May 24, 2023

Hon. Lily L. Batchelder
Assistant Secretary for Tax Policy
Department of the Treasury

Mr. William M. Paul
Principal Deputy Chief Counsel and Deputy
Chief Counsel (Technical)
Internal Revenue Service

Via Electronic Submission

Re: Notice 2022-49 Request for Comments on Certain Energy Generation Incentives – Hydrogen (IRC Section 45V)

Dear Assistant Secretary Batchelder and Mr. Paul:

The Nuclear Energy Institute and the undersigned companies that own more than 75 percent of the merchant nuclear plants operating in the United States jointly submit this response to the supplemental comments submitted by the Clean Air Task Force and Natural Resources Defense Council ("CATF/NRDC") on April 10, 2023, concerning whether Treasury may impose a requirement (commonly referred to as the "additionality" requirement) that only new generation adding incremental capacity to the electric grid could be used to produce clean hydrogen for purposes of the Section 45V credit.

Meeting the Biden Administration's decarbonization goals requires rapid deployment of clean hydrogen. In order to achieve the Department of Energy's ("DOE") base-case targets for the National Clean Hydrogen Strategy and Roadmap, clean hydrogen use must increase from near-zero today to 10 million metric tons (MMT) by 2030 and 20 MMT by 2040.[1] To realize that level of clean hydrogen production, electrolyzer costs must fall by 30% by 2030 and 50% by 2040,[2] which can only be accomplished through the immediate and sustained build-out of electrolyzer production capacity. DOE projects that this expanded electrolyzer capacity is more

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1 *Pathways to Commercial Liftoff: Clean Hydrogen* (Mar. 2023), at p. 33, Figure 13.1, *available at* https://liftoff.energy.gov/wp-content/uploads/2023/03/20230320-Liftoff-Clean-H2-vPUB.pdf ("DOE Liftoff Report").

2 *Id.*, at p. 27, Figure 11.

than five times the amount of currently-announced electrolyzer projects.[3] If all of these electrolyzers were required to be powered by newly-built wind and solar generation, DOE estimates that *up to 200 gigawatts of new renewables* would be needed just for hydrogen production[4]—roughly equivalent to *all of the wind and solar generation ever built in the United States*.[5] That is an infeasible amount of new renewable generation to bring online by 2030 given that, over the same period, large amounts of new wind and solar also must be built to meet state clean energy mandates and satisfy corporate procurements. Access to available sources of carbon-free electricity from existing generators is therefore essential for the Section 45V tax credit to increase the production, reduce the cost, and encourage adoption of clean hydrogen.

Hydrogen is one of the few ways to decarbonize industries and manufacturing processes that cannot be easily powered by clean electricity.[6] Over the past decade, the U.S. power sector has reduced emissions by approximately one-third through the adoption of smart climate policies that preserved existing carbon-free resources while deploying new clean energy at an increasingly fast rate. During that same period, emissions have held steady or increased in other major sectors of the economy. To address the climate crisis, solutions must be deployed now to reduce pollution across all sectors, but producing clean hydrogen using today's technologies is as much as five times as expensive as fossil-based hydrogen. This puts clean hydrogen out of reach for American industries trying to decarbonize. The Section 45V production tax credit helps overcome this price gap, but only when hydrogen producers make their product cheaper by passing credit value on to their customers. That is the entire point of the federal support: to lower the cost of clean hydrogen and unlock the potential of the power sector to decarbonize other sectors of our economy.

CATF/NRDC ask the Department of Treasury ("Treasury") to stand in the way of electrolyzer deployment by inserting into Section 45V a prohibition on the use of otherwise-

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[3] *Id.*, at p. 47, Figure 18.

[4] *Id.*, at p. 5 ("up to 200 GW of new renewable energy may be needed by 2030 to produce ~10 MMT clean hydrogen if water electrolysis dominates as the production pathway (>90% production mix) as well as 2–20 million metric tonnes of new CO2 storage for reformation-based production").

[5] *See* https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php (U.S. renewable energy generation by type, 2021).

[6] DOE Liftoff Report, at page 7 ("Most of the total emissions reduction is expected in heavy-duty transportation (e.g., road, aviation fuels, maritime fuels) and industrial sectors where hydrogen is one of the primary feedstocks (e.g., ammonia, methanol, fuels) and alternatives do not exist."); Kiran Julin, *Hydrogen Can Play Key Role in U.S. Decarbonization*, News from Lawrence Berkeley National Laboratory (Oct. 8, 2021), *available at* https://newscenter.lbl.gov/2021/10/08/hydrogen-can-play-key-role-in-u-s-decarbonization/ ("We see hydrogen as something that can really help decarbonize hard-to-decarbonize sectors. Such applications include industrial usages such as a reductant in steel manufacturing or making green ammonia for fertilizers, using its thermal energy for thermal processes, or heavy-duty transportation such as long-haul trucking, maritime, trains, and aviation, to name a few.").

available carbon-free electricity to power hydrogen production. Doing so would violate the plain language of Section 45V, conflict with the Environmental Protection Agency's ("EPA") interpretation of similar statutory provisions and implementation of new carbon pollution standards, and undermine the purpose of the Inflation Reduction Act: to incent investment in clean energy technologies that enable the transition to a carbon-free economy.

Executive Summary

- An "additionality" requirement to disqualify existing producers of zero-emissions electricity is inconsistent with the statute. Congress clearly intended for electricity generated by existing nuclear plants to produce hydrogen, as the IRA explicitly links eligibility for the Section 45V tax credit with the Section 45U tax credit that is available only to existing nuclear plants.

- The policy behind the IRA is clear and an "additionality" requirement would run counter to that policy. An "additionality" requirement would make it impossible to realize the projections of clean hydrogen deployment that EPA is relying on to legally justify new carbon pollution standards for the power sector.

- Studies claiming that "additionality" will not hinder hydrogen development assume an immediate and limitless supply of new wind and solar projects. In the real world, interconnection queue congestion, difficulties in building transmission, supply chain constraints, and permitting challenges limit the supply of new grid-connected renewables in multiple regions through the late 2020s. Congress enacted the hydrogen tax credit to spur investments that will accelerate technological breakthroughs in decarbonizing difficult to electrify sectors, which cannot happen without access to available zero-emissions electricity.

- It would be administratively infeasible for Treasury to define and enforce a standard for determining which new resources are truly "additional," coming online specifically due to the power needs of hydrogen production. The practical impact of an additionality requirement would limit hydrogen production to new wind and solar plants, which already have strong enough incentives under federal and state policy to come online irrespective of the Section 45V tax credit.

- Congress clearly knew how to create vintage requirements in the IRA and even included them in Section 45V for in-service and construction dates for hydrogen production itself, but did not carve out generation facilities constructed prior to its passage.

- Congress directed Treasury to use the GREET model, which is pre-populated for different types of hydrogen production (including electrolyzers powered by nuclear plants) and does not include "additionality" requirements, which CATF and NRDC concede by calling for an immediate "successor" model. Congress could not have intended for Treasury to immediately discard the GREET model before credits are claimed and, in any event, another model would still need to comply with the statutory directive to focus the emissions calculation on the process of hydrogen production.

- When an electrolyzer is powered by electricity from a directly connected generator, there is no ambiguity about its emissions profile under the GREET model or otherwise. Earlier comments filed by CATF and NRDC in this proceeding agreed that the emissions profile of the input electricity is clear in this configuration and that such hydrogen production projects should "immediately qualify"[7] under Section 45V.

- EPA has rejected "additionality" in implementing the referenced lifecycle analysis provision, explicitly adopting average grid emissions rates for electricity used to produce renewable fuels even when the agency is otherwise considering indirect emissions impacts of changes in land use.

- Counting electricity going to other customers as indirect electrolyzer emissions is outside the scope of Section 45V, which is limited to the "process" of hydrogen production.

Adoption of an "Additionality" Requirement Would Violate Section 45V

In promulgating regulations, an agency "must give effect to the unambiguously expressed intent of Congress."[8] In the Inflation Reduction Act, Congress made clear that electricity generated by existing nuclear facilities could be used to produce hydrogen by explicitly linking Section 45V with the also newly-enacted Section 45U production tax credit for existing nuclear facilities. Section 45U establishes a production tax credit that is available *only* to nuclear facilities placed in service *prior to* enactment of the IRA. In Section 45U(c)(2), Congress incorporated special rules (set forth in Section 45(e)(13)) that would allow existing nuclear facilities receiving credits under Section 45U to also receive credits under Section 45V if they use the electricity they generate to produce clean hydrogen. Congress would not have done so if it had intended to limit Section 45V credits only to hydrogen producers using new clean energy resources. If the Section 45V credit were limited to "additional" resources, then there would be no facilities that could receive both Section 45U credits and Section 45V credits. An

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[7] Response of Natural Resources Defense Council, at p. 2 (Dec. 2, 2023), *available at* https://downloads.regulations.gov/IRS-2022-0029-0079/attachment_1.pdf ("NRDC December Comments").

[8] *Chevron, U.S.A., Inc. v. Nat. Res. Def. Council, Inc.*, 467 U.S. 837, 843 (1984).

"additionality" requirement would effectively nullify Section 45U(c)(2)'s incorporation of Section 45(e)(13), conflicting with a basic principle of statutory interpretation and negating Congress's intent.[9]

Attempting to work around this statutory language, CATF/NRDC suggest that an existing nuclear reactor claiming both the 45U and 45Y credits "could effectively draw on new clean energy supply."[10] The existing nuclear reactor would do this, in their view, by expanding its generating capabilities, demonstrating that the reactor would otherwise shut down but for the hydrogen-induced demand, or buying carbon-free electricity from new carbon-free generators to "offset the lifecycle emissions of diverting nuclear power from the grid."[11]

These creative interpretations do not comport with the statute, which says nothing about applying only to *a portion* of the energy produced by existing nuclear plants or conditioning Section 45V on an existing nuclear plant being on the verge of shutting down to qualify for clean hydrogen production. The entire point of enacting the Section 45U tax credit was to prevent further retirements of existing nuclear plants through 2032. The suggestion that Congress intended for nuclear plants powering hydrogen production under Section 45V to replace their own zero-emissions power with output from different zero-emissions generators is laughable. And when Congress intends to limit a credit to the portion of a facility that is uprated after a certain date, it has done so expressly in the IRA. In Section 45(c)(8), Congress defined qualified hydropower production for purposes of the renewable electricity production credit to be limited only to uprated capacity: "incremental hydropower production" is the portion of production "attributable to the efficiency improvements or additions of capacity placed in service after the date of the enactment of this paragraph."[12] There is nothing similar for a nuclear reactor claiming both the 45U and 45Y credits.

Had Congress wanted to impose an "additionality" requirement, it would not have directed Treasury to allow existing nuclear plants to qualify for the clean hydrogen tax credit but would have adopted vintage-based eligibility criteria for Treasury to implement. The absence of any express authority for an "additionality" requirement stands in contrast to the numerous other vintage-based requirements that Congress *did* expressly impose in Section 45V. These include, for example, rules prescribing an in-service date of no later than January 1, 2033

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[9] *See, e.g.*, *Hibbs v. Winn*, 542 U.S. 88, 101 (2004) ("A statute should be construed so that effect is given to all its provisions, so that no part will be inoperative or superfluous, void or insignificant").

[10] CATF/NRDC comment letter to Treasury, Apr. 10, 2023, at p. 14 ("CATF/NRDC").

[11] *Id*., at p. 14.

[12] *See* 26 U.S.C. § 45(c)(8)(B)(i). "[I]n the case of any hydroelectric dam which was placed in service on or before the date of the enactment of this paragraph, the incremental hydropower production for the taxable year," where "incremental hydropower production" is the portion of production "attributable to the efficiency improvements or additions of capacity placed in service after the date of the enactment of this paragraph."

for qualified clean hydrogen production facilities[13] and a construction date requirement for hydrogen production facilities eligible for increased credit amounts on account of compliance with certain labor requirements.[14] Congress's decision to impose time-based limitations in certain provisions of the statute indicates that Congress intended to omit such limitations from other parts of the statute.[15]

Instead, Congress directed Treasury to determine eligibility for the Section 45V tax credit using "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)."[16] Treasury cannot ignore the statute's explicit incorporation of the GREET model, and yet that is precisely what CATF/NRDC suggest in their latest comments – even though they argued the opposite just a few months ago.

The GREET Model Dictates How to Measure Emissions Associated with Electricity Sources

There are two general ways to power an electrolyzer: by using electricity from an adjacent, directly connected and identifiable generator (referred to as behind-the-meter) or by using the power grid to deliver electricity to the electrolyzer (referred to as grid-connected). The various commenters urging Treasury to adopt an "additionality" requirement generally have focused on the second, grid-connected configuration. For example, NRDC in its December 2022 comments stated that "its focus is to provide recommendations … for calculating the greenhouse gas emissions of grid-connected electrolyzers" and that "[p]roducers of electrolytic hydrogen that use primarily on-site, zero-carbon electricity should immediately qualify."[17] This is consistent with the position taken by others, including the researchers at Princeton University on which CATF, NRDC and others rely in advocating for an "additionality" requirement.[18]

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[13] 26 U.S.C. § 45V(c)(3)(C).

[14] 26 U.S.C. § 45V(e)(2)(A).

[15] *E.g.*, *Bittner v. United States*, 598 U.S. __, 143 S. Ct. 713, 720 (2023) ("When Congress includes particular language in one section of a statute but omits it from a neighbor, we normally understand that difference in language to convey a difference in meaning.").

[16] 26 U.S.C. § 45V(c)(1)(B).

[17] NRDC December Comments, at p. 2.

[18] Response of the Princeton University Zero-carbon Energy systems Research and Optimization Laboratory (ZERO Lab), at p. 7 (Dec. 2, 2023), *available at* https://downloads.regulations.gov/IRS-2022-0029-0071/attachment_1.pdf ("any electricity generated by behind-the-meter resources and consumed in the process of hydrogen production should be considered to have embodied emissions equivalent to those of the installed resources") ("Princeton December Comments"); *accord* Response of Rocky Mountain Institute, at p. 30 (Dec. 3,

NRDC's recommendation in December that behind-the-meter electrolyzers "immediately qualify" for the 45V tax credit was based on NRDC's separate "recommend[ation that] Treasury use the DOE GREET model to qualify projects."[19] This is exactly how the GREET model works. Using nuclear power as an example, the hydrogen producer simply selects a series of entries from drop-down boxes in an Excel spreadsheet and the model embedded in that spreadsheet automatically calculates a lifecycle greenhouse gas emissions rate.[20] This is why a number of commenters, including Princeton University, agreed with NRDC's December position: "*As a baseline, any electricity generator by behind-the-meter resources and consumed in the process of hydrogen production should be considered to have the embodied emissions equivalent to those of the installed resources*… This approach is fully consistent with the current iteration of the GREET model, which has been designated in IRA as the means by which hydrogen's emissions intensity should be calculated for the purpose of 45V PTC qualification."[21]

Now, in their latest comments, CATF/NRDC argue that the GREET model "does not determine the type of emissions that Treasury may include in its account regulations" because it does not incorporate the "the 'new supply' additionality pillar [that] is legally necessary for *all* projects – grid-connected and behind-the-meter."[22] In other words, because CATF/NRDC believe that an "additionality" requirement needs to be imposed by Treasury, Treasury cannot use the GREET model that Congress directed it to use because that model does not include an "additionality" requirement. The circularity of this bootstrapped argument is apparent on its face.

There is no uncertainty or ambiguity in the GREET model about the emissions profile of electricity being used in the hydrogen production process for a behind-the-meter electrolyzer, regardless of whether the zero emissions generation is existing or newly-built.[23] In October 2022, the Energy Systems and Infrastructure Analysis Division at Argonne National Laboratory

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2023), *available at* https://downloads.regulations.gov/IRS-2022-0029-0111/attachment_1.pdf ("zero carbon behind the meter resources [should] count as 'zero carbon'").

[19] NRDC December Comments, at p. 2.

[20] *See* Argonne National Lab, GREET Model for Hydrogen Life Cycle GHG Emissions, at pp. 7-8, https://www.energy.gov/sites/default/files/2022-06/hfto-june-h2iqhour-2022-argonne.pdf. The Excel spreadsheet containing the GREET model is available for public download on the Argonne National Lab website and nuclear power as a pre-programmed energy input in the H2_User_Inputs tab. *See* https://greet.es.anl.gov/greet_hydrogen.

[21] Princeton December Comments, at p. 7 (emphasis in original; footnotes omitted).

[22] CATF/NRDC, at pp. 1, 5 (emphasis in original).

[23] This approach is consistent with the Department of Energy's recently published well-to-gate lifecycle greenhouse gas emissions rate for electrolysis powered by renewables and nuclear. *See* DOE Liftoff Report, at p. 17 ("Dedicated zero-carbon electricity: Non-emitting energy sources such as solar, wind, nuclear, and hydro can produce hydrogen with carbon intensities lower than 0.45 kg CO2e/kg H2, qualifying for the full production tax credit (PTC, $3/kg "of H2).").

published a report summarizing the "major updates and expansions to the hydrogen technology pathways in the model" in light of the passage of the Infrastructure Investment and Jobs Act and the Inflation Reduction Act.[24] The report "presents the key parameters, data sources, and carbon accounting methodology" that the GREET model uses and analyzes both well-to-gate and well-to-wheel systems.[25] In its analysis of hydrogen produced through an electrolyzer under the well-to-gate system boundary, the GREET model concludes that "all GHG emissions arise from power generation supplied to the electrolyzer, which is 0 for solar, wind, and hydroelectric power sources."[26] That analysis affirmed that the GREET model's inputs include the emissions only of the direct source of electricity for production—not the indirect effects that using that source of electricity may have on the emissions profile of electricity used by other consumers elsewhere on the grid.

Faced with that reality, CATF/NRDC suggest that Treasury create a "successor model" of its own invention and use that in place of the most recent version of the GREET model. This reading of the statute is also unsupported by the plain language because there is no successor model at this time—less than a year after the passage of the Inflation Reduction Act—only the current model. When Congress specifically identified the "most recent" GREET model, while also allowing for the possibility that Argonne might modify the model in the future, it did not authorize Treasury to immediately discard the GREET model and create an alternative to use in its place. If that is what Congress had intended, it would have given Treasury that authority by using an "alternative" rather than "successor."

CATF/NRDC argue that if Treasury is limited to using the GREET model, and the GREET model does not account for system redispatch that may occur when a hydrogen producer is added to the grid, then the cross-reference in Section 45V(c)(1) to Section 211(o)(1)(H) of the Clean Air Act is superfluous. Not so. Subparagraph (B) identifies the end point of the fuel lifecycle emissions analysis: "the point of production." But it is silent as to the starting point. Subparagraph (A)'s incorporation of Section 211(o)(1)(H) identifies the starting point: "from feedstock generation or extraction." Thus, for example, the lifecycle emissions of blue hydrogen—which is produced using a natural gas feedstock, through a process of steam methane reformation and carbon capture—would include fugitive methane emissions that occur when natural gas is gathered. For electrolytic hydrogen, produced using water as a feedstock, this could be emissions associated with securing and transporting the water and its diversion

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[24] *See* Argonne Nat'l Lab., Hydrogen Life-Cycle Analysis in Support of Clean Hydrogen Production, at p. 2 (Oct. 2022), *available at* https://greet.es.anl.gov/files/hydrogenreport2022.

[25] *Id*., at p. 3.

[26] *Id.,* at p. 7. For nuclear, the value reflects the emissions associated with producing nuclear fuel: "WTG CI of PEM electrolysis with conventional light water reactor (LWR) nuclear power includes GHG emissions related to the uranium supply chain activities, which includes mining, transportation, and enrichment."

from alternative uses. Subparagraph (A)'s reference to Section 211(o)(1)(H), including its reference to "significant indirect emissions" still has meaning.

The Emissions Associated with Customers Other than the Hydrogen Producer are Outside the Scope of Treasury's Responsibility under the IRA

CATF/NRDC focus on whether a hydrogen producer is "avoiding … systemwide emissions,"[27] but Section 45V is instead focused on the "process" through which the "hydrogen … is produced" and lifecycle emissions "through the point of production"[28]—that is, the emissions resulting from the production of *the hydrogen itself*, and not total emissions of the electric grid overall. The focus of an "additionality" requirement is not on the emissions of the generation being used to power the electrolyzer, nor on the emissions associated with the electrolyzer's construction and operation. Instead, it hinges on the emissions associated with electricity going to other customers and seeks to have Treasury treat those as indirect emissions of the electrolyzer. That is inconsistent with the statutory language directing Treasury to determine emissions for the "process" through which the "hydrogen … is produced" because emissions occurring elsewhere on the grid take place outside of the "point of production."

It comes as no surprise, then, that Congress itself is interpreting the Section 45V tax credit as available to hydrogen producers when using existing sources of carbon-free generation. On April 26, 2023, the House of Representatives passed legislation that, among other things, would repeal Section 45V and other tax credits enacted by the Inflation Reduction Act. In evaluating the potential budget impact of that legislation, the Joint Committee on Taxation estimated that $127 million in clean hydrogen tax credits will be claimed in 2023.[29] Some of those tax credits will be claimed by a DOE-funded electrolyzer powered by electricity from the existing Nine Mile Point nuclear power station that came online in March 2023. DOE has praised this project for "demonstrat[ing] that our nation's existing reactor fleet can produce clean hydrogen today."[30] If Congress intended the Section 45V production tax credit to instead be available only for hydrogen projects powered by newly-constructed carbon-free generation, the Joint Committee on Taxation's estimate of Section 45V costs for 2023 would have been zero. It takes years to develop and bring online new wind and solar generation, making it impossible for any hydrogen production occurring in 2023 to be powered by generation resources that began

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[27] CATF/NRDC, at p. 8.

[28] 26 § U.S.C. 45V(c)(2)(A); *id*. at § 45V(c)(1)(B) (lifecycle emissions "shall only include emissions through the point of production").

[29] HR 2811 CBO score, JCX-7-23, at line 6 (Apr. 26, 2023), *available at* https://www.jct.gov/getattachment/1bd2fab7-1a0f-4c30-9a8f-94b98f3b2888/x-7-23.pdf.

[30] https://www.energy.gov/ne/articles/nine-mile-point-begins-clean-hydrogen-production#:~:text=Clean%20hydrogen%20production%20is%20underway,clean%20hydrogen%20using%20nuclear%20power.

development after enactment of the Inflation Reduction Act in August 2022. Like the Nine Mile project, clean hydrogen production occurring in 2023 is instead being powered by otherwise-available sources of carbon-free electricity, precisely as Congress intended.

Adoption of an "Additionality" Requirement Would Conflict With EPA Implementation of the Clean Air Act

EPA's Interpretation of Section 211(o) of the Clean Air Act Rejected Additionality

Unable to justify the proposed "additionality" requirement under the language of Section 45V, CATF/NRDC attempt to rely on EPA interpretations of the term "lifecycle greenhouse gas emissions" under section 211(o) the Clean Air Act. They rely primarily on EPA's consideration of emissions associated with indirect changes in land use associated with the production of biofuels. They note that, when calculating the lifecycle emissions of a particular biofuel, EPA evaluates the emissions impact of shifts in land use attributable to the feedstock used in biofuel production. They conclude that "Congress knew about EPA's interpretation of section 211(o) when it drafted the IRA" and "[b]y incorporating section 211(o) into the IRA, Congress blessed EPA's interpretation of that provisions, and ordered Treasury to apply EPA's logic to hydrogen production."[31]

We agree that Congress was intentional in its incorporation of section 211(o) of the Clean Air Act, which governs EPA's Renewable Fuel Standard (RFS) program. EPA has decades of experience calculating lifecycle emissions in its RFS program and Treasury should indeed look to EPA's existing interpretations. Those interpretations, however, affirm the rejection of an "additionality" requirement for clean hydrogen production.

Like hydrogen, biofuel production requires the use of electricity. But when EPA has applied the definition of "lifecycle greenhouse gas emissions" in the RFS program, it has not treated new electric generation resources any differently than existing ones. Under Section 211(o), EPA must calculate lifecycle emissions for various types of renewable fuels, including electricity produced by landfills using biogas. In implementing that emissions calculation, EPA considered—and rejected—a distinction between landfills that already had existing gas-to-electricity projects and those that were newly-installing those projects.[32] EPA rejected that approach for a number of reasons, including because such a distinction would result in electricity from all new projects qualifying under applicable lifecycle emissions criteria and no

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[31] CATF/NRDC, at p. 6.

[32] Support for Classification of Biofuel Produced from Waste Derived Biogas as Cellulosic Biofuel and Summary of Lifecycle Analysis Assumptions and Calculations for Electricity Biofuel Produced from Waste Derived Biogas, EPA Air and Radiation Docket EPA-HQ-OAR-2012-0401, at p. 22 (July 1, 2014), *available at* https://www.regulations.gov/document/EPA-HQ-OAR-2012-0401-0243.

electricity from any existing project qualifying under the same criteria even though "many of the new facilities may have installed gas-to-energy projects regardless of the [renewable fuels] program, driven by the same incentives that motivated the existing facilities. Given the existence of other incentives to install gas-to-energy capabilities, discriminating between existing and new gas-to-energy projects seems arbitrary in this light."[33]

Furthermore, EPA precedent confirms that the emissions associated with the energy input—electricity—is the emissions intensity of the incoming power, even when EPA is otherwise including indirect emissions caused by changes in land use. EPA has addressed how to account for grid-delivered electricity used as an energy input in its implementation of the RFS program—using the grid mix as reflected in GREET—and we agree this is the right starting point.[34] EPA has not considered changes occurring elsewhere on the power grid with respect to other users of electricity when determining the emissions associated with electricity used as an energy input to fuel production.[35] CATF/NRDC incorrectly cite EPA's 2010 RFS rule as precedent for considering systemwide grid effects. In actuality, EPA explicitly adopted use of the average grid mix emissions rate for electricity delivered by the transmission grid that is used in the production of a biofuel.[36]

CATF/NRDC mistakenly point to EPA's consideration of indirect land use effects, also discussed in the 2010 RFS rule, as indicating that EPA already has demonstrated that emissions from other customers' uses of electricity must be included in the lifecycle emissions calculation. This mischaracterizes EPA's consideration of indirect land use effects. Section 211(o) expressly

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[33] *Id.*; *see also* Regulation of Fuels and Fuel Additives: RFS Pathways II, and Technical Amendments to the RFS Standards and E15 Misfueling Mitigation Requirements, 79 Fed. Reg. 42,128, 42,142 (July 18, 2014), *available at* https://www.govinfo.gov/content/pkg/FR-2014-07-18/pdf/2014-16413.pdf (EPA rejecting request to distinguish between existing and new landfill gas-to-electricity projects under the Section 211(o) renewable fuels standard).

[34] Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program, 75 Fed. Reg. 14670, 14782 (Mar. 26, 2010), *available at* https://www.govinfo.gov/content/pkg/FR-2010-03-26/pdf/2010-3851.pdf ("EPA RFS 2010 Rule") (adopting emissions factors for process inputs to biofuel production and setting emissions attributable to grid-delivered electricity at "average U.S. grid electricity production emissions").

[35] *See* Great Plains Superior, LLC, EPA Office of Air and Radiation Pathway Assessment, at 9 (Feb. 14, 2023), *available at* https://www.epa.gov/system/files/documents/2023-02/grn-plains-superior-determin-ltr-2023-02-14-signed.pdf ("The lifecycle GHG emissions factors for process energy were the same emissions factors used in the modeling for the March 2020 RFS rule: … U.S. average grid electricity = 0.750 kgCO2e/kWh…"). Although EPA has not addressed how to treat energy inputs from a directly-connected generator, as noted above, commenters agree in this proceeding that this is easy and is clearly the emissions profile of the directly-connected generator. *See supra* notes 17-19.

[36] In December 2022, EPA issued Notice of Proposed Rulemaking requesting comment on the lifecycle analysis for renewable hydrogen. EPA does not so much as mention this issue, let alone suggest it is considering changes to its long-standing approach. *See* Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes, 87 Fed. Reg. 80582, 80687 (Dec. 30, 2022), *available at* https://www.govinfo.gov/content/pkg/FR-2022-12-30/pdf/2022-26499.pdf.

references indirect land use and, therefore, EPA incorporates this statutory direction into the first step of its lifecycle emissions analysis evaluating feedstock and transportation.[37] For example, where growing corn to be used in biofuel results in land use changes, EPA will account for the indirect emissions caused by those changes. CATF/NRDC are correct that that 2010 RFS rule includes these impacts in EPA's lifecycle emissions calculation, but do not disclose that—in the same document—EPA did not account for the indirect emissions associated with other uses of electricity even when the production of the biofuel is using grid-delivered electricity.[38] This is consistent with the statute, which makes no mention of indirect uses of electricity.

The distinction between land use and electricity use is also consistent with the focus of Section 211(o) on "direct emissions and significant indirect emissions (such as significant emissions from land use changes) … *related to the full fuel lifecycle*."[39] The fuel here is hydrogen, and the "full fuel lifecycle" includes "fuel and feedstock production and distribution."[40] CATF/NRDC claim that "electrons" are the feedstock for hydrogen production.[41] That is incorrect. Water is the feedstock for hydrogen produced through electrolysis and natural gas is the feedstock for hydrogen produced through steam methane reformation. Just as with biofuels, electricity is a component of the production process that converts a feedstock (water or natural gas) into hydrogen, and EPA has adopted use of the average grid mix emissions rate for electricity delivered by the transmission grid. While Congress modified the reference to Section 211(o) in other ways (adopting a "well-to-gate" limitation on the lifecycle emissions calculation), it did not include statutory language directing any modifications to EPA's historical treatment of energy inputs.

The unworkability of CATF/NRDC's position is demonstrated by applying the logic of their argument to other forms of hydrogen production, such as steam methane reforming. That process uses steam to break methane into component parts, releasing both hydrogen and greenhouse gas emissions. Under the CATF/NRDC logic, that hydrogen producer could use newly-constructed renewables to reduce emissions from its local electricity grid by the amount of emissions released during its hydrogen production process, and the direct and indirect emissions of its production process would satisfy the Section 45V statutory criteria. That cannot

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[37] EPA breaks the lifecycle analysis into 3 parts: feedstock production and transportation; fuel production and distribution; and use of the finished fuel (referred to in total as "well to wheel"). *See* https://www.epa.gov/renewable-fuel-standard-program/lifecycle-analysis-greenhouse-gas-emissions-under-renewable-fuel.

[38] *See* 40 C.F.R. § 80.1416(b)(1)(V).

[39] 42 U.S.C. § 7545(o)(1)(H) (emphasis added).

[40] *Id.*

[41] CATF/NRDC, at p. 6.

be what CATF/NRDC intend nor what Congress contemplated, and yet that would be the effect of their proposal.

EPA's Proposed Rules for Power Sector GHG Emissions Rely on Rapidly Increasing the Availability of Clean Hydrogen

On May 11, EPA proposed greenhouse gas emissions limits for fossil-fired power plants under Section 111 of the Clean Air Act, including new and existing natural gas-powered generation. These proposed rules are a signature piece of the administration's agenda to combat climate change and will help further decarbonize the power grid, avoiding up to 617 million metric tons of carbon emissions through 2042 which is equivalent to the annual emissions from roughly half of the cars in the U.S.[42] To accomplish this, EPA proposes to rely heavily on hydrogen blending as the best system of emission reduction (BSER).

To meet EPA's compliance timelines, higher capacity natural gas plants would need to blend 30% clean hydrogen by volume in less than a decade and further ramp up to 96% hydrogen blending in 15 years. EPA justifies these requirements by relying on DOE projections that 10 MMT of clean hydrogen will be available and affordable annually by 2030 for use in power plant operations. EPA even acknowledges that its rules may drive demand beyond DOE's expectations: "The EPA's hydrogen co-firing BSER proposal, if finalized, would create a significant additional demand driver for electrolytic hydrogen not considered in the DOE's hydrogen production goals of 10 MMT by 2030 and 20 MMT by 2040."[43]

As discussed above, DOE estimates that up to 200 gigawatts of new renewables would be needed to reach an annual clean hydrogen production rate of 10 MMT[44]—roughly equivalent to all of the wind and solar generation ever built in the United States.[45] That is an infeasible amount of new renewable generation to bring online by 2030 given the large amounts of new wind and solar that also must be built to meet state clean energy mandates and satisfy corporate procurements. The success of EPA's regulations therefore hinges on Treasury's interpretation of

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[42] *See* https://www.epa.gov/newsreleases/epa-proposes-new-carbon-pollution-standards-fossil-fuel-fired-power-plants-tackle.

[43] New Source Performance Standards for Greenhouse Gas Emissions from New, Modified, and Reconstructed Fossil Fuel-Fired Electric Generating Units; Emission Guidelines for Greenhouse Gas Emissions from Existing Fossil Fuel-Fired Electric Generating Units; and Repeal of the Affordable Clean Energy Rule, Proposed Rule (May 11, 2023), at p. 263, *available at* https://www.epa.gov/system/files/documents/2023-05/FRL-8536-02-OAR%20111EGU%20NPRM%2020230504_Admin.pdf ("EPA 2023 NSPS Proposed Rule").

[44] DOE Liftoff Report, at p. 5 ("up to 200 GW of new renewable energy may be needed by 2030 to produce ~10 MMT clean hydrogen if water electrolysis dominates as the production pathway (>90% production mix) as well as 2–20 million metric tonnes of new CO2 storage for reformation-based production").

[45] *See https://www.eia.gov/energyexplained/electricity/electricity-in-the-us-generation-capacity-and-sales.php* (U.S. renewable energy generation by type, 2021).

Section 45V. As part of its rulemaking process, EPA is required to demonstrate with substantial evidence that reducing emissions from gas plants through blending is feasible alongside competing hydrogen demands from other industries.[46] The technology underpinning EPA's emissions standard—namely, hydrogen blending—cannot be "adequately demonstrated" under the Clean Air Act unless EPA is able to "reasonably project[] that it will be available by a future date certain"[47] and "at reasonable cost."[48] Without access to the Section 45V production tax credit, it will be impossible to scale clean hydrogen production from where it is now—with only a miniscule amount of clean hydrogen production—to the levels projected by DOE that, in turn, are needed to support EPA's implementation of power sector emissions limits under the Clean Air Act.

EPA's Recent Vehicle Rules Can Serve as an Example for Treasury

EPA's approach to calculating greenhouse gas emissions under its recently-released vehicle emissions is a useful model for Treasury. In a proposed rule to set vehicle emissions standards for model years 2027-2032, EPA announced that it will continue the current practice of including only emissions measurable directly from the vehicle's tailpipe, hence attributing 0 g/mile for electric vehicle operations. This was notable because EPA previously indicated that it would begin considering upstream emissions associated with the use of electricity by vehicles for model year 2027 and beyond.[49] Instead, EPA concluded that it would continue the current

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[46] Section 111 of the Clean Air Act requires EPA's emissions standards to "reflect[] the degree of emission limitation achievable through the application of the best system of emission reduction which (taking into account the cost of achieving such reduction and any nonair quality health and environmental impact and energy requirements) the Administrator determines has been adequately demonstrated." Long-standing case law interpreting Section 111 has established that EPA may project into the regulatory future what systems of emission reduction will be adequately demonstrated and how they will perform. However, it is equally clear that EPA must provide a reasonable basis to support its conclusion that these future developments will come to fruition: "Recognizing that the Clean Air Act is a technology-forcing statute, we believe EPA does have authority to hold the industry to a standard of improved design and operational advances, so long as there is substantial evidence that such improvements are feasible and will produce the improved performance necessary to meet the standard." *Sierra Club v. Costle*, 657 F.2d 298, 364 (D.C. Cir. 1981).

[47] EPA 2023 NSPS Proposed Rule, at page 127 (citing *Portland Cement Ass'n* v. *Ruckelshaus,* 486 F.2d 375, 391 (D.C. Cir. 1973)); *see also id.* at 136-137 ("a standard of performance is 'achievable' if a technology can reasonably be projected to be available to an individual source at the time it is constructed that will allow it to meet the standard.") (citing *Sierra Club v. Costle*, 657 F.2d 298, 364, n. 276 (D.C. Cir. 1981)).

[48] *Id.* at 267 ("EPA proposes that co-firing low-GHG hydrogen on that pathway is adequately demonstrated in light of the capability of combustion turbines to co-fire hydrogen and the EPA's reasonable expectation that adequate quantities of low-GHG hydrogen will be available by 2032 and 2038 and at reasonable cost.").

[49] When EPA established GHG emission standards for new light-duty motor (LDV) vehicles in 2012, it decided that the compliance value for electric vehicles (EVs), including battery EVs and fuel cell EVs, "would be based on net upstream emissions accounting (i.e., EPA would attribute a pro rata share of national CO_2 emissions form

approach to emissions accounting because the program "has functioned as intended, encouraging the continued development and introduction of electric vehicle technology." In addition, EPA explicitly based its decision on the ongoing decarbonization of the power grid: "As a separate and independent reason for making the current treatment permanent, EPA originally proposed using upstream emissions in PEV compliance calculations at a time when there was little if any regulation of stationary sources for GHGs . . . In the 2020 rule, EPA extended 0 g/mi in part because power sector emissions were declining and the trend was projected to continue. . . . [P]ower sector emissions are expected to decline further in the future."[50]

The federal government has heavily incentivized the development of a robust electric vehicle sector and, as costs have come down, penetration is accelerating rapidly. Electric vehicle sales in the U.S. grew by 85% between 2020 and 2021 alone and accelerating adoption of electric vehicles is considered a climate success story. As the electric vehicle industry flourished, the electric sector reduced emissions by about a third, demonstrating that we can electrify other sectors of the economy and decarbonize the grid at the same time. Neither EPA nor Congress has required electric vehicle buyers to pair their purchase with new solar panels in order to qualify for the incentives that have helped make them affordable. The same successful playbook should be followed for hydrogen to decarbonize industrial sectors.

There is a good practical reason for not attempting to model indirect effects on emissions on the power grid associated with changing uses of electricity, whether for hydrogen production, charging electric vehicles, or any other decarbonization activity. To conduct an analysis of the GHG effects from indirect land use changes under the RFS program, EPA dedicated years to the development of highly complex modeling that "required breaking new scientific ground and using analytical tools in new ways," creating those models through a lengthy process that involved independent scientific peer review.[51] To develop its models, EPA "held hundreds of meetings with stakeholders, including government, academia, industry, and non-profit organizations, to gather expert technical input," consulted with several other agencies, and took numerous steps to model projected emissions from land use change.[52] Even then, EPA used a key simplifying assumption: it focused on what alternative land uses would be in 2022, and projected the impact of those changes over an additional 30 years.[53] EPA explained that "it

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electricity generation to each mile driven under electric power . . ." *See* Multi-Pollutant Emissions Standards for Model Years 2027 and Later Light-Duty and Medium-Duty Vehicles, pre-publication version, at p. 202.

[50] *Id.*, at p. 204.

[51] EPA RFS 2010 Rule, 75 Fed. Reg. at 14,764.

[52] Renewable Fuel Standard Program (RFS2) Summary of Analysis and Comments, at p. 7-57, EPA-420-R-10-003 (Feb. 2010), *available at* https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1007GC4.pdf ("RFS Response to Comments").

[53] EPA RFS 2010 Rule, 75 Fed. Reg. at 14,768-69, 14,780.

would require an extremely complex assessment and administratively difficult implementation program to track how biofuel production might continuously change from month to month or year to year."[54]

Evaluating "indirect power use" as suggested by CATF/NRDC would require an even more daunting evaluation of power grid effects on a nearly real-time basis, given that grid operators are dynamically balancing electricity production from thousands of generators and millions of consumers on a moment-by-moment basis. To follow the precedent of EPA's land use modeling, Treasury would need to analyze both changes in grid dispatch as well as attributable impacts like the land use of renewables (taking farmland out of service and expanding somewhere else, removing forests and groundcover plants, etc.) and changes in emissions associated with shifting uses of electricity by other users in response to changes in the dispatch stack (alternative prices inducing different customer behavior and choices and, in turn, the emissions impacts of those choices). Those effects would need to be assessed and modeled over multiple decades, like the land use models, to determine the cumulative GHG emissions, which would require a sophisticated modeling of electricity markets and generation. Treasury has no expertise in such modeling nor jurisdiction over power grid, further cementing that Congress could not have intended this outcome given that EPA itself has not incorporated comparable modeling in its own lifecycle emissions determinations.

An "Additionality" Requirement Would Undermine Investments in Clean Hydrogen Deployment

Finally, CATF/NRDC argue that an "additionality" requirement is necessary to align Treasury's implementation of Section 45V with one of the Inflation Reduction Act's primary goals: to combat climate change through the reduction in greenhouse gas emissions. But addressing climate change and reducing emissions requires an urgent transformation of our entire economy—not just the power sector. It is essential to both clean the grid and quickly develop a robust clean hydrogen economy to decarbonize other sectors of the economy. CATF/NRDC do not acknowledge that Congress intentionally adopted this dual-path approach, making existing and new carbon-free energy generators eligible to support both clean energy production and clean hydrogen production.

Congress adopted a range of programs in the Inflation Reduction Act. Some are focused on decarbonizing power generation. These include, for example, the clean electricity production credit in Section 45Y, the clean electricity investment credit in Section 48E, and the credit for

[54] RFS2 Response to Comments, at p. 7-32.

carbon oxide sequestration in Section 45Q.[55] Other programs, such as the tax credit in Section 30D, support electric vehicles even though (under a static snapshot of the grid) adding new electricity demand to the grid may in the short run result in increased emissions from the power sector. Congress also recognized that EPA, not Treasury, has the authority to regulate emissions from the power grid, using the Inflation Reduction Act to appropriate funds and grant additional authorities to that agency.[56]

The clean hydrogen tax credit, meanwhile, seeks to decarbonize sectors of the economy responsible for substantial carbon emissions, but which cannot readily be electrified. In its recent Commercial Liftoff report, DOE explained that "[l]ow-cost clean hydrogen via electrolysis will also depend on ample availability of low-cost clean electricity (<$20/MWh) that will need to scale in parallel with market demand for clean hydrogen."[57] From the standpoint of hydrogen producers, the main effect of an additionality requirement would be to limit the options available to them in sourcing electricity, making it more costly and more difficult to produce clean hydrogen. Studies claiming that "additionality" requirement would not undermine the economics of clean hydrogen production assume that an unlimited amount of new wind and solar generation is available immediately and in perpetuity.[58] In the real world, interconnection queue congestion, difficulties building transmission, supply chain constraints, and permitting challenges make the supply of new grid-connected renewables more or less fixed through the late 2020s in multiple regions of the U.S. Congress's goals will not be achieved if the energy transition in these hard-to-electrify sectors is throttled by the pace of investment in clean power generation.

Indeed, the Executive Director of CATF acknowledged in recent testimony before Congress that nuclear energy "is an ideal source of energy to decarbonize the hard-to-abate sectors, both by producing zero carbon fuels like hydrogen and ammonia, as well as providing the electricity and heat for chemical and other industrial uses." He noted that programs are

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[55] *E.g.*, 26 U.S.C. §§ 45Y(b)(1)(A) and 48E(b)(3)(A) (defining "qualified facility" for purposes of the clean-electricity production credit and clean electricity investment credit to include generators "for which the greenhouse gas emissions rate … is not greater than zero."); 26 U.S.C. § 45Q (credit for carbon dioxide sequestration).

[56] *See, e.g.*, Inflation Reduction Act §§ 60103 (Greenhouse Gas Reduction Fund), 60107 (Low Emissions Electricity Program), 60113 (Methane Emissions Reduction Program); *see also* U.S. Environmental Protection Agency, Inflation Reduction Act (IRA) Overview – Climate and Clean Air-related Provisions, *available at* https://www.epa.gov/system/files/documents/2022-09/IRA%20Overview.pdf.

[57] DOE Liftoff Report, at p. 7.

[58] *See The Cost of Clean Hydrogen with Robust Emissions Standards: A Comparison Across Studies*, Princeton Zero-LAB, at pp. 5-8, https://zenodo.org/record/7838874#.ZFCNLs7MKpc; *Smart Design of 45V Hydrogen Production Tax Credit Will Reduce Emissions and Grow the Industry*, at p. 36, *available at* https://energyinnovation.org/publication/smart-design-of-45v-hydrogen-production-tax-credit-will-reduce-emissions-and-grow-the-industry/.

needed "to support the scaling of nuclear technologies for these applications" and suggested that such programs include "a pathway for large-scale commercial hydrogen production from existing reactors within the next three years, starting in 2022."[59] Excluding existing nuclear plants from participating in the Section 45V tax credit through insertion of an "additionality" requirement is entirely inconsistent with this desire to immediately begin scaling hydrogen production from existing nuclear reactors.

It is also difficult to see how Treasury could define and enforce the criteria for an "additionality" standard in a way that would withstand judicial scrutiny. A requirement to have a generation project come online within a specified period of time would be meaningless. Projects in early development stages could seek to renegotiate with planned customers and then backfill the contract (perhaps at a discount) with clean energy attributes from other sources of power, while claiming that the generation project is "additional" for purposes of hydrogen production. Treasury would need to engage in a project-by-project "but for" review that would be unworkable for hydrogen producers and unmanageable for Treasury.

As CATF/NRDC themselves acknowledge, if "underlying clean power would have been generated anyway," it does not "actually avoid[] systemwide emissions." [60] Thus, the linchpin of CATF/NRDC's position that clean energy generation directed to hydrogen production is not "additional" unless it would not have been constructed but for the hydrogen tax credit program. Nothing in their comments, however, provides any support for this assumption. The entire thrust of the Inflation Reduction Act is to provide substantial new revenue streams for clean energy generation in order to transform the power sector, and these federal incentives are on top of state programs including renewable portfolio standards, tax credits, and other support.[61] Indeed, there is so much new clean generation under development that there is a backlog on interconnecting those projects with the grid.[62] There is no basis for concluding that a new wind or solar facility connected to the grid is coming on line *only* due to the electricity demand from hydrogen

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[59] Testimony of Armond Cohen, Executive Director, Clean Air Task Force, Inc., Nuclear Energy: Pathways and Requirements for Global Scale-Up, and the Role of U.S. Policy, Before the United States House of Representatives Committee on Energy and Commerce, Subcommittee on Energy, Climate, and Grid Security (Apr. 18, 2023), *available at* https://d1dth6e84htgma.cloudfront.net/04_18_23_Energy_Cohen_Testimony_1_546cd91fb6.pdf?updated_at=2023-04-17T14:21:49.095Z.

[60] CATF/NRDC, at p. 3.

[61] *See* National Conference of State Legislatures, State Renewable Portfolio Standards and Goals, *available at* https://www.ncsl.org/energy/state-renewable-portfolio-standards-and-goals (collecting state renewable portfolio standards); NC Clean Energy Technology Center, Database of State Incentives for Renewables & Efficiency, https://www.dsireusa.org/ (collecting state-level clean energy incentives).

[62] Shannon Osaka, *This Little-Known Bottleneck is Blocking Clean Energy for Millions*, Washington Post (Dec. 20, 2022), https://www.washingtonpost.com/climate-environment/2022/12/20/clean-energy-bottleneck-transmission-lines/.

production and not to sell its clean attribute credits to any of the many other potential buyers. A new renewable generator providing electricity to hydrogen producers cannot be assumed to be "additional" just because it is new.

The consequence of an "additionality" requirement would be an overheating of demand for new renewables, driving up the price of state clean energy programs and voluntary purchases by corporate buyers. There is no shortage of buyers for new renewable projects. All economic models show that as much renewable capacity would be built as the model is permitted to add. Interconnection issues, transmission limitations, materials sourcing, and permitting and siting delays are the real constraints[63] and imposing an "additionality" requirement on hydrogen deployment would simply impose all of these renewable development constraints on clean hydrogen projects. None of those considerations have been taken into account, much less addressed, by "additionality" proponents.

In short, the goal of the hydrogen tax credit is to create a market for hydrogen produced using a non-emitting process, like electrolysis or carbon capture. Its purpose is not to provide an additional subsidy for new renewables. Congress enacted other programs to promote continued investment in clean power generation and to encourage a continued reduction in the grid-wide emissions rate. Treasury should let the hydrogen tax credit do the job that Congress intended and rely on those other programs to induce new clean generation. The "additionality" requirement should be rejected.

Thank you for your consideration of these comments. We would be pleased to discuss our perspectives on these issues with you at any time.

Nuclear Energy Institute

Constellation Energy Corporation

Energy Harbor Corporation

Public Service Enterprise Group

Vistra Corporation

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[63] Peter Hannam, *Supply chain delays and steel costs are part of 'perfect storm' stalling renewable energy growth*, The Guardian (May 23, 2022), *available at* https://www.theguardian.com/environment/2022/may/24/supply-chain-delays-and-steel-costs-are-part-of-perfect-storm-stalling-renewable-energy-growth; Clean Power Quarterly Market Report | Q3 2022, American Clean Power, *available at* https://cleanpower.org/resources/clean-power-quarterly-market-report-q3-2022/ ("In total, 14 GW of clean power capacity was delayed this quarter, adding to a growing backlog of delayed projects that totals 36 GW—63% of which are solar projects.").