CLEARPATH

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# ClearPath Response to the Department of Treasury Proposed Rule regarding Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property

**RFI/NOI title and reference number:**
Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property (IRS REG-117631-23) (88 FR 89220)

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## Introduction:

ClearPath appreciates the opportunity to respond to the Department of Treasury's Request for Comments on the Proposed Rulemaking on Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property. ClearPath's mission is to develop and advance policies that accelerate innovations to reduce and remove global energy emissions. To advance that mission, we develop cutting-edge policy solutions on clean energy and industrial innovation. An entrepreneurial, strategic nonprofit, ClearPath (501(c)(3)) collaborates with public and private sector stakeholders on innovations in nuclear energy, carbon capture, hydropower, natural gas, geothermal, energy storage, and heavy industry to enable private-sector deployment of critical technologies.

Hydrogen has enormous potential to be an effective climate solution for electric grid reliability, energy storage and hard-to-decarbonize industries. A clear, predictable final rule from the U.S. Department of Treasury is critical to maximizing hydrogen's potential to support American energy security, environmental goals and domestic supply chains. ClearPath supports policies to advance deployment for emerging technologies, like the hydrogen tax credit.

*Unfortunately, the proposed rule drifts considerably from the statutory intent of Congress by implementing overly strict and variable rules that create investment uncertainty.* The Department's next steps will either accelerate commercialization or serve as a missed opportunity to spur innovation toward a low-carbon future.

The proposed rule is overly restrictive, contrary to the Inflation Reduction Act's (IRA) clear language and the goals of that act to incentivize hydrogen infrastructure build-out. The Investment and Jobs Act (IIJA) is a bipartisan law that modernized the Department of Energy's hydrogen research, development, and demonstration (RD&D) programs and appropriated $9.5 billion in taxpayer dollars to commercialize hydrogen production and create foundational regional clean hydrogen hubs (H2Hubs), meant to be "developed into a national clean hydrogen network to facilitate a clean hydrogen economy."[1] The H2Hub selections announced by the U.S. Department of Energy (DOE) include four projects using existing nuclear generation to produce clean hydrogen.[2] The tax credit enacted in the IRA was meant to complement the policies in the IIJA and boost the efficacy of the H2Hubs. Without the tax credit, IIJA grant funding to get steel in the ground will be misdirected toward closing the production cost gap. Furthermore, the proposed rule, if implemented, would work counter to the DOE's Hydrogen Shot to "accelerate innovation and spur the demand for clean hydrogen by reducing the cost by 80 percent, to $1 per 1 kilogram of clean hydrogen within 1 decade."[3] As such, it would be inconsistent to develop conflicting policies.

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[1] 42 U.S.C § 16161a (2021)
[2] The four hubs who have publicly stated they are using nuclear power are the Heartland Hydrogen Hub, Mid-Atlantic Clean Hydrogen Hub (MACH2), Midwest Alliance for Clean Hydrogen (MachH2), and the HyVelocity Clean Hydrogen Hub.
[3] U.S. National Clean Hydrogen Strategy and Roadmap

The current 45V proposed rule conflicts with the H2Hubs selections made by the DOE due to the Treasury's lack of consideration for the fundamental technical and market differences between renewable and existing nuclear and hydroelectric assets. To maximize the $9.5 billion federal taxpayer dollars from the IIJA and support the public-private partnerships established through the H2Hubs, the Treasury must implement a final rule for the 45V tax credit that includes exemptions for existing minimal emitting energy sources, a feasible date to introduce hourly matching and improvements to the 45VH2-GREET model. If crafted correctly, a final rule has the potential to support a growing industrial base and help meet projected demand for clean, reliable and affordable energy by accelerating the deployment of hydrogen technologies.

Currently, there are negligible amounts of clean hydrogen produced in the U.S.; however, the DOE forecasts demand for 10 million metric tonnes (MMT) of clean hydrogen annually by 2030 and 50 MMT annually by 2050.[4] Furthermore, the DOE anticipates the creation of around 100,000 new jobs through the build-out of new clean hydrogen projects by 2030.[5] The DOE also estimates that $85-215 billion of cumulative public and private investment is needed through 2030 to realize this job creation and meet demand.[6] The Treasury has the opportunity to ensure that federal dollars are spent responsibly to spur the deployment of hydrogen technologies in the U.S. and stimulate job growth.

ClearPath seeks and offers clarification on several areas where the Treasury can streamline the proposed rule to encourage the rapid deployment of clean hydrogen technologies and create predictable outcomes for project developers.

Thank you for the opportunity to respond. Please do not hesitate to reach out for additional information.

Sincerely,

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[4] U.S. National Clean Hydrogen Strategy and Roadmap
[5] Pathways to Commercial Liftoff: Clean Hydrogen
[6] Pathways to Commercial Liftoff: Clean Hydrogen

## Response to Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property

## II.C. Most Recent GREET Model

**Proposed § 1.45V–1(a)(8)(ii) would provide that the term "most recent GREET model" means the latest version of 45VH2–GREET developed by Argonne National Laboratory (ANL) that is publicly available on the first day of the taxpayer's taxable year in which the qualified clean hydrogen for which the taxpayer is claiming the section 45V credit was produced. After consultation with the Department of Energy (DOE), the Treasury Department and the IRS believe that the use of the latest version of 45VH2–GREET would be appropriate because it is tailored to the administration of the section 45V tax credit and includes features that make it easy to use for taxpayers. Use of the latest version of 45VH2–GREET would also ensure that the pathways and approaches provided for determining well-to-gate emissions for various hydrogen production processes are of sufficient methodological certainty to be appropriate for determining eligibility of tax credits. The latest version of 45VH2–GREET is the only variant of GREET that is suitable for use and may be used to determine emissions rates for purposes of the section 45V credit.**

**Further, proposed § 1.45V–1(a)(8)(ii) would provide that, if a version of 45VH2–GREET becomes publicly available after the first day of the taxable year of production (but still within such taxable year), then the taxpayer may, in its discretion, treat such version of 45VH2–GREET as the most recent GREET model.**

**Instead of defining "most recent GREET model" to be the latest version of 45VH2–GREET that is publicly available on the first day of the taxpayer's taxable year, an alternative approach would be for the Secretary to determine that the latest version of 45VH2–GREET is an appropriate "successor model," as provided by section 45V(c)(1)(B), for the purpose of administering the section 45V tax credit. The Treasury Department and the IRS request comment on these approaches.**

> **Response:** The Treasury needs to consider the compliance barrier imposed on the taxpayer by changing the 45VH2-GREET model frequently. The proposed rule requires taxpayers to recertify *each year* under an annually updated Argonne National Lab 45VH2-GREET model. This evolving criteria poses investment uncertainty and may hinder clean hydrogen deployment.
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> While regularly updating the basis may be practical for an indefinite program, this tax credit only applies to facilities that have commenced construction by January 1, 2033.

The proposed approach will create significant uncertainty for and burden on project developers while making project financing challenging.

Even other programs that use GREET and update periodically change less frequently, increasing project developers' certainty. For example, the California Low Carbon Fuel Standard (CA LCFS) Proposed Regulation Order gives existing participants *two years* to recertify their projects and transition from the current CA-GREET model to the updated model.[7] The Treasury's decision to impose a rolling 45VH2-GREET model *annually* is stricter than the CA LCFS's two-year compliance window. The Treasury's expectation for an annual update is not feasible for project developers to comply with changing qualifications for the 45V tax credit. Instead, the Treasury should provide predictability and a clear onramp for project developers utilizing the existing model.

Nascent technologies, like hydrogen, require predictability to reach deployment. It would be reasonable to allow the hydrogen producer to verify their lifecycle greenhouse gas emissions rate annually with the 45VH2-GREET model that they initially qualified under. This method would still verify the emissions intensity of production on a yearly basis while providing more certainty for project investors and limiting administrative burden. A project's eligibility criteria (i.e., the version of the 45VH2-GREET model) should be able to remain unchanged from when the credit is claimed until the end of the tax credit term. This certainty would support the commercialization and deployment of hydrogen technology.

Additionally, the Treasury could consider allowing hydrogen producers to elect to use a future, updated model as new pathways are added, data input becomes more accurate, and the electricity grid changes.

## V.A. Procedures for Determining Lifecycle Greenhouse Gas Emissions Rates for Qualified Clean Hydrogen

**As described in Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2–GREET (GREET User Manual), certain parameters in 45VH2–GREET are fixed assumptions, referred to as "background data" in this document. Users of 45VH2–GREET may not change background data. Examples of background data include upstream methane loss rates, emissions associated with power generation from specific generator types, and emissions associated with regional electricity grids. Background data are parameters for which bespoke inputs from hydrogen producers are unlikely to be independently verifiable with high fidelity, given the current status of verification mechanisms. The Treasury Department and the IRS seek comment on the readiness of verification mechanisms that could be utilized for certain background data in 45VH2–GREET if it were reverted to foreground data in future releases. For example, the upstream methane loss rate is background data in**

[7] Appendix A-1 §95488 subdivision (C)(1) of the California Low Carbon Fuel Standard (LCFS) Proposed Regulation Order

**45VH2–GREET, and the Treasury Department and the IRS seek comment on conditions, if any, under which the methane loss rate may in future releases become foreground data (such as certificates that verifiably demonstrate different methane loss rates for natural gas feedstocks, sometimes described as responsibly sourced natural gas).**

**Response:** ClearPath recommends that the Treasury include upstream methane loss rates as foreground data in the 45VH2-GREET model to encourage project developers to pursue low-methane intensity natural gas feedstocks.

As the Treasury notes, existing verification frameworks for methane leakage, such as responsibly sourced gas, still need to be standardized and, thus, are not comparable. The federal government has several programs to harmonize both existing and developing frameworks. For example, the Department of Energy (DOE) participates in the International Working Group[8] to synchronize global monitoring, measurement, reporting, and verification (MMRV) frameworks for exported liquified natural gas. Once completed, some components of this MMRV framework may inform upstream methane accounting frameworks for natural gas feedstocks. The Environmental Protection Agency (EPA) is also developing a process to include empirical data in its Title 40 Subpart W calculations.[9] Once finalized, components could be used to calculate and verify a methane intensity metric to qualify for the tax credit. Before these programs are standardized, the project developers could provide the Treasury with verification from existing emission accounting frameworks.

Most existing frameworks focus on methane intensity at the production level, the highest emission source within the value chain. It is important to stress that no official metric for low-methane intensity currently exists.[10] Allowing projects with methane feedstocks to get recognition for sourcing cleaner methane will encourage better practices and upstream upgrades. Another option is to apply the International Organization for Standardization's lifecycle analysis (LCA) for hydrogen production via steam methane reforming.

The Treasury should include the upstream methane loss rates as foreground data to reward hydrogen producers for purchasing certified or differentiated lower-emission natural gas feedstocks. This low-methane intensity natural gas may also carry a price premium, incentivizing natural gas producers to take the necessary steps to obtain certification. Allowing hydrogen producers to input their upstream methane loss rate into

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[8] Office of Fossil Energy and Carbon Management. (2023, November 15). *DOE Announces Global Collaboration to Reduce Methane Emissions*. Energy.gov. https://www.energy.gov/fecm/articles/doe-announces-global-collaboration-reduce-methane-emissions#:~:text=The%20MMRV%20Working%20Group%20will%20create%20a%20shared%20and%20broadly,sellers%2C%20or%20by%20individual%20governments.

[9] Reference Title 40 Protection of Environment Chapter I Subchapter C Part 98 Subpart W

[10] However, the Inflation Reduction Act used a methane intensity metric of 0.2% as a baseline for its methane emission fee for oil and gas producers. This is significantly lower than the 0.9% used in the 45VH2-GREET model.

the 45VH2-GREET model will allow them to prove a lower emissions intensity. This change will enable them to demonstrate a lower-methane intensity and qualify the hydrogen producer for a higher tax credit, spurring demand for more low-methane intensity natural gas to be produced and certified.

## V.C. Use of Energy Attribute Certificates

## 2.A. Incrementality

**The Treasury Department and the IRS note that there are circumstances in which an existing higher-emitting electricity generating facility may make upgrades to subsequently deliver minimal-emitting electricity. For example, an existing fossil-fuel electricity generating facility may add CCS capability, thereby reducing its lifecycle emissions rate as determined in 45VH2–GREET. The Treasury Department and the IRS request comments on whether the electricity generated by such a facility should be considered incremental under circumstances such as if an existing fossil fuel electricity-generating facility after the addition of CCS (after upgrade), had a COD that is no more than 36 months before the relevant hydrogen production facility was placed in service. Comment is also requested on the related question of whether, depending on its carbon dioxide capture rate, it would be appropriate to treat such a facility as a new source of minimal-emitting generation on the grid that would not be associated with induced grid emissions. Relevant to these questions, the Treasury Department and the IRS additionally request comment on what information would be needed to allow for qualifying EACs representing existing fossil fuel-powered electricity from facilities that have added CCS. In particular, comment is requested on whether there are safeguards that can ensure that a hydrogen producer's purchase and use of electricity from an existing fossil fuel-fired electricity generating facility that installs CCS does not result in indirect GHG emissions due to the dynamics of the electricity market and electric grid. The Treasury Department and the IRS request comment on the direct and induced emissions impacts of making such a facility eligible, and whether and under what circumstances it would be appropriate to do so.**

**Response:** ClearPath recommends that electricity generated by an existing, higher-emitting electricity source that recently incorporated carbon capture and storage (CCS) technology should be considered incremental. The Section 45V tax credit can be a compelling incentive for existing facilities to adopt CCS technology. The integration of CCS technology decreases emissions associated with the power being used by hydrogen production.

CCS technology is still being scaled up to commercialization today.[11] Any CCS that becomes operational within the appropriate timeframe would be a decarbonization

[11] National Energy Technology Laboratory. (n.d.). *Point Source Carbon Capture*. netl.doe.gov. https://netl.doe.gov/carbon-management/carbon-capture

activity that would not have otherwise occurred. Adding CCS constitutes a proactive effort to reduce emissions rather than maintaining the status quo. These retrofits contribute to advancing carbon management technologies, facilitating the transition toward cleaner energy production. Additionally, incentivizing CCS retrofits would encourage investment in shared infrastructure upgrades, like $CO_2$ pipelines, which would align with the Administration's stated goals of reaching 100 percent carbon-pollution-free electricity by 2035.[12] Therefore, recognizing CCS retrofits as incremental ensures that efforts to reduce emissions are adequately incentivized and rewarded, ultimately accelerating progress toward achieving carbon reduction targets and fostering a clean energy landscape.

**The DOE has advised that 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. Such circumstances may include generation from minimal-emitting power plants (i) that would retire absent the ability to sell electricity for qualified clean hydrogen production, (ii) during periods in which minimal-emitting generation would have otherwise been curtailed, if marginal emissions rates are minimal, or (iii) 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. The Treasury Department and the IRS seek comments on whether and how to provide alternative approaches to identifying circumstances in which there is minimal risk of significant induced grid emissions for certain existing electricity generating facilities.**

**Response:** To maximize the value of clean electricity, ClearPath recommends that the Treasury apply incrementality thoughtfully to reduce net emissions while not being overly prescriptive for systems and technologies. The Treasury's final rule should be a predictable and straightforward regulatory scheme that thoughtfully considers all types of minimally-emitting energy generators and clean hydrogen producers.

**The proposed rule does not properly consider nuclear energy in its underlying assumptions.**

In (A)(III) of section 2, "Formulaic Approaches To Addressing Incrementality From Existing Clean Generators," the proposed rule suggests an approach that would allow "five percent of the hourly generation from minimal-emitting electricity generators (for example, wind, solar, nuclear, and hydropower facilities) placed in service before January 1, 2023, as satisfying the incrementality requirement." This approach assumes that five percent of hourly generation would be a proper substitute for electricity generators that would otherwise curtail their output. The five percent value uses "The

[12] The United States Government. (n.d.). *President Biden's Actions to Tackle the Climate Crisis*. The White House. https://www.whitehouse.gov/climate/#:~:text=Reaching%20100%25%20carbon%20pollution%2Dfree,clean%20energy%20to%20disadvantaged%20communities

Renewables and Wholesale Electricity Prices (ReWEP) Tool" developed by Lawrence Berkeley National Laboratory as a justification.

The ReWEP tool draws on a study that finds that "negative wholesale prices occurred during roughly five percent of hours over the last several years." The Treasury likely considered this data sufficient because the study considered over 50,000 wholesale pricing nodes across the nation; however, the tool only considers the "ongoing interactions between *wind and solar* generation and wholesale energy prices."[13] The tool does not include other sources of minimal-emitting electricity generators like nuclear and hydropower facilities.

The study used to support the ReWEP tool states that "most generator types operate at lower production levels (or capacity factors) when prices turn negative. There are two notable exceptions: during negative price hours, nuclear projects continue to generate power at near-peak capacity levels, and wind turbines generate at higher-than-average production levels—near 75% of their rated capacity."[14] *Thus, this finding shows that nuclear energy is not well suited to operating flexibly and that the basis on which the Treasury determines a five percent exception is flawed because that basis does not adequately account for nuclear energy.*

Considering that renewable generation is variable, it is reasonable to average curtailment within any given hour of generation for that subset of generators. However, that is not an accurate assumption for nuclear power because U.S. reactors are designed to operate at or near full power 24/7.

The benefit of nuclear hydrogen cogeneration is that producing hydrogen allows nuclear plants to provide electricity to the grid flexibly in a market of increasing variability due to higher renewable penetration. Allowing existing nuclear power generation to qualify as an EAC enables nuclear plants to curtail electricity toward something useful (i.e., clean hydrogen generation) during low and negative pricing periods that could typically cause revenue losses. Nuclear plants are driven to be marginal generators during maximal renewable generation. This relationship means that, if used flexibly, the nuclear facility would produce hydrogen during times of minimal grid impact and maximal secondary revenue generation.

Furthermore, the DOE white paper notes that some existing tracking systems for EACs only track renewable electricity. In these cases, "tracking systems would need to expand their functionality to capture a broader suite of generators that might sell eligible EACs to clean hydrogen producers."[15] In the proposed rule, the Treasury assumes that nuclear

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[13] Energy Markets & Policy Berkeley Lab. (n.d.). *The Renewables and Wholesale Electricity Prices (REWEP) Tool*. Lawrence Berkeley National Laboratory. https://emp.lbl.gov/renewables-and-wholesale-electricity-prices-rewep

[14] Seel, J., Millstein, D., Mills, A., Bolinger, M., & Wiser, R. (2021, October 13). *Plentiful electricity turns wholesale prices negative*. Advances in Applied Energy. https://doi.org/10.1016/j.adapen.2021.100073

[15] Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit. The U.S. Department of Energy. (n.d.). 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

energy (and other minimal emitting assets like hydropower) has access to the same tracking infrastructure as renewables. In the final rule, the Treasury must rectify this oversight by not solely focusing on renewable energy but also incorporating nuclear energy as a significant climate solution. Nuclear energy plays a crucial role in decarbonization efforts, and its exclusion from proper consideration could impede its ability to contribute effectively to decarbonizing hydrogen and other related sectors.

**Maximizing the value of clean nuclear energy has spanned decades and Administrations.**

Utilizing nuclear electricity and steam for hydrogen production has long been identified as an ideal pathway because of nuclear's reliable electricity generation and the fact that it has the highest average capacity factor of any source of electricity at ~92 percent.[16] The federal government has emphasized the importance of nuclear power by researching the feasibility of the relationship between hydrogen and nuclear energy for years.

The first U.S. hydrogen program plan, the 2002 *A National Vision of America's Transition to a Hydrogen Economy - to 2030 and Beyond*, envisioned that by 2030 "hydrogen produced from fossil fuels (with carbon capture and sequestration), renewable energy, and nuclear energy will be used throughout the transportation and electric power sectors."[17] Each subsequent program plan or roadmap has also recognized nuclear's important role in a clean hydrogen future.[18] Most recently, the *2020 DOE Hydrogen Program Plan*,[19] the *2023 U.S. National Clean Hydrogen Strategy and Roadmap*,[20] and the *2023 Pathways to Commercial Liftoff: Clean Hydrogen*[21] continue to emphasize the importance of nuclear energy to the success of clean hydrogen. The Office of Nuclear Energy's *Integrated Energy Systems: 2020 Roadmap*[22] draws further attention to the significance of nuclear hydrogen cogeneration.

In addition to strategies, significant funding has gone into exploring this production pathway. In 2020, the DOE Office of Nuclear Energy awarded over $15 million for nuclear hydrogen cogeneration projects.[23] In the following year, 2021, the DOE awarded another $20 million for a demonstration project producing clean hydrogen from nuclear

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[16] *Nuclear Explained: U.S. nuclear industry*. U.S. Energy Information Administration (EIA). (n.d.). https://www.eia.gov/energyexplained/nuclear/us-nuclear-industry.php

[17] A National Vision of America's Transition to a Hydrogen Economy – To 2030 and Beyond (2002)

[18] Hydrogen Program. (n.d.). *Program Plans, Roadmaps, and Vision Documents*. Energy.Gov. https://www.hydrogen.energy.gov/library/roadmaps-vision

[19] Department of Energy Hydrogen Program Plan (2020)

[20] U.S. National Clean Hydrogen Strategy and Roadmap (2023)

[21] Pathways to Commercial Liftoff: Clean Hydrogen (2023)

[22] Bragg-Sitton, S. M., Rabiti, C., Boardman, R. D., O'Brien, J. E., Morton, T. J., Yoon, S., Yoo, J. S., Frick, K. L., Sabharwall, P., Harrison, T. J., Greenwood, M. S., & Vilim, R. (2020, September 1). *Integrated Energy Systems: 2020 roadmap*. OSTI.GOV. https://doi.org/10.2172/1670434

[23] *U.S. Department of Energy announces $26.9 million for Advanced Nuclear Technology*. Energy.gov. (2020, October 8). https://www.energy.gov/ne/articles/us-department-energy-announces-269-million-advanced-nuclear-technology

power.[24] In 2023, the DOE selected seven consortiums for the H2Hubs program, four of which included nuclear projects.[25] In addition to funding pilot demonstrations, Congress has specifically funded research on nuclear hydrogen cogeneration, appropriating $23 million in the fiscal year 2023 Consolidated Appropriations Act (P.L.117-328). The Integrated Energy Systems lab at Idaho National Laboratory (INL) has research, development, and demonstration efforts for nuclear hydrogen cogeneration that range from materials development to safety testing.[26] INL's research has resulted in a multitude of reports to support the economic and safety case for nuclear hydrogen cogeneration.[27]

**The lack of consideration for nuclear energy is contrary to the clear intent of Congress.**

Section 45U(c)(2) allows existing nuclear facilities to receive both the Section 45U tax credit and the Section 45V tax credit if they use nuclear-generated electricity to produce hydrogen.[28] Congress explicitly authorized the simultaneous use of the credits; this shows Congress intended existing nuclear facilities to qualify for the 45V tax credit.

Additionally, in a separate piece of legislation, the IIJA H2Hubs program gave special consideration to nuclear energy. Congress required the DOE to include at least one nuclear hydrogen project.[29] Unsurprisingly, given the DOE's years of RD&D for nuclear hydrogen, four out of the seven H2Hubs selected by the DOE plan to use nuclear energy as a source of clean energy.[30]

Furthermore, Congress intended for the 45V tax credit and the IIJA H2Hubs program to complement one another. The tax credit aims to decrease hydrogen's unit production costs, while the latter focuses on diminishing capital costs associated with clean hydrogen investments. Congress enacted the tax credit after passing the H2Hubs program to increase the efficacy of capital investments.

For example, the MachH2 hydrogen hub selected by the DOE in October of 2023 aims to use a portion of the federal financial support to build a nuclear-powered clean hydrogen production facility at the LaSalle Clean Energy Center in Illinois. If realized, the LaSalle Clean Energy Center will stand as the world's largest nuclear-powered clean hydrogen facility, with a projected annual production capacity of approximately 33,450

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[24] *DOE Announces $20 Million to Produce Clean Hydrogen From Nuclear Power*. Energy.gov. (2021, October 7). https://www.energy.gov/articles/doe-announces-20-million-produce-clean-hydrogen-nuclear-power

[25] Office of Clean Energy Demonstrations. (n.d.). *Regional Clean Hydrogen Hubs Selections for Award Negotiations*. Energy.gov. https://www.energy.gov/oced/regional-clean-hydrogen-hubs-selections-award-negotiations

[26] Idaho National Laboratory. (n.d.). Hydrogen. https://inl.gov/integrated-energy/hydrogen/

[27] LIGHT WATER REACTOR SUSTAINABILITY PROGRAM. (n.d.-b). Reports View. https://lwrs.inl.gov/Flexible%20Plant%20Operation%20and%20Generation/Forms/Reports%20View.aspx

[28] 26 U.S.C § 45U(c)(2) (2022)

[29] 42 U.S.C § 16161a (2021)

[30] The four hubs utilizing nuclear power plants are the Heartland Hydrogen Hub, Mid-Atlantic Clean Hydrogen Hub (MACH2), Midwest Alliance for Clean Hydrogen (MachH2), and the HyVelocity Clean Hydrogen Hub.

tons of clean hydrogen.[31] With that amount of clean hydrogen, steel mills could produce about 464,580 tons of hydrogen-based clean steel,[32] which is equivalent to the steel needed to build eight Empire State Buildings.[33] Despite the significant financial investment committed by the DOE, uncertainty around the Treasury guidance put the economic viability of the project in question.[34]

A final rule on the 45V tax credit from the Treasury must include existing nuclear assets for nuclear facilities involved in the H2Hub projects to have the certainty to invest in and deploy hydrogen for scalable, clean, dispatchable energy.

**The Treasury can incentivize nuclear plant owners to commercialize High-Temperature Steam Electrolysis (HTSE) produced hydrogen with a level playing field.**

Unlike low-temperature electrolysis (LTE), HTSE utilizes steam instead of water and is 30-50 percent more thermodynamically efficient.[35] Only thermal energy sources like nuclear and geothermal energy can realistically produce the steam needed for HTSE, and existing nuclear power plants are the only near-term pathway to enable this new technology.

The DOE has supported the research and development of HTSE with nuclear power for years. In 2009, the Idaho National Laboratory (INL) recommended that "DOE-NE should focus on the continued development of HTSE as the leading candidate for integration with [the Next Generation Nuclear Plant]."[36] The DOE Office of Nuclear Energy and the DOE Hydrogen and Fuel Cell Technologies Office now co-fund a HTSE test skid run at INL.[37] Additionally, prior to the enactment of the 45V tax credit, the DOE selected and awarded grants to three nuclear hydrogen cogeneration demonstration projects. One of

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[31] *Constellation To Play Key Role in $1 Billion Clean Hydrogen Hub Awarded by U.S. Department of Energy*. Constellation Energy Corporation. (2023, October 16). https://www.constellationenergy.com/newsroom/2023/Constellation-To-Play-Key-Role-in-1-Billion-Clean-Hydrogen-Hub-Awarded-by-US-Department-of-Energy.html

[32] Hoffmann, C., Van Hoey, M., & Zeumer, B. (2020, April). Decarbonization Challenge for Steel. https://www.mckinsey.com/industries/metals-and-mining/our-insights/decarbonization-challenge-for-steel

[33] American Society of Civil Engineers. (n.d.). *Empire State Building*. ASCE Metropolitan Section . https://www.ascemetsection.org/committees/history-and-heritage/landmarks/empire-state-building

[34] *Constellation To Play Key Role in $1 Billion Clean Hydrogen Hub Awarded by U.S. Department of Energy*. Constellation Energy Corporation. (2023, October 16). https://www.constellationenergy.com/newsroom/2023/Constellation-To-Play-Key-Role-in-1-Billion-Clean-Hydrogen-Hub-Awarded-by-US-Department-of-Energy.html

[35] Boardman, R., & Ding, D. (2019, April 30). *HydroGEN: High-Temperature Electrolysis.* Energy Materials Network.https://www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/review19/p148b_boardman_2019_p.pdf

[36] O'Brien, J., Stoots, C., Herring, J., McKellar, M., Condie, K., Sohal, M., & Harvego, E. (2010, February). High-Temperature Electrolysis for Hydrogen Production from Nuclear Energy – Technology Summary. https://inldigitallibrary.inl.gov/sites/sti/sti/4480292.pdf

[37] *A step closer to clean hydrogen*. Idaho National Laboratory. (2021, March 5). https://inl.gov/integrated-energy/a-step-closer-to-clean-hydrogen

these projects was to demonstrate HTSE at the Prairie Island Nuclear Generating Plant.[38]

Nuclear plant owners will not be incentivized to commercialize HTSE without a level playing field. Currently, HTSE has a lower technology readiness level than LTE, meaning that HTSE is not as technologically mature;[39] however, research has shown that hydrogen production using HTSE is more efficient.[40] Because of the increased efficiency, HTSE can potentially produce hydrogen cost-competitively with LTE. However, since HTSE is pre-commercial, nuclear plants are unlikely to make this investment without access to the 45V tax credit.

Because nuclear plants are the only clean generators that can use HTSE in the near term, not allowing nuclear plants to access the 45V tax credit will stunt the commercialization of HTSE, a significantly more efficient option to maximize the value of clean electricity.

**All relicensed nuclear and hydroelectric plants should be considered incremental.** ClearPath recommends that the Treasury allow relicensed plants to be considered incremental because maximizing the value of relicensed nuclear and hydropower generators helps clean energy resources not prematurely retire.

Between 2028 and 2034, about 30 percent of the U.S. nuclear fleet must pursue license renewal to continue operating.[41] The relicensing process requires a significant financial investment and time commitment from the plant owner; the plant must have a reasonable prospect of return to make this investment worthwhile. Existing nuclear power plants currently have the 45U tax credit and the Civil Nuclear Credit (CNC) program to assist economically challenged facilities in avoiding early retirement; however, both programs end in the early 2030s. For nuclear power plants, a license renewal lasts up to 20 years, so a facility must find a way to remain financially viable after the expiration of these programs to avoid early retirement.

Additionally, in the late 2030s, the DOE estimates that hydrogen production will ramp up. Allowing existing nuclear to take advantage of the 45V tax credit may incentivize license renewal because of the flexibility an additional revenue source can provide after the 45U tax credit has ended. Considering all relicensed nuclear projects as incremental allows

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[38] Office of Nuclear Energy. (2022, November 9). *3 Nuclear Power Plants Gearing Up for Clean Hydrogen Production*. Energy.gov. https://www.energy.gov/ne/articles/3-nuclear-power-plants-gearing-clean-hydrogen-production

[39] Boardman, R., & Ding, D. (2019, April 30). *HydroGEN: High-Temperature Electrolysis.* Energy Materials Network.https://www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/review19/p148b_boardman_2019_p.pdf

[40] Revankar, S. (2019). *Chapter Four - Nuclear Hydrogen Production* . ScienceDirect. https://doi.org/10.1016/B978-0-12-813975-2.00004-1

[41] Nuclear Regulatory Commission, Information Digest, 2022–2023 (NUREG-1350, Volume 34), Dataset – Commercial Nuclear Power Reactors – Operating Reactors, https://www.nrc.gov/reading-rm/doc-collections/nuregs/staff/sr1350/index.html

hydrogen to serve as an economic boost, avoid early retirement, and encourage plant owners to make investments that align with the future grid.

In regards to hydropower relicensing, nearly half of the nonfederal U.S. hydropower fleet, which powers approximately 13 million homes, will be up for relicensing by 2035.[42] Similar to nuclear relicensing, the monetary costs and human resources expended in the relicensing process are considerable. The DOE has found that relicensing hydropower generators takes an average of eight years. The process can often extend to over a decade and cost over 10 million dollars.[43] Today, over one-third of hydropower owners are actively considering decommissioning.[44] Preserving clean baseload resources is essential to decarbonize the grid by 2050; allowing existing relicensed hydroelectric resources to qualify for EACs could help extend the life of these national assets.

**Uprates should be considered incremental.**
ClearPath agrees with the Treasury's proposal that uprates should be regarded as a source of incremental generation and qualify for EACs.

The Treasury should note that the Nuclear Regulatory Commission (NRC) regulates reactors based on licensed thermal power in megawatts-thermal units for nuclear energy. Therefore, a conversion will be necessary if the Treasury writes the final rule in megawatts-electric.

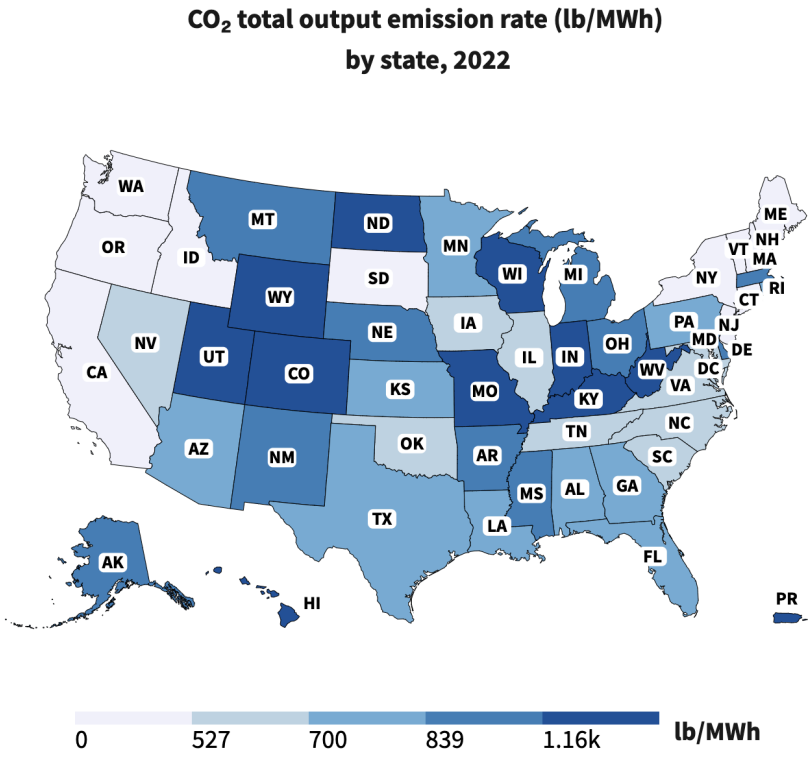
**The Treasury should explore marrying state-level policies with guidelines for deliverability to identify regions where strict incrementality is unnecessary.**
ClearPath recommends that the Treasury consider allowing clean hydrogen production from existing minimal emission assets to qualify in regions with low-emission grids and enforceable emission reduction goals.

In the proposed rule, the Treasury includes deliverability and incrementality as restrictions for Energy Attribute Certificates (EACs) to qualify for use by clean hydrogen producers. Because emission reduction policies are done at the state-level through the state government or public utility commissions, the proposed regions on the map would have to follow state lines to incorporate this feature reasonably. For simplicity, if this were incorporated, ClearPath recommends adapting the proposed deliverability map to encompass both the deliverability requirement and the incrementality regional exception.

One method of how this could be done is by using U.S. average grid emissions in conjunction with existing state-level, enforceable emission-reduction policies to determine if a region should be exempt from incrementality. For example, the Treasury could use the average emissions intensity of the U.S. grid, which is approximately 860

[42] May, B. (2023, June 28). *The Importance of Hydropower Licensing Reform*. The Business Council for Sustainable Energy. https://bcse.org/importance-hydropower-licensing-reform/
[43] Levine, A., Pracheil, B., Curtis, T., Smith, L., Cruce, J., Aldrovandi, M., Brelsford, C., Buchanan, H., Fekete, E., Parish, E., Uria-Martinez, R., Johnson, M., & Singh, D. (2021, October). An Examination of the Hydropower Licensing and Federal Authorization Process. https://www.nrel.gov/docs/fy22osti/79242.pdf
[44] https://bcse.org/importance-hydropower-licensing-reform/

lbs of $CO_2$/MWh as of 2022.[45] Several states fall well below this baseline with the help of existing minimal-emitting assets like nuclear and hydroelectric power. Table 1 in the Appendix depicts state-level data and demonstrates that thirty-two states are below the national average.[46] It is important to note that this data only considers in-state power generators and does not include interstate power imports, which the Treasury may also need to consider. The Treasury could couple the average emissions intensity threshold with an exemption for states with enforceable emission reduction goals.




Five of the seven states with the lowest emissions intensity primarily rely on hydropower as their largest electricity source. Furthermore, a sixth has hydropower as its second largest electricity source.[47] Hydropower has been vital to reducing U.S. emissions. Enforcing incrementality in these regions with an existing base of minimal-emitting assets will only create an administrative burden for hydrogen producers and negatively impact the hydroelectric dams that have made it possible for regions to have lower emission profiles. As mentioned above, many hydroelectric plants are facing early

[45] U.S. Energy Information Administration. (n.d.). *How much carbon dioxide is produced per kilowatthour of U.S. electricity generation?*. Frequently Asked Questions (FAQs). https://www.eia.gov/tools/faqs/faq.php?id=74&t=11
[46] Environmental Protection Agency. (2024, January 30). eGRID Data Explorer. https://www.epa.gov/egrid/data-explorer
[47] U.S. Energy Information Administration. (n.d.). *Where hydropower is generated* . Hydropower explained. https://www.eia.gov/energyexplained/hydropower/where-hydropower-is-generated.php

retirement. Eliminating the incrementality requirement for areas with low emissions can serve as a way to keep these clean assets running.

Almost half the states in the U.S. have enforceable emissions reduction goals. Currently, there are 23 states, the District of Columbia and Puerto Rico with 100 percent clean energy goals.[48] These states have enforceable and trackable goals that require new loads to be powered by minimal emitting energy sources. Adding incrementality in these regions would create unnecessarily duplicative and costly burdens on hydrogen producers. Additionally, it would further delay the deployment of clean hydrogen because it takes an average of four years for a clean energy project to interconnect to the grid.[49]

## 2.A. Temporal Matching

**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:** In response to the Treasury's question on temporal matching, ClearPath has identified significant challenges within the proposed rule related to feasibility and affordability, as our goal is to accelerate innovation to support clean, reliable and affordable energy.

**Hourly matching in 2028 is not feasible.**

The Treasury's proposed rule to transition to hourly matching in 2028 contradicts U.S. national interests by being more strict on temporal matching than the European Union (EU). The Treasury's proposed rule would implement hourly matching on January 1st, 2028, two years before the EU. The European Commission's delegated act[50] would begin hourly matching in 2030, only after conducting a feasibility study to ensure that hydrogen producers can reasonably comply with that requirement.

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[48] Clean Energy States Alliance. (n.d.-b). Table of 100% Clean Energy States. https://www.cesa.org/projects/100-clean-energy-collaborative/guide/table-of-100-clean-energy-states/

[49] IEA, Average lead times to build new electricity grid assets in Europe and the United States, 2010-2021, IEA, Paris https://www.iea.org/data-and-statistics/charts/average-lead-times-to-build-new-electricity-grid-assets-in-europe-and-the-united-states-2010-2021, IEA. Licence: CC BY 4.0

[50] Commission, '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' COM (1184).

Even the DOE's supporting document has expressed doubt about the feasibility of creating adequate tracking systems and associated trading markets on such a compressed timescale. In particular, the DOE found that:

- "hourly tracking systems for EACs are not yet broadly available across the country" and that "widespread availability and functionality will take time;"[51]
- the U.S. has nine different systems to track and trade EACs that have "limited functionality";"[52] and
- a market for hourly EACs does not exist,[53] and it is uncertain when hourly tracking systems will become widely available for taxpayers to qualify for this credit.

With the information gathered by the DOE, it is clear that hourly matching unnecessarily limits production pathways if the Treasury's final rule transitions to hourly matching in 2028. At a minimum, the Treasury, in collaboration with the DOE, should conduct a system readiness study that results in a positive finding before requiring the industry to switch to an hourly system.

**The cost of compliance with hourly matching is significant.**

The American Council on Renewable Energy (ACORE), a national nonprofit organization focused on the deployment of renewable energy, and E3, an energy consulting firm that works with clients across the industry, found that across all scenarios (markets, years and renewable portfolio), hydrogen production costs under an hourly approach are 14-108 percent higher than under an annual approach with the same assumptions.[54]

Another organization, American Clean Power, representing more than 800 companies that do business in the U.S. clean energy sector, determined through a member survey that hourly matching would increase the cost of hydrogen production by 20-150 percent, making it uneconomic for most applications.[55] In some instances, like an electric utility, the added investment cost will be passed to the customers. Furthermore, the increased costs associated with hourly matching will slow deployment because only high-paying sectors can afford the price premium.

**Project developers need investment certainty.**

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[51]Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit. The U.S. Department of Energy. (n.d.). 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.

[52] Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit. The U.S. Department of Energy. (n.d.).

[53] Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit. The U.S. Department of Energy. (n.d.). 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

[54] Olson, A., Gangelhoff, G., Fratto, A., Felicien, H., & Walter, K. (2023, April). Analysis of Hourly & Annual GHG emissions: Accounting for hydrogen production. https://acore.org/resources/analysis-of-hourly-annual-ghg-emissions-accounting-for-hydrogen-production/

[55] The American Clean Power Association (ACP). (2023, November). Green Hydrogen Deployment Brief. https://cleanpower.org/wp-content/uploads/2023/11/ACP_Green_Hydrogen_Deployment_Brief.pdf

In addition to costliness and feasibility, ensuring a predictable regulatory framework throughout a project's lifetime is paramount for successful deployment; further delay could be detrimental to early project deployment. If the Treasury does not confidently believe that a proper hourly tracking system can be implemented by 2028, it should propose a more feasible date. If there is any possibility of a change to the regulation, a project developer has to assume that change will occur and incorporate that into their financial plan.

The stability provided by a consistent compliance structure is essential for attracting financing and instilling confidence in project developers. However, the proposed mandate requiring hydrogen producers to transition to hourly matching by 2028 introduces uncertainty and regulatory risk, which may hinder early movers.

Maintaining regulatory consistency throughout a project's lifetime is crucial to mitigate these concerns and foster a conducive environment for project development. Not only would maintaining annual matching for projects that start before the transition to hourly matching create project certainty, but it would incentivize industry to move quickly. Grandfathering annual matching would provide a first-mover advantage that could jumpstart clean hydrogen production.

By promoting early deployment and reducing regulatory ambiguity, the Treasury can stimulate innovation and accelerate progress in the hydrogen sector while ensuring a streamlined and accessible regulatory landscape for all stakeholders. One mechanism to provide investment certainty is to allow the temporal matching regime during the taxpayer's first election for the credit to remain in place through the ten-year tax credit period.

# Appendix

### Table 1. $CO_2$ Total Output Emission Rate (lb/MWh) by State, 2022[56]

| Region | CO2 total output emission rate (lb/MWh) by state 2022 | Region | CO2 total output emission rate (lb/MWh) by state 2022 |
|---|---|---|---|
| ALABAMA | 787.656 | MONTANA | 1023.457 |
| ALASKA | 912.714 | NEVADA | 676.959 |
| ARIZONA | 709.12 | NEW HAMPSHIRE | 302.928 |
| ARKANSAS | 1055.801 | NEW JERSEY | 486.628 |
| CALIFORNIA | 455.94 | NEW MEXICO | 985.806 |
| COLORADO | 1166.201 | NEW YORK | 489.708 |
| CONNECTICUT | 520.864 | NORTH CAROLINA | 654.57 |
| DELAWARE | 899.252 | NORTH DAKOTA | 1311.282 |
| DISTRICT OF COLUMBIA | 553.976 | OHIO | 1156.152 |
| FLORIDA | 815.565 | OKLAHOMA | 686.629 |
| GEORGIA | 737.189 | OREGON | 298.211 |
| HAWAII | 1453.179 | PENNSYLVANIA | 711.366 |
| IDAHO | 247.852 | PUERTO RICO | 1593.481 |
| ILLINOIS | 588.411 | RHODE ISLAND | 811.317 |
| INDIANA | 1566.914 | SOUTH CAROLINA | 556.736 |
| IOWA | 617.347 | SOUTH DAKOTA | 325.105 |
| KANSAS | 820.173 | TENNESSEE | 693.632 |
| KENTUCKY | 1720.072 | TEXAS | 818.537 |
| LOUISIANA | 818.058 | UTAH | 1514.282 |
| MAINE | 336.612 | VERMONT | 35.627 |
| MARYLAND | 637.051 | VIRGINIA | 587.449 |
| MASSACHUSETTS | 851.739 | WASHINGTON | 184.81 |
| MICHIGAN | 1009.305 | WEST VIRGINIA | 1958.897 |
| MINNESOTA | 768.241 | WISCONSIN | 1171.455 |
| MISSISSIPPI | 886.211 | WYOMING | 1804.487 |
| MISSOURI | 1506.211 | | |

[56] Environmental Protection Agency. (2024, January 30). eGRID Data Explorer. https://www.epa.gov/egrid/data-explorer