Submitted via the Federal eRulemaking Portal February 26, 2024

The Honorable Aviva Aron-Dine
Acting Assistant Secretary (Tax Policy)
Department of the Treasury
1500 Pennsylvania Avenue, NW
Washington, DC 20220

The Honorable Daniel Werfel
Commissioner
Internal Revenue Service
1111 Constitution Avenue, NW
Washington, DC 20224

William Paul
Principal Deputy Chief Counsel
Internal Revenue Service
1111 Constitution Avenue, NW
Washington, DC 20224

Re: Comment on Guidance for Section 45V Credit for Production of Clean Hydrogen

Dear Acting Assistant Secretary Aron-Dine, Commissioner Werfel, and Principal Deputy Chief Counsel Paul,

Please find enclosed our comment on the Notice of Proposed Rulemaking published by the Department of the Treasury and the Internal Revenue Service in the Federal Register on December 26, 2023. We appreciate the careful attention to the numerous complexities of the section 45V credit and the competing priorities and interests of the many stakeholders seeking guidance on this credit. The enclosed comment reiterates that section 45V requires consideration of significant indirect emissions (including induced emissions) in determining the lifecycle greenhouse gas emissions rate of clean hydrogen and addresses several other issues included in the Notice of Proposed Rulemaking.

The Tax Law Center at NYU Law is a public interest initiative that seeks to improve the integrity of the tax system. Our staff includes tax law experts with experience in tax administration, private practice, and the tax legislative process. We would be pleased to discuss these comments with you or your staff.

Sincerely,

Chye-Ching Huang
Executive Director, Tax Law Center at NYU Law
taxlawcenterclimate@nyu.edu

1 Introduction

The statutory framework of the Inflation Reduction Act (IRA) reflects a broad shift in tax and energy policy, moving the US from a technology-specific approach to a technology-neutral approach to determining eligibility for clean fuel and clean generation credits. Beginning in 2025, most projects will receive credits based on a greenhouse gas emissions analysis, not on the type of technology generating the fuel or electricity. More specifically, clean hydrogen, other clean fuels, and generation projects using gasification will receive credits based on the "*lifecycle* greenhouse gas emissions" (lifecycle GHG emissions) of the project. This new structure underlies a system-wide approach to decarbonizing the grid, fuels, and other historically difficult-to-decarbonize sectors.

The reference in section 45V(c)(1)[1] to the Clean Air Act (CAA), which requires the lifecycle GHG emissions of clean hydrogen to include "significant indirect emissions" that are "related to" the fuel lifecycle, is consistent with this broader system-wide approach.[2] The Notice of Proposed Rulemaking (NPRM) properly reflects this policy change by capturing the system-wide emissions of electrolytic hydrogen production, including induced grid emissions, consistent with the purposes and structure of the IRA.[3] This comment proceeds as follows:[4]

- **Part 2** outlines the statutory requirements of section 45V, cites the various broad grants of authority given to the Secretary of the Department of the Treasury (Treasury) to determine lifecycle GHG emissions, and sets out a brief history of the provision.
- **Part 3** describes how the proposed regulations adopt the three pillars in order to account for induced grid emissions resulting from the production of electrolytic hydrogen.
- **Part 4** explains why Treasury and the Internal Revenue Service (IRS) are required by statute to account for induced grid emissions associated with electricity used in producing electrolytic hydrogen. This requirement flows from the mandatory directive in section 45V(c)(1)(A) to account for "significant indirect emissions" that are "related to" hydrogen production and from the plain meaning of these terms and their role in the statutory framework.
- **Part 5** explains in detail how section 45V(c)(1)(B) operates to scope certain emissions out of the lifecycle GHG emissions calculation and provide an administrable calculation method. Importantly, the provision does not alter the requirement to account for significant indirect emissions, including induced grid emissions, in the lifecycle GHG emissions rate of hydrogen.

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[1] Unless otherwise noted, all references to the "Code" are to the Internal Revenue Code of 1986, as amended, all references to "section" are to sections of the Code, and all references to "Treas. Reg. §" are to Treasury regulations issued thereunder.

[2] Clean Air Act § 211(o)(1)(H), 42 USC 7545(o)(1)(H).

[3] Section 45V Credit for Production of Clean Hydrogen; Section 48(a)(15) Election To Treat Clean Hydrogen Production Facilities as Energy Property, REG-117631-23, 88 Fed. Reg. 89220 (December 26, 2023) ("45V NPRM").

[4] The principal authors of this comment are Taylor Cranor, Grace Henley, Chye-Ching Huang, Michael Kaercher, and Kyle Sweeney.

- **Part 6** then addresses a specific issue raised in the NPRM—whether book-and-claim accounting should be used to determine the emissions of hydrogen projects using renewable natural gas (RNG).

2 Statutory framework and history

Section 45V provides a production tax credit (PTC) for clean hydrogen. The amount of the credit is based on the lifecycle GHG emissions rate of hydrogen produced. Qualified clean hydrogen with the lowest lifecycle GHG emissions rate receives a credit of up to $3 per kg of hydrogen produced, while qualified clean hydrogen with a higher rate may receive credits of $1.00, $0.75, or $0.60 per kg, based on the lifecycle GHG emissions rate.[5] Hydrogen that has a lifecycle GHG emissions rate above 4 kg of CO2e per kg of hydrogen produced is ineligible for the 45V credit.

Section 45V(c) provides the following definition for calculating the lifecycle GHG emissions rate:

> (c) DEFINITIONS. For purposes of this section—
>
> (1) LIFECYCLE GREENHOUSE GAS EMISSIONS
>
> (A) In general
>
> Subject to subparagraph (B), the term "lifecycle greenhouse gas emissions" has the same meaning given such term under subparagraph (H) of section 211(o)(1) of the Clean Air Act (42 U.S.C. 7545(o)(1)), as in effect on the date of enactment of this section.
>
> (B) GREET model
>
> The term "lifecycle greenhouse gas emissions" shall only include emissions through the point of production (well-to-gate), as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Transportation model (commonly referred to as the "GREET model") developed by Argonne National Laboratory, or a successor model (as determined by the Secretary).

Section 211(o)(1)(H) of the CAA defines lifecycle GHG emissions as follows (emphasis added):

> The term "lifecycle greenhouse gas emissions" means the aggregate quantity of greenhouse gas emissions (**including direct emissions and significant indirect emissions** such as significant emissions from land use changes), as determined by the Administrator [of the Environmental Protection Agency], **related to the full fuel lifecycle**, including **all stages of fuel and feedstock production** and distribution, from feedstock generation or extraction **through the distribution and delivery and use of the finished fuel to the ultimate consumer**, where the mass values for all greenhouse gases are adjusted to account for their relative global warming potential.

In addition to specifically granting Treasury and the IRS the authority to determine a "successor" model as noted above, section 45V provides a specific, broad grant to Treasury and the IRS to carry out the purposes of section 45V and determine the lifecycle GHG emissions of clean hydrogen:

[5] The credit amounts listed here assume that the prevailing wage and apprenticeship requirements described in section 45V(e)(3) are satisfied. If these requirements are not satisfied, then the credit tiers are reduced by 80%.

> (f) REGULATIONS
>
> Not later than 1 year after the date of enactment of this section, the Secretary shall issue regulations or other guidance to carry out the purposes of this section, including regulations or other guidance for determining lifecycle greenhouse gas emissions.

An earlier draft bill of the clean hydrogen tax credit similarly contained a tiered-credit structure based on the lifecycle GHG emissions rate of the hydrogen produced.[6] Similar to section 45V, that bill defined lifecycle GHG emissions by cross-reference to section 211(o)(1)(H) of the CAA. However, it did not contain a reference to GREET. As the draft bill was incorporated into the IRA, one change made was the addition of the reference to GREET and the "well-to-gate" analysis. Another change was that the original bill instructed the Secretary to publish guidance to "consider the emissions associated with any feedstock or energy source which is not co-located at the qualified clean hydrogen production facility" when certain conditions are met.[7] This reference to a book-and-claim system was dropped from the statutory text when the hydrogen PTC was incorporated into the IRA. However, on the day before the IRA passed the Senate, Senator Carper (the author of the original bill) and Senator Wyden (Chairman of the Finance Committee) engaged in a colloquy on the floor, which included the following excerpt:

> Senator Carper: Section 13024 of title I of the Inflation Reduction Act of 2022 provides a production and investment tax credit for the production of clean hydrogen. In Section 13204, the term "lifecycle greenhouse gas emissions" for a qualified hydrogen facility is determined by the aggregate quantity of greenhouse gas emissions through the point of production, as determined under the most recent Greenhouse gases, Regulated Emissions, and Energy use in Technologies--GREET--model. It is also my understanding of the intent of section 13204, is that in determining "lifecycle greenhouse gas emissions" for this section, the Secretary shall recognize and incorporate indirect book accounting factors, also known as a book and claim system, that reduce effective greenhouse gas emissions, which includes, but is not limited to, renewable energy credits, renewable thermal credits, renewable identification numbers, or biogas credits.
>
> Is that the chairman's understanding as well?
>
> Chairman Wyden: Yes.[8]

This history indicates that certain book-and-claim systems may offer appropriate methodological proxies for determining eligibility of tax credits, but only if they properly account for the direct and significant indirect emissions, as required by the statute.

3 The NPRM allows energy attribute certificates that account for direct and significant indirect emissions to be considered in the lifecycle GHG emissions rate of electrolytic hydrogen

The proposed regulations provide a pathway for electrolytic hydrogen producers to use a book-and-claim system in a way that is consistent with the statute. The proposed regulations satisfy the statutory requirement to account for significant indirect emissions with respect to electrolytic

[6] *See* Clean H2 Production Act, S.1807, 117th Cong. § 2(a) (as referred to the Committee on Finance, May 5, 2021).

[7] *Id.*

[8] 168 Cong. Rec. S4165-66 (August 6, 2022).

hydrogen by adopting the "three pillars" emissions accounting concept. Generally, taxpayers may treat electricity used to produce electrolytic hydrogen as zero GHG-emitting electricity by purchasing energy attribute certificates (EACs) that comply with these pillars. An EAC qualifies if it is (1) temporally matched, meaning generated in the same calendar year (before January 1, 2028) or the same hour (after January 1, 2028) as the taxpayer's hydrogen production; (2) deliverable, meaning generated in the same region as the taxpayer's hydrogen production; and (3) incremental, meaning sourced from an electricity generating facility that began commercial operations no more than 36 months before the hydrogen production facility was placed in service.[9] Treasury and the IRS have made the determination that EACs compliant with these pillars "serve as a reasonable methodological proxy for quantifying certain indirect emissions associated with electricity for purposes of the section 45V credit."[10]

This approach has generated substantial attention because as a practical matter (and as discussed further below), induced grid emissions are a significant source of emissions for electrolytic hydrogen, meaning including them in the lifecycle GHG emissions rate will substantially impact a hydrogen producer's eligibility for section 45V credits. As we explain below, the proposed rules flow directly from the best interpretation of the statutory text and framework, which require Treasury and the IRS to consider the effects of significant indirect emissions when calculating the lifecycle GHG emissions rate of clean hydrogen.

4 The requirement to consider "direct and significant indirect emissions" "related to" the production of hydrogen is mandatory based on the statutory text

The reference in section 45V(c)(1)(A) to section 211(o)(1)(H) of the CAA requires Treasury and the IRS to consider the "direct and significant indirect emissions" that are "related to the full fuel lifecycle" in determining section 45V credits. As we set out here, the best reading of these terms based on their plain meaning and the statutory structure requires Treasury to consider a broad set of effects on emissions. In turn, the determination as to whether any specific category of emission is "indirect," "related to the full fuel lifecycle," and "significant" is a factual determination that has been delegated to Treasury and the IRS within the statutory boundaries of section 45V and subject to the requirement that Treasury engage in reasoned decision-making. Here, Treasury and the IRS have engaged in the necessary factfinding that supports including emissions from induced grid emissions in determining section 45V credits because those emissions are "significant," "indirect," and "related to" the electrolytic hydrogen lifecycle.

4.1 "Indirect" and "related to"

The plain meaning of "indirect emissions" that are "related to" the production of hydrogen indicates that emissions beyond those most proximate to feedstock and production must be included in the calculation of 45V credits. This is consistent with the dictionary and the Environmental Protection Agency's (EPA) definitions of these terms. Oxford Learner's Dictionary defines "indirect" as "happening not as the main aim, cause or result of a particular action, *but in addition* to it," while "related to" generally means "to be connected with something."[11] Likewise, EPA has interpreted "indirect emissions" under section 211 of the CAA

[9] Prop. Treas. Reg. § 1.45V-4(d).

[10] *See* 45V NPRM, 88 Fed. Reg. at 89227.

[11] *Indirect*, Oxford Learner's Dictionary (2024); *Relate to*, Oxford Learner's Dictionary (2024).

to include emissions that are "secondary."[12] EPA has also ruled emissions are "related to" the fuel cycle where predictive modeling demonstrates a causal link between emissions and a fuel's production.[13]

For example, in analyzing whether emissions arising from international land use changes were "indirect" and "related to" the biofuels lifecycle, EPA engaged in a factual inquiry and modeled the relationship. Those models demonstrated that the linkages between international land use change and US demand for biofuels are "generally close, and are not extended or overly complex," meaning such emissions were appropriately included in the lifecycle analysis.[14] Similarly, EPA has said that determining indirect emissions related to the biofuel lifecycle requires a "consequential" approach, considering "market interactions *induced* by expanded biofuel production and use that may result in *secondary* or indirect greenhouse-gas emissions."[15]

At the most basic level, electrolytic hydrogen production requires three things: water, an electrolyzer, and electricity. The analysis of the full fuel lifecycle must therefore account for the emissions associated with these key inputs in order to fulfill the statutory requirement to include direct and indirect (where significant) emissions "related to" the "full fuel lifecycle." However, the directive in section 211 of the CAA is not confined to emissions from inputs; the "full fuel lifecycle" also includes **production**, meaning the direct *and* significant indirect emissions from using electricity to convert water into hydrogen must be accounted for.[16]

Electrolytic hydrogen is produced by splitting water into hydrogen and oxygen using an electrolyzer. There are several types of electrolyzers, all of which "consist of an anode and a cathode separated by an electrolyte" and which use electricity to cause the chemical reaction that creates hydrogen.[17] Electrolysis is energy intensive, potentially requiring roughly 50 kWh of electricity (far in excess of the average American household's daily use)[18] to produce just a single kg of hydrogen, though energy needs vary by electrolyzer.[19] This is why the Department of Energy (DOE) estimates that if "electrolysis dominates as the production method, up to 200

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[12] Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 74 Fed. Reg. 24904, 24916 (May 26. 2009).

[13] Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 75 Fed. Reg. 14760, 14767 (March 26, 2010) ("Changes to RFS Final Rules").

[14] *Id.*

[15] Environmental Protection Agency (EPA), Letter on Interpretation of CAA Section 211(o)(1)(H) to Inform Treasury's Implementation of IRC Section 45V, 3 (December 20, 2023) ("45V Letter").

[16] The act of converting water into hydrogen, like converting other feedstock, is best understood as part of the "fuel production" process, which is included in the lifecycle of a fuel. *See generally Lifecycle Analysis of Greenhouse Gas Emissions under the Renewable Fuel Standard*, EPA (last visited February 22, 2024).

[17] *See Hydrogen Production: Electrolysis*, Office of Energy Efficiency & Renewable Energy (last visited February 22, 2024).

[18] *See How much electricity does an American home use?*, US Energy Information Administration (last visited February 22, 2024) (noting that "the average annual amount of electricity sold to (purchased by) a US residential electric-utility customer" was approximately 30kWh per day in 2022).

[19] Paul Day, *US grapples with how clean is green hydrogen*, Reuters (June 7, 2023).

GW of new renewable power would be needed by 2030 to support clean hydrogen production."[20] That is approximately 5% of total electricity generation currently, and roughly equivalent to the amount of all US solar power forecasted to be produced in 2023.[21]

As modelers and DOE have noted, absent incrementality, "electrolyzers would unquestionably raise GHG emissions."[22] If the electricity used by electrolyzers is not replaced with clean electricity, the production of electrolytic hydrogen will cause additional emissions. The electricity displaced from the grid and the ensuing emissions are not merely theoretical—they are measurable, and like emissions from land use changes in the production of biofuel, they are "consequential,"[23] "secondary" emissions "induced by expanded" electrolytic hydrogen production.

Some commenters have suggested that the statutory directive to consider "indirect emissions" only extends to land use changes that result from the changes in the supply of feedstock for other purposes. Under this interpretation, only the indirect emissions from the redirected use of water as a feedstock for hydrogen production would be considered. This is incorrect; section 211 of the CAA requires an analysis of indirect emissions from the "full fuel lifecycle," which includes feedstock *and* production. Land use changes are but one example of sources of significant indirect emissions that Congress listed in section 211 of the CAA,[24] but they are not the only type. Confining the analysis to indirect emissions from land use changes or feedstock production would violate the directive in section 211 of the CAA to analyze the full fuel lifecycle.

Similarly, some have suggested that Treasury and the IRS cannot consider induced grid emissions because the Renewable Fuel Standard (RFS) program and RFS regulations only consider the *direct* grid emissions associated with electricity related to the production of biofuel. Even if Treasury and the IRS were bound by the precise methodology used to assess the lifecycle emissions of biofuels, it would still be within Treasury's authority to consider induced grid

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[20] *The Pathway To: Clean Hydrogen Commercial Liftoff*, Department of Energy (DOE) (last visited February 22. 2024).

[21] *See* *Increasing renewables likely to reduce coal and natural gas generation over next two years*, US Energy Information Administration (January 19, 2023).

[22] Dan Esposito, Eric Gimon & Mike O'Boyle, *Smart Design of 45V Hydrogen Production Tax Credit Will Reduce Emissions and Grow the Industry* 18 (2023); *see also* Wilson Ricks, Qingyu Xu & Jesse Jenkins, *Minimizing Emissions from Grid-Based Hydrogen Production in the United States*, 18 Environmental Research Letters 1, 1 (2023); DOE, *Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit* 5-6 (2023) ("DOE Technical Paper").

[23] There are two key types of LCA methods—the attributional and consequential methods. The attributional method "depicts the potential environmental impacts that can be attributed to a system (e.g. a product) over its lifecycle, i.e. upstream along the supply-chain and downstream following the system's use and end-of-life value chain." *See* EUCAR, *Report on Attributional vs. Consequential LCA* 6 (2020). The consequential method "aims to quantify the *change* in emissions caused by decisions or interventions." *See* Matthew Brander, *The Most Important GHG Accounting Concept You may Not Have Heard of: The Attributional-Consequential Distinction*, GHG Management Institute (April 21, 2021). Induced grid emissions, like emissions from land use changes, are generally consequential. *See generally* Tomas Ekvall, *Attributional and Consequential Life Cycle Assessment*, in Sustainability Assessment at the 21st Century 1, 8 (2019) (explaining the importance of the marginal effects of changes in electricity usage on the grid as an important feature of consequential LCA).

[24] Section 211(o)(1)(H) of the CAA provides that lifecycle GHG emissions "includ[e] direct emissions and significant indirect emissions **such as** significant emissions from land use changes" (emphasis added). The use of "such as" indicates that land use changes are one illustrative example, and not the only category to be considered.

emissions. In its recent letter to Treasury ("45V Letter"), EPA confirms that, in fact, "for most of its [lifecycle analyses (LCAs)] the EPA currently uses an 'emission factor' for electricity use in biofuel production that represents grid average emissions," and "[i]n doing so, the EPA attempts to capture, on a systemwide basis*, both the direct and indirect emissions associated with increased electricity demand due to biofuel production*."[25] EPA explains that it opted for assigning an "emissions factor" rather than specifically including induced grid emissions in its biofuel LCAs because it lacked sufficient "analytical tools" at the time it developed those models. This does not indicate that induced grid emissions should be wholly excluded from the analysis in all cases. Instead, EPA indicates that even for biofuels, induced grid emissions are currently taken into account to some extent, albeit using a different method than the proposed regulations.[26] It is also worth noting that allowing only an emission factor methodology for electrolytic hydrogen, instead of the book-and-claim approach included in the proposed regulations, would likely make all electrolytic hydrogen projects ineligible for section 45V credits.

Lastly, as indicated previously, whether emissions are "indirect" and "related to" the fuel cycle is ultimately a factual determination. The NPRM engages in that factfinding to establish that induced grid emissions are indeed indirect emissions that are related to the lifecycle of electrolytic hydrogen. In the NPRM, Treasury cites a DOE technical paper, *Assessing Lifecycle Greenhouse Gas Emissions Associated with Electricity Use for the Section 45V Clean Hydrogen Production Tax Credit* (DOE Technical Paper), that explains how increased electric load, such as from electrolytic hydrogen production, would have operational and structural impacts on the grid that would result in additional greenhouse gas emissions.[27] Independent modeling also confirms that electrolytic hydrogen production without stringent guardrails would result in significant induced grid emissions. [28] These sources all support Treasury's conclusion that induced grid emissions are in fact "indirect" and closely "related to" electrolytic hydrogen production and therefore should be accounted for in determining the lifecycle GHG emissions rate for clean hydrogen.[29]

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[25] 45V Letter, *supra* note 15, at 4 (emphasis added).

[26] EPA has also considered *reductions* to the total lifecycle GHG emissions of certain biofuels on account of byproducts potentially *increasing* renewable electricity available to the grid. For example, EPA has determined that the greenhouse gas emissions profile of imported sugar cane ethanol should be reduced because the waste products associated with production can be used to generate electricity that would displace natural gas-based electricity on the grid. *See* Changes to RFS Final Rules, 75 Fed. Reg. at 14782-83. This shows that the impact a fuel has on the supply of grid electricity is appropriately considered in the fuel's lifecycle emissions analysis.

[27] DOE Technical Paper, *supra* note 22, at 5.

[28] *See, e.g.*, Ricks, *supra* note 22, at 1 ("We find that subsidized grid-connected hydrogen production has the potential to induce additional emissions at effective rates worse than those of conventional, fossil-based hydrogen production pathways"); Dan Esposito, Eric Gimon & Mike O'Boyle, *45V Exemptions Need Strong Guardrails to Protect Climate, Grow Hydrogen Industry* 1 (2024) (demonstrating that deeming 5% of the hourly generation from minimal-emitting electricity generators placed in service before January 1, 2023 as satisfying the incrementality requirement would contribute roughly 30 to 60 million metric tons of carbon dioxide per year).

[29] *See* 45V NPRM, 88 Fed. Reg. at 89229 ("Electricity from a specific generator will have a GHG emissions profile that results from both its direct and indirect emissions. EACs with attributes that meet the three criteria are intended to address indirect GHG emissions resulting from the dynamics of the electricity market and the electric grid.").

4.2 "Significant"

Because Treasury and the IRS have determined that induced grid emissions are "indirect" and "related to" the production of electrolytic hydrogen, the next question is whether such indirect emissions are also "significant."

"Significant" means "of a noticeably or measurably large amount";[30] "important or noticeable";[31] or "large or *important enough to have an effect* or to be noticed."[32] EPA has interpreted the term "significant" under section 211 of the CAA consistent with this plain meaning and the statutory context shared by the CAA and the IRA to reduce greenhouse gas emissions. EPA regulations under the RFS program account for "the real-world emissions consequences" of renewable fuels and assess whether emissions are significant "in terms of their relationship to total greenhouse-gas emissions for given fuel pathways."[33] In the 45V Letter, which explains the agency's historical interpretation of "significant indirect emissions," EPA provides examples of "significant" indirect emissions as determined under the RFS regulations for sugarcane and switchgrass ethanol.[34] EPA notes that for those fuels, emissions from land use changes have been deemed "significant" because they account for approximately 13% (for sugarcane ethanol) and 60% (for switchgrass ethanol) of the total greenhouse gas emissions for those pathways.[35]

Whether or not emissions are significant is also a factual determination based on the relevant context. For section 211 of the CAA, and for section 45V, which references the CAA, the relevant context for both is a statutory regime that seeks to calculate the "aggregate quantity of greenhouse gas emissions" of a fuel's lifecycle with an aim to reduce those emissions. Treasury and the IRS have provided the necessary factual basis for establishing that induced grid emissions from electrolytic hydrogen are "significant."[36]

Although section 45V does not define the word "significant," Treasury reasonably relies on the ordinary meaning of the word—"large" or "noticeable"—as well as EPA's definition of "significant." As modelers have indicated, the lifecycle emissions of electrolytic hydrogen vary depending on the share of fossil fuel generation feeding the grid in the producing region, but generally, such emissions exceed the limits set in section 45V to qualify for the credit.[37] For example, induced emissions from electrolytic hydrogen could range from 10 to 40 kg of CO2e per kg of hydrogen produced.[38] These numbers far exceed the tiers in section 45V, which limit the lifecycle GHG emissions rate to just 4 kg of CO2e per kg of hydrogen produced in order to claim even the lowest credit amount. If new, carbon-free electricity is used that complies with

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[30] *Significant*, Merriam-Webster (2024).

[31] *Significant*, Cambridge Dictionary (2024).

[32] *Significant*, Oxford Learner's Dictionary (2024) (emphasis added).

[33] 45V Letter, *supra* note 15, at 4.

[34] *Id.*

[35] *Id.*

[36] *See* 45V NPRM, 88 Fed. Reg. at 89227-29.

[37] *See* Ricks, *supra* note 22, at 5.

[38] *Id.*

the three pillars, modeling indicates electrolysis can achieve minimal induced emissions and qualify for the credit under section 45V,[39] meaning direct and induced emissions together would fall to 4 kg or less of CO2e per kg of hydrogen produced.[40] This indicates that at present, induced grid emissions indeed account for a "significant" portion of the total greenhouse gas emissions of the electrolytic hydrogen pathway and are therefore "significant" under the plain meaning of the word and EPA's definition of the term.

In establishing the significant nature of induced grid emissions, Treasury also refers to the analysis set out in the DOE Technical Paper, which concludes that "electrolysis projects that use grid electricity have the potential to be *several times more GHG intensive* than the threshold for the lowest value § 45V tax credit tier . . . and could be *more GHG intensive* than existing forms of conventional hydrogen production." [41] According to DOE, this is because electricity displaced from the grid by electrolyzers will be replaced by "dispatchable generators," which are "primarily natural gas or coal that emit GHGs."[42] These operational impacts, along with other structural impacts, "can *significantly* change GHG emissions" on a system-wide basis, meaning "capturing both is important in accurately assessing the ways in which increased loads can impact GHG emissions."[43]

By seeking public input in Notice 2022-58 and the NPRM, Treasury and the IRS have engaged and continue to engage in the necessary factfinding to determine that induced grid emissions are in fact "significant." That factfinding reveals that electrolyzers have the potential to draw substantial electricity from the grid. The DOE Technical Paper, along with EPA's standard for "significant" indirect emissions, informs the best interpretation of section 211 of the CAA and its reference in section 45V. These sources and the plain meaning of the term all indicate that induced grid emissions caused by electrolysis must be accounted for when determining the lifecycle GHG emissions rate of clean hydrogen.

5 Section 45V(c)(1)(B) provides additional direction on how to determine lifecycle GHG emissions consistent with the requirement to account for "significant indirect emissions"

Section 45V(c)(1)(B) mandates that lifecycle GHG emissions "shall only include emissions through the point of production (well-to-gate), as determined under the most recent [GREET model], or a successor model (as determined by the Secretary)" (the "GREET model" provision).

The best reading of this provision is that section 45V(c)(1)(A) applies first to include all "direct and significant indirect" emissions as "lifecycle greenhouse gas emissions," and that the first clause of section 45V(c)(1)(B) then applies to carve out certain categories of emissions that occur post the "point of production" or "gate." This limitation does not scope induced grid emissions out of lifecycle GHG emissions for electrolytic hydrogen, as they are "significant indirect emissions" that are "related to" the production stage of the hydrogen lifecycle. Both the well-to-gate limitation and the reference to GREET or a successor model in the second clause of

[39] *See* Esposito, *supra* note 22, at 18.

[40] *See* Ricks, *supra* note 22, at 1.

[41] DOE Technical Paper, *supra* note 22, at n.3 (emphasis added).

[42] *Id.* at 5.

[43] *Id.* (emphasis added).

section 45V(c)(1)(B) provide for an administrable way to calculate hydrogen emissions. Below we set out the elements of the statutory text and framework that support this interpretation. We then discuss why the model the regulations use to estimate lifecycle GHG emissions must comply with the statutory requirements of section 45V(c)(1) and explain that Treasury appropriately selected the 45VH2-GREET model.

5.1 Statutory text and framework

The structure of section 45V(c)(1) indicates that section 45V(c)(1)(B) puts certain practical limits on the definition of lifecycle GHG emissions by carving out particular difficult-to-estimate emissions categories and providing for a simplified tool (a model) for administrative simplicity. Section 45V(c)(1)(B) does not alter the core directive of section 45V(c)(1)(A) to include "direct and significant indirect" emissions in the lifecycle GHG emissions calculation.

The cross-reference to the CAA is presented first, and labeled as an "in general" rule, which underscores that this is the starting point for determining the meaning of lifecycle GHG emissions. The GREET model provision is presented subsequently and separately, structurally reinforcing that it operates after the "in general" rule. Moreover, the reference to the CAA contains the "meaning" of lifecycle GHG emissions, whereas the GREET model provision clarifies that the lifecycle analysis begins at the well (similar to RFS) but ends at the gate (after production is complete, but earlier than a "well-to-wheel" analysis under RFS). Therefore, the GREET model provision excludes certain emissions that would otherwise be included under the "in general" rule—namely, those related to stages of the hydrogen lifecycle that occur after production. Section 45V(c)(1)(B) therefore should not be read as altering or supplanting the "in general" rule's requirement that "direct and significant indirect emissions" "related to" the relevant lifecycle stages be included in lifecycle GHG emissions.

The concepts underlying the "in general" rule and "GREET model" provision also support this reading. The CAA cross-reference in section 45V is to a general conceptual definition, as analyzed at **Part 4** above. The "GREET model" provision then contains two specific mandates: (1) that the term "lifecycle greenhouse gas emissions" only include emissions through the point of production; and (2) that those emissions are to be determined under a specified model.

Unlike the "in general" definition, these two parts of the "GREET model" provision both relate to administrability considerations in measuring hydrogen production emissions. The requirement that lifecycle GHG emissions only include emissions through the point of production relates to a key practical consideration in estimating hydrogen lifecycle emissions. Hydrogen currently has a broader range of potential uses beyond transportation fuel, including in energy storage, fuel cells, industrial processes, and the production of fertilizer, among others.[44] This makes it currently difficult to determine the emissions related to the "use of the finished fuel to the ultimate customer" that the cross-reference to the CAA would require if section 45V(c)(1)(B) were not included.[45] Section 45V(c)(1)(B) thus provides administrable bounds on the definition of lifecycle GHG emissions through the "well-to-gate" limitation.

[44] *See, e.g.*, Galen Bower et al., *Clean Hydrogen: A Versatile Tool for Decarbonization*, Rhodium Group (September 9, 2021).

[45] *See* section 45V(c)(1)(A); Clean Air Act § 211(o)(1)(H), 42 USC 7545(o)(1)(H).

The directive to use GREET or a successor model further provides an administrable tool for calculating the aggregate quantity of greenhouse gas emissions. A model is a simplified description of reality. By specifying the use of a model as an administrative method, section 45V explicitly does not require a perfectly accurate calculation of aggregate in-scope emissions—it provides for appropriate simplifications. As **Part 5.2** will discuss below, the model Treasury uses to determine lifecycle GHG emissions must still comply with all statutory requirements in section 45V(c)(1), including the requirement to account for "significant indirect emissions."

The development of section 45V is consistent with this reading of section 45V(c)(1)(B). An earlier draft bill of the clean hydrogen tax credit contained a tiered-credit structure based on the lifecycle GHG emissions of the hydrogen produced, similar to section 45V.[46] That bill defined lifecycle GHG emissions by cross-reference to section 211(o)(1)(H) of the CAA, but it did not contain a reference to GREET.[47] While providing a conceptual basis for applying section 45V, this approach would have created substantial uncertainty and administrative complexity in how to determine the lifecycle GHG emissions rate due to the difficulty in determining the end use of hydrogen. Unlike RFS, the GREET model provided an existing platform where variables could be selected to determine a lifecycle GHG emissions rate for a hydrogen production process. Therefore, as the draft bill was incorporated into the IRA, one key change made was the addition of the reference to GREET and the "well-to-gate" analysis. This requires Treasury to use a model as an administrative tool for implementing lifecycle analysis that does not need inputs regarding the final use of hydrogen. Importantly, the general definition of lifecycle GHG emissions stayed the same as in the draft bill, pointing to section 211(o)(1)(H) of the CAA.

As applied to electrolytic hydrogen, section 45V(c)(1)(B) does not scope out induced grid emissions. Per our discussion in **Part 4**, Treasury and the IRS have determined that induced grid emissions are "significant indirect" emissions "related to" hydrogen production and so are included under the "in general" rule. The "GREET model" provision does not remove such indirect emissions from the lifecycle GHG emissions analysis because induced grid emissions are related to the production stage of the electrolytic hydrogen lifecycle. Treasury must therefore consider these emissions in its lifecycle GHG emissions analysis.

This natural reading of the statute gives section 45V(c)(1)(B) substantial practical effect. For example, the emissions associated with the distribution of hydrogen fuel would be included under the "in general" rule of section 45V(c)(1)(A). However, the "GREET model" provision operates to carve these emissions out of the lifecycle GHG emissions definition as they occur after the point of production.

5.2 Treasury must ensure that GREET or a successor model properly accounts for direct and significant indirect emissions through the point of production

Section 45V(c)(1)(B) contains the specific grant of authority to the Treasury Secretary to choose between "the most recent [GREET] model developed by Argonne National Laboratory . . . , or a successor model (as determined by the Secretary)" to determine lifecycle GHG emissions. The Treasury Secretary must select a model that satisfies all of the statutory requirements in section

[46] Clean H2 Production Act, 117th Cong. § 2(a).

[47] *Id.*

45V(c)(1). The statute requires the selected model to include all "direct and significant indirect" emissions "related to" the well-to-gate stages of the hydrogen lifecycle.

These requirements apply regardless of whether the Treasury Secretary selects the "most recent [GREET] model" or a "successor model." The Code and regulations use the term "successor" in only limited instances, but in all cases, it means something that comes after something else.[48] Dictionaries also define "successor" to mean "something that comes after another person or thing."[49] However, it would be improper to read the delegation in section 45V(c)(1)(B) as giving the Secretary unconstrained authority to choose *any* model that comes later in time than the GREET model as a "successor model." For example, the Secretary could not select a model that ignores significant indirect emissions associated with the well-to-gate stages of the hydrogen lifecycle. That would essentially nullify the statutory requirements of section 45V(c)(1). Instead, the most recent GREET model or successor model must estimate lifecycle GHG emissions as required under the "in general" rule in section 45V(c)(1)(A) and only include emissions through the point of production. This underscores that the directive to use the most recent GREET or a successor model does not supplant the "in general" definition but rather provides for the choice of method for administering that basic concept and the well-to-gate limitation.

The Treasury Secretary engaged in factfinding to ensure that 45VH2-GREET properly considers the factors that flow from the statutory structure. 45VH2-GREET aims to estimate "direct and significant indirect emissions" "related to" the well-to-gate stages of the hydrogen lifecycle within the plain meaning of those terms as discussed in **Parts 4** and **5.1** above. This model requires electrolytic hydrogen producers who use EACs to purchase and retire *qualifying* EACs (i.e., EACs that meet the three pillars) in order to account for induced grid emissions and treat electricity used to produce electrolytic hydrogen as "clean."[50] The choice of the 45VH2-GREET model is supported by the factfinding discussed in **Part 4** that establishes induced grid emissions as significant indirect emissions related to hydrogen production. The 45VH2-GREET 2023 user manual also notes that 45VH2-GREET has been "tailored to the administration of the 45V tax credit" and specifically references the NPRM and the three pillars in instructing users to specify the source of electricity consumed.[51] Treasury and the IRS have thus selected a model that follows the statutory requirements of section 45V(c)(1).

6 Whether and how book-and-claim should be used for hydrogen production using renewable natural gas

The preamble notes that Treasury and the IRS "are considering providing rules to address whether or how book-and-claim systems with sufficient tracking and verification mechanisms may be used to attribute the environmental benefits of RNG or fugitive methane to hydrogen producers in the final regulations." The NPRM asks the following:

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[48] For example, section 51 provides the work opportunity credit to employers hiring members of a "targeted group," which includes persons receiving qualified assistance from a state program "funded under part A of title IV of the Social Security Act and any successor of such program," clearly indicating a program that comes after.

[49] *Successor*, Cambridge Dictionary (2024). *See also*, *Successor*, Merriam-Webster (2024) ("one that follows"); *Successor*, Oxford Learner's Dictionary (2024) ("thing that comes after . . . something else and takes . . . its place").

[50] *See* 45V NPRM, 88 Fed. Reg. at 89227-29.

[51] DOE, *Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2-GREET* iii, 19-20 (2023).

> How broadly available and reliable are existing electronic tracking systems for RNG certificates in book and claim systems? What developments may be required, if any, before such systems are appropriate for use with RNG certificates used to claim the section 45V credit?

We offer three points relevant to these questions.

First, the statutory mandates, as discussed in **Parts 4** and **5**, require any potential allowance of RNG book-and-claim to properly account for direct and significant indirect emissions.

Second, to meet these statutory requirements, if RNG book-and-claim accounting is allowed, it should use a proper system of registries that publicly tracks retirements and has robust mechanisms to avoid double-counting of the same environmental attributes.

Third, this system must also be able to distinguish and identify certificates that minimize risk of significant indirect emissions, including but not limited to induced emissions. Similar to electricity, diverting existing RNG resources could cause a gap in the market that must be filled by other, likely more carbon intensive, sources of natural gas. In order to meet the statutory requirement to determine significant indirect emissions, induced emissions related to RNG diversion to hydrogen production must be accounted for. A system that fails to do so would not meet the statutory requirements and create disparities among hydrogen production pathways. The criteria may be different for RNG book-and-claim than for EACs, but they should equally minimize the risk of unaccounted induced emissions. Furthermore, there may be categories of significant indirect emissions that are distinct from the analysis of electricity use.