February 26, 2024

Submitted via Federal eRulemaking Portal (REG-117631-23)

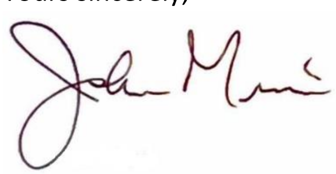
Re: Comments on Proposed Regulations for §45V Clean Hydrogen Production Credit

Dear Sir/Madam:

Shell USA, Inc. respectfully submits comments in response to REG-117631-23 issued by the Department of the Treasury and the Internal Revenue Service regarding the Section 45V Credit for Production of Clean Hydrogen and Section 48(a)(15) Election to Treat Clean Hydrogen Production Facilities as Energy Property (the Proposed Rule), established in the Inflation Reduction Act (IRA).

Shell appreciates this opportunity to share considerations specific to hydrogen and to help inform the implementation of the IRA clean energy credits.

Yours sincerely,



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Shell[1] is committed to the advancement of a net-zero emissions economy including the production and use of clean hydrogen, as defined by the US Department of Energy's (DOE) Clean Hydrogen Production Standard (CHPS). Shell supports policy designs that stimulate the production and use of clean hydrogen with a fully transparent lifecycle greenhouse gas (GHG) accounting system applied consistently across the value chain. The comments contained herein are informed by Shell's experience and expertise in developing hydrogen projects in the U.S. and worldwide.

Shell appreciates the challenge faced by the Administration and Treasury in implementing complex and critically important IRA incentives under tight timeframes amid conflicting stakeholder priorities.

Getting §45V[2] implementation guidance right is foundational to the clean hydrogen economy that the DOE described in its National Clean Hydrogen Strategy and Roadmap. Shell agrees with the Administration that hydrogen can play a critical role in helping the U.S. reach net zero emissions, particularly in hard to abate sectors. Globally, large-scale production of hydrogen from renewables is Shell's ultimate goal, but to achieve scale in the timeframe required for hydrogen to make a difference as a net-zero lever, all forms of clean hydrogen are needed, including hydrogen production paired with CCS. Abundant and affordable supplies of clean hydrogen are essential for the success of the U.S. hydrogen hubs, which will serve as the foundation of a hydrogen economy.

Achieving swift and affordable scale-up of clean hydrogen production requires a level of policy support from governments that enables clean hydrogen to compete with existing fuels. A workable §45V credit that incentivizes capital investment at scale across multiple sectors moves the U.S. closer to the Administration's aspirations of $1/kg of clean hydrogen by 2031, 10 MMT of production, and the creation of 100,000 new jobs. An overly restrictive §45V guidance that discriminates based on fuel source and seeks to restrict select markets or proven market instruments, relies too heavily on potentially unpredictable approval processes, or mandates steep environmental gains too early, puts at risk the important aspirations of the national hydrogen strategy and the role hydrogen can play in achieving both U.S. near-term and long-term emission reduction targets.

In the EU, Shell has welcomed ambitious legislation to kick-start demand for clean hydrogen in hard-to-abate sectors. However, the complexity of the regulations and uncertainties around their implementation in EU Member States risk slowing down or deterring final investment decisions (FID) on pioneer projects. Volume and affordability are both key. Unless the U.S. incentivizes customer demand, something Congress is typically reluctant to do, the production of affordable, competitive volumes at scale are the only way to reap the emission reductions as envisioned in the national hydrogen strategy. By learning from the EU's challenges, Treasury has an opportunity to issue final guidance that triggers early investments in production, infrastructure, and market development needed for the energy transition.

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[1] The companies in which Shell plc directly and indirectly owns investments are separate legal entities. In this document, "Shell", "Shell USA", "Shell Group" and "Group" are sometimes used for convenience where references are made to Shell plc and its subsidiaries in general.

[2] Unless otherwise indicated, all statutory references are to the Internal Revenue Code (Code) of 1986, Title 26 U.S.C., as amended; all regulation references are to the Code of Federal Regulations, Title 26 (Treas. Reg.), as amended.

This document is structured in sections that align with the Proposed Regulations published on December 26, 2023: Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property

Definitions (Section II)

C. Most Recent GREET Model

Shell supports the Argonne 45VH2-GREET model (GREET) as the best available open-source lifecycle analysis (LCA) methodology. ***Treasury should provide taxpayers, at their discretion, the option (a) to use the version of GREET in effect at the start of construction for subsequent tax years (i.e., GREET grandfathering), and (b) the ability to adopt an updated version of GREET at any time during the credit period***. A taxpayer's FID requires confidence in project economics and §45V tax credits are an important value driver. If an updated version of GREET can negatively impact or eliminate §45V eligibility, it will make investment decisions high risk and will jeopardize the ability to secure project financing. This could cause an otherwise viable project to fail or to shut down. GREET grandfathering reduces this risk by providing taxpayers with greater certainty. Likewise, future optionality is required to avoid punishing early-stage projects operating under older guidance. For example, if an updated GREET moved new emissions factors or pathways from background to foreground data, then it could result in a given project having a lower carbon intensity (CI) under the updated GREET than under the previous version. Early movers are taking additional risk and should not be disadvantaged. GREET grandfathering with future optionality is a necessary mechanism to de-risk investment decisions and to bolster long-term project viability. Addressing this uncertainty is a critical element for project developers to sanction projects and kickstart the hydrogen economy.

Procedures for Determining Lifecycle Greenhouse Gas Emissions Rates for Qualified Clean Hydrogen (Section V)

Qualified Clean Hydrogen

The lifecycle GHG emissions rate of all hydrogen produced at a qualified clean hydrogen production facility is proposed annually and measured at the end of the taxable year. ***During times of natural disasters, emergency events, start-ups, shutdowns, and maintenance activities, hydrogen production may not qualify as "qualified clean hydrogen" and should therefore be excluded from the calculated emissions rate for the taxable year*** per the verification process. There is currently no guidance regarding treatment for these types of activities. Further, ***Treasury should allow batching of continuous production*** from a facility for a given period. Taxpayers would earn credits specific to each batch, rather than averaged over a taxable year. This is similar to the Low Carbon Fuel Standard (LCFS) Reporting Tool and Credit Bank & Transfer System (LRT-CBTS) system used by the California Air Resources Board (CARB) where credits are reported on a transactional basis. The same approach could be used for batches of clean hydrogen. Batching would give hydrogen producers the ability to pursue a wider range of operating modes. This would translate into less downtime and a stronger ability to serve customers with clean hydrogen tailored to their needs.

A. GREET Model

Background Data:

The final §45V guidance should allow for changing the GREET background data. Without this flexibility, it leads to inaccurate hydrogen CI calculations for certain projects, especially with respect to natural gas feedstock used for hydrogen production.

Currently, natural gas feedstock has a single, national average emission factor. When this value is used to model hydrogen production with carbon capture and sequestration (CCS), the upstream natural gas emissions contribute more than 50% of the hydrogen's CI. However, upstream GHG emissions of natural gas are highly variable and depend on the region or the field producing the gas. This has a significant impact on the calculated CI.[3] To incentivize lower GHG intensity feedstock, taxpayers using GREET should be able to procure low-carbon or other environmental certifications and recognize those attributes in their hydrogen production modeling via book and claim. This could be enabled by third-party certification of the GHG intensity of different natural gas producers. To achieve demand-driven emission reductions in the natural gas market, four elements need to be integrated. First, measurement-informed reproducible standards are necessary to ensure accuracy and consistency. Second, methane emissions should be tracked and verified at the asset level to ensure holistic emissions representation. Third, emissions need to be verified by an independent third-party auditor to maintain credibility. Lastly, robust certificate registries must be in place to maintain accurate tracking and retiring of methane emission attributes.

Third-party certification programs that meet these four elements exist currently. They use detailed bottom-up measurements along the entire molecule life cycle, complemented by a top-down approach using drone and satellite technologies. This comprehensive approach helps ensure data accuracy, precision, and credibility. Existing certificates are being transferred and retired in the market, which indicates their operational readiness.

The §45V tax credit is intended to stimulate the production of low carbon hydrogen. Using a default methane loss rate as background data does not effectively satisfy this objective. Under the proposed §45V guidance, a single upstream natural gas value represents a missed opportunity to incentivize investment in decarbonization along the full natural gas value chain. Given the market readiness of certification, clean hydrogen can be an important mechanism to drive emissions reductions in the gas value chain with impacts far beyond volumes used for hydrogen production.

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[3] Evan Sherwin, et al., *Quantifying oil and natural gas system emissions using one million aerial site measurements* (2023), https://assets.researchsquare.com/files/rs-2406848/v1/45687726-a75d-4bf4-b689-aa49b448849a.pdf?c=1674152998; Office of Fossil Energy and Carbon Management, *Greenhouse Gas Supply Chain Emissions Measurement, Monitoring, Reporting, Verification Framework* (2023), https://www.energy.gov/fecm/greenhouse-gas-supply-chain-emissions-measurement-monitoring-reporting-verification-framework.

Co-products, System Expansion, and Steam

Shell supports the idea that co-products from the hydrogen production process that are productively utilized can be allocated emissions using the "system expansion" approach. Shell agrees that the steam produced should not be done with a wasteful intent and encourages the implementation of energy efficient solutions. One example is waste heat recovery to reduce steam usage in processes such as the carbon capture required for producing clean hydrogen. To incentivize taxpayers to implement energy-efficient processes that reduce the overall GHG emissions of their operations, steam needs to be recognized as a co-product of hydrogen production.

GREET should include the ability to reflect the actual quantities of co-produced steam from hydrogen production. Currently, it is impossible to include any steam co-product in a hydrogen pathway using CCS. However, Shell is evaluating numerous technology configurations that use CCS and produce steam as a co-product. Excluding this possibility will lead to inaccurate hydrogen CI calculations under §45V. To appropriately model the LCA of hydrogen in GREET, taxpayers should be able to input steam exports regardless of technology, so long as the net steam export accurately reflects the process. This approach would also allow commercially available technologies, which are net steam export facilities, to be modelled accurately in GREET without having to submit a provisional emissions rate (PER) application. By having this as the standard in GREET for any hydrogen and CCS technology, accurate LCA analysis of clean hydrogen production can be completed whilst identifying areas to decrease overall emissions intensity of operations.

B. <u>Provisional emissions rate</u>

Project Readiness: The proposed timing for the PER applications is incompatible with the typical project delivery framework used on major capital projects. Taxpayers developing capital intensive projects will typically spend significant time analyzing and selecting a specific technology or facility design concept, often referred to as Pre-FEED (front end engineering design). Pre-FEED completion signals the end of an optionality period to alter the technology or facility design concept, and the project then progresses into FEED. During FEED, final engineering is completed on the basis that design work is finalized and the project scope is frozen. Waiting until after FEED to submit the PER application will delay or eliminate the taxpayers' ability to progress a project that aligns with standard project assurance and auditing processes, resulting in potential project delay of one to two years. The PER application timing at the end of FEED would also complicate and delay the ability to order long-lead items, which taxpayers must order prior to making FID. Given the uncertainty of the PER process for a given project, waiting for a PER outcome could further delay execution and onstream dates. ***The more appropriate timing for the PER application is at the completion of pre-FEED***. At this time, taxpayers should have developed the following deliverables that would signal sufficient project maturity to apply for a PER: Class 4 Cost Estimate (+/- 30%), Level 2 Schedule, Basis of Design including product specifications and plant capacity requirements, heat and material balance, utility balance, equipment list, preliminary piping and instrumentation diagrams, plot plan, risk management plan, economic assessments, and

Scope of Work for FEED phase. Similar to the discussion in Section II(C), PER grandfathering and future optionality to use GREET should apply to projects receiving a PER.

Eligibility: Under the proposed §45V guidance, taxpayers can request a PER only if their project uses a feedstock and/or production technology that is excluded from GREET. ***Treasury should provide taxpayers the option to apply for a project-specific PER***, ***even in cases where the feedstock and production technology is present in GREET***. While this may require additional resources to administer, it would allow taxpayers to make more informed design choices. For instance, it would provide the flexibility needed to capture project-specific design choices that are the basis for calculating well-to-gate GHG intensity of hydrogen production. Specifically, these choices will directly influence the feedstock and utility input requirements, as well as the yield of hydrogen and other co-products. More accurate hydrogen CI calculations will incentivize project and technology decisions that minimize GHG emissions.

GREET only includes two technologies that produce clean hydrogen by thermal conversion of natural gas – steam methane reforming (SMR) and auto thermal reforming (ATR). This limited approach omits important and commercially available technologies that were previously recognized by the DOE,[4] including partial oxidation (POx). Taxpayers considering technologies such as POx will thus need to petition for a PER. However, under the proposed guidance, the PER may only be submitted after conducting a FEED or similar study that is sufficient to make FID. This timing discrepancy creates undue burden and uncertainty for taxpayers considering such technologies and would likely influence early project decisions in favor of technologies that are included in GREET, rather than technical merit (i.e., lower CI). Compared to other technologies included in GREET, POx generates, rather than consumes, steam to satisfy the demands of the process. This benefit currently translates to lower carbon dioxide emissions and cost of hydrogen (relative to other technologies included in GREET),[5] both of which are key priorities in the U.S. strategy to develop and adopt clean hydrogen.[6] For these reasons, ***it is important that POx be included in the next available GREET update***.

C. <u>Use of energy attribute certificates (EAC)</u>

The proposed §45V guidance provides requirements for incrementality, temporal matching, and deliverability (3 Pillars) that are overly restrictive, cost prohibitive, and not reflective of the current energy landscape. This limits the hydrogen production that §45V is meant to incentivize. For example, the incrementality requirement limits the electricity component to recently or newly developed projects and adopts strict criteria for older projects. This fails to recognize the expansive growth in renewable energy project development over the last several decades. It also

[4] Shannon McNaul, et al., *Hydrogen Shot Technology Assessment: Thermal Conversion Approaches* (February 2024), https://netl.doe.gov/projects/files/HydrogenShotTechnologyAssessmentThermalConversionApproachesRevised_120523.pdf.
[5] IEA Greenhouse Gas R&D Programme (IEAGHG), *New IEAGHG Technical Report: 2022-07 Low Carbon Hydrogen from Natural Gas: Global Roadmap* (August 2022).
[6] DOE, *U.S. National Clean Hydrogen Strategy and Roadmap* (June 2023), https://www.hydrogen.energy.gov/docs/hydrogenprogramlibraries/pdfs/us-national-clean-hydrogen-strategy-roadmap.pdf.

assumes the infrastructure and regulatory environment to interconnect new clean energy projects exist. ***Any EAC that can be validated should be eligible***, including those associated with existing renewable resources, resources that can be repowered to avoid project retirements, and projects that add technologies to lower resource emissions, such as CCS.

a. Incrementality – As previously noted, the requirement that resources be "new" is impractical and overly restrictive. Additionally, the guidelines for existing clean resources permit only a 5% allowance. It's important to recognize that regions with a high concentration of renewables can have hours when renewables are curtailed (e.g., solar in the California Independent System Operator (CAISO) and wind in West Texas) because of an abundance of excess energy. In 2022, "CAISO curtailed 2.4 million megawatt hours (MWh) of utility-scale wind and solar output . . . ."[7] If there are no upgrades to the Texas power grid, forecasts predict that Texas wind power curtailments will rise to 13% of total available generation by 2035, up from 5% in 2022.[8] Solar curtailments are forecasted to increase from 9% to 19% under the same grid scenario.[9] ***Limitations on existing renewable energy projects, if any, should be based on regional resource modeling and consider available resources in the system***. This means including renewable energy curtailments, rather than setting an arbitrary eligibility percentage.

b. Temporal Matching – The proposed §45V guidance requires hourly matching by 2028; however, this assumes all regions have adopted an EAC tracking system and that the renewable electricity can be directly delivered in the hour it was produced. Transmission congestion can prevent the electricity from being delivered in the hour in which it was produced. Clean energy, however, was still generated and added to the grid to serve load that could have otherwise been served by fossil generation.

The final §45V guidance should acknowledge that certain regions don't have approved registries to create and track EACs. For example, Louisiana does not. Moreover, the regions that have registries cannot support hourly matching. Instead of requiring compliance by 2028, ***the final regulations should establish milestones to review and assess system capability until hourly matching is feasible***.

c. Deliverability – The regions as currently defined do not recognize existing regional transmission organizations that support reliability and ensure deliverability of resources across their systems. The Midwest ISO (MISO), for example, has abundant renewable energy resources that can be distributed across the Midwest, Plains, and Delta regions. Wind resources located in Iowa provide a lower emissions footprint for all of MISO. The Western Electricity Coordinating Council is separated into four regions and does not reflect the ability and common practice of transmitting

[7] Lori Aniti, Susanna Smith, *Solar and wind power curtailments are rising in California* (October 2023), https://www.eia.gov/todayinenergy/detail.php?id=60822.
[8] Mark Shenk, *Rising curtailments in Texas magnify grid, storage shortfalls* (October 2023), https://www.reuters.com/business/energy/rising-curtailments-texas-magnify-grid-storage-shortfalls-2023-10-19/.
[9] *Id*.

energy over long distances using regional interties. For instance, the Northwest/Southwest and California regions are incredibly well connected. In fact, major renewable project developments will be directly interconnected to California using a new interregional transmission pathway (currently under construction). Two large renewable projects intend to join the CAISO as subscribing participating transmission owners; however, the §45V rules effectively eliminate the ability to use wind from Wyoming or New Mexico to satisfy electrolyzer load in California. Projects connected with dedicated interregional transmission such as Texas and Louisiana should either be able to rely on book and claim accounting or be exempt from deliverability requirements under §45V. To support the GHG lifecycle emissions analysis, ***hydrogen production facilities located within regional transmission organizations or with access to interregional transmission should be able to utilize the emissions profile of the grid power matched with verified EACs***.

The 3 Pillars requirements should not be more stringent than those defined in existing programs. For example, the California Low Carbon Specification program provides for book and claim accounting to incentivize hydrogen production. As written in the proposed §45V guidance, the 3 Pillars will suppress rather than encourage investment in new hydrogen production facilities.

Exclusions – ***Treasury should exclude the 3 Pillars criteria in all cases of 'direct connection'*** of power or feedstock inputs to hydrogen production. For example, when power or feedstock from a known source goes directly and exclusively into the production system boundary, it is known with certainty that the inputs for hydrogen have a specific GHG footprint. This could apply to power or feedstock generation processes that are co-located to hydrogen production. Likewise, it could apply to projects that are co-developed specifically for operation with a hydrogen production project.

The purpose of the 3 Pillars is irrelevant for 'direct connection' of power. The origin and use of these specific inputs are physically traceable to the produced hydrogen. It is not connected to a broader market and there is limited risk of unintended indirect impacts of using such inputs.

Renewable Natural Gas and Fugitive Sources of Methane (Section IX)

First Productive Use: The first productive use requirement is based on the premise that RNG used in hydrogen production must protect against market repercussions. This concern relies on the assumption that demand from alternate use cases (e.g., transportation or power generation) will be eliminated when a new use is introduced. This is not the case. Diversion of RNG from existing or future markets would not impact the demand from existing uses. Rather, an increase in aggregate demand is more likely to incentivize additional supply development, which would result in greater emission reductions. As a testament to the market's ability to meet demand, there are currently 300 RNG projects in various stages of construction and development. ***Treasury should allow the market to operate competitively.*** Requiring RNG-to-hydrogen developers to bear the responsibility of market externalities is burdensome, unnecessary, and inconsistent with precedent shown through existing programs:

> No low-carbon or renewable fuel program currently active in the U.S. requires that credits be produced only from new facilities built for the purpose of generating credits under the program. However, there is strong evidence that demand for clean resources either driven by procurement mandates or voluntary action leads to resource additions without formal additionality requirements.[10]

Treasury should eliminate the first productive use requirement for RNG entirely because it is unwarranted. This will maximize the decarbonization impact of RNG-to-hydrogen.

Alternatively, Treasury should include an RNG grace period to address project delivery concerns, similar to the 3-year look-back for electricity markets. This look-back allows for flexibility in a variety of circumstances between two related, but separate projects (i.e., renewable power generation and an accompanying electrolyzer) that come online at different times. The same flexibility is necessary for RNG to accommodate start-up timing differences and to avoid curtailment of RNG development (and its decarbonization benefits). A greenfield RNG facility that is intended to supply a greenfield thermal hydrogen facility could easily come online several years before the accompanying hydrogen facility. To avoid first productive use issues, the taxpayer is incentivized to let the RNG facility sit idle or to curtail RNG volumes. Eliminating the first productive use requirement or creating a grace period would reduce the likelihood that such facilities would be left idle or have their volumes curtailed.

Deliverability and Temporal Matching: According to the Energy Information Administration (EIA),[11] the existing gas infrastructure grid contains 3 million miles of pipeline, which delivered 27.6 trillion cubic feet of gas to customers in 2021. This infrastructure operates regardless of RNG volumes relating to hydrogen. Even with robust RNG growth assumptions, RNG is likely to represent ~3% of total natural gas volumes by 2050. ***Given this robust natural gas infrastructure already exists with its own emissions profile, trying to identify the impact of small amounts of RNG is burdensome and inconsequential***. On the other hand, it is a beneficial and worthwhile effort to improve the understanding of leakage and emissions of the natural gas infrastructure, along with providing an incentive to recognize reduced emissions in hydrogen production.[12] However, that effort should be independent of whether RNG/biogas is transported on the pipeline.

Temporal matching of RNG provides no benefit. The natural gas infrastructure includes 4,196 Bcf of underground storage capacity dispersed nationally. This provides a significant buffer for periods of excess

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[10] Dr. Jeffrey Reed, et al., *Environmental Attribute Credits: Analysis of Program Design Features and Impacts* (September 2023), https://cleanenergy.uci.edu/PDF_White_Papers/Environmental_Attribute_Credits_Analysis_of_Program_Design_Features_and_Impacts_091523.pdf.

[11] Energy Information Administration, *Natural gas pipelines* (November 2022), https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php.

[12] Please refer to the comments in Section V(A), GREET Model: Background Data, in reference to allowing lower CI natural gas feedstock to be recognized in hydrogen production.

demand and addresses seasonality of gas markets.[13] Additionally, there is no meaningful variability of CI of natural gas produced based on time of day or season. The interstate pipeline system enables injected physical molecules to be accounted for and tied to equivalent molecules that can be dispensed elsewhere in the network. These elements eliminate the need to closely match production and usage.

Book and Claim: RNG is indistinguishable from fossil natural gas which allows it to be injected and distributed through the North American natural gas pipeline system. RNG facilities are geographically dispersed and are typically not co-located with ideal hydrogen production locations. A direct connection requirement disregards this world-class infrastructure, rather than embracing it. Existing systems can credibly account for attributes to be tracked between counterparties. Established programs recognize this system and allow for the use of book-and-claim accounting treatment of RNG, including EPA's Renewable Fuel Standard and California's LCFS. These programs also recognize the importance of robust substantiation and have developed policies and oversight that include routine reconciliations, attestations, annual audits, and third-party verification. ***Treasury should not develop a separate and burdensome process that forces an inconsistent treatment of RNG from an already proven and successful market.***

[13] EIA, *Underground Natural Gas Working Storage Capacity* (August 2022), https://www.eia.gov/naturalgas /storagecapacity/.