generate electricity within one day of its production unless moved to another deliverability region). It would be appropriate to leverage the DOE’s expertise in setting any such boundaries.

To catch further possible abuse of the 45V credit and to deter such practices, we recommend that Treasury regularly review or audit projects at random and determine ex post whether projects should have earned credits. Such risk of having credits clawed back would discourage investment in clearly fraudulent schemes.

Request being addressed (pages 89238-89240): The Treasury Department and the IRS request comment on several aspects of their approach to “Renewable Natural Gas and Fugitive Sources of Methane.”

Response: While our comments have focused almost exclusively on guidance design for electrolytic hydrogen production, we vehemently support strong guardrails for renewable natural gas and fugitive methane as well, such as prohibiting emissions offsets. We refer to comments from the Environmental Defense Fund, RMI, and the Union of Concerned Scientists for more detailed analysis and recommendations.³⁴

Conclusion

In summary, Treasury’s NPRM has major implications for the net GHG emissions impact of support for clean hydrogen. We commend Treasury’s inclusion of a strong three-pillars framework that strikes the right balance between accurately measuring electrolyzers’ GHG emissions intensities and selecting administrable parameters that reduce compliance and verification burdens. As Treasury seeks to finalize its rules, we make the following recommendations:

³³ <https://www.regulations.gov/comment/IRS-2022-0029-0145>

³⁴ See also: (1) <https://blog.ucsusa.org/julie-mcnamara/the-serious-risks-around-treatment-of-biomethane-in-45v/>; and (2) <https://heatmap.news/climate/hydrogen-tax-credit-final-methane-offsets>

- **Incrementality**
 - We refer Treasury to our Appendix, which includes detailed recommendations related to whether and how to exempt existing clean energy generation from the incrementality requirement. In particular, we strongly recommend Treasury not adopt an indiscriminate 5 (or other) percent allowance for existing clean energy resources, and we recommend against including an exemption for clean energy facilities that would otherwise retire. We also make recommendations for guardrails that could allow for exempting clean energy that would otherwise be curtailed or exempting states or regions with binding emissions caps.
 - Treasury should recognize that any modeling-based exemption to incrementality needs to incorporate detailed knowledge of the bulk power grid in a given region. Any modeling exemption should happen in coordination with independent third parties like ISOs/RTOs using transparent, widely accepted, and vetted methodologies.
 - Treasury should recognize that responsibility for modeling an exemption to incrementality will need to be tied to the particular location where power will be consumed. For these purposes, it should also allow for an independent third party to become the validator of 45V compliance via audited specialized tariffs.
- **Deliverability**
 - We recommend Treasury require a hydrogen production facility to match each consumed MWh with $[1 / (1 - \text{line losses})]$ qualifying EACs, with this provision waived in the case of co-located, directly connected projects.
 - We recommend Treasury work with ISOs/RTOs to (1) define tighter deliverability regions corresponding to regional hubs or zones and (2) use available transfer capacity data to determine when inter-regional EAC trading ought to count as satisfying the deliverability requirement.
- **Time-matching**
 - We recommend Treasury maintain its 2028 phase-in date for hourly matching with no grandfathering of projects built or commencing construction in earlier years.
- **Other**
 - To further prevent abuse of Section 45V, we recommend Treasury forbid hydrogen production facilities from receiving 45V credits for hydrogen produced at the same time that electricity is generated from hydrogen-to-power equipment that is physically connected via pipeline. We also recommend Treasury regularly review and audit projects at random and determine ex post whether projects should have earned credits.
 - We recommend Treasury establish strong guardrails for renewable natural gas and fugitive methane, such as prohibiting emissions offsets.

We look forward to future opportunities to engage in this process and support Treasury’s continued guidance design for these provisions.

Sincerely,

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Appendix – 45V Exemptions Need Strong Guardrails to Protect Climate, Grow Hydrogen Industry

We published the following public analysis on February 22, 2024. It is accessible in full on the following pages and includes a detailed list of our recommendations related to incrementality exemptions.