February 26, 2024

U.S. Department of the Treasury, Internal Revenue Service
Office of Tax Policy
Ben Franklin Station
P.O. Box 7604, Room 5203
Washington, DC 20044

*Submitted via www.regulations.gov, IRS REG–117631–23*

Thank you for the opportunity to comment on the Treasury and Internal Revenue Service's ("IRS") proposed regulations for the implementation of the 45V hydrogen production tax credit, 88 Fed. Reg. 89,220 (Dec. 26, 2023). These comments are submitted on behalf of the Center for Biological Diversity ("Center").

The Center has already submitted comprehensive comments on the hydrogen tax credit as part of the Friends of the Earth et al. letter representing 77 groups.[1] This comment letter provides more detail outlining our concerns over and opposition to the production of hydrogen from woody biomass, including forest and agricultural biomass.

We urge the Treasury and IRS to ensure that the final rule rejects any loophole allowing hydrogen produced from woody biomass to qualify for the 45V tax credit, and to replace the GREET modules pertaining to forest feedstocks with corrected assessment tools, specifically:

**(1) Hydrogen made from woody biomass feedstocks and/or using woody biomass-powered electricity should not be eligible for the production tax credit based on extensive evidence demonstrating the significant greenhouse gas pollution, air pollution, harms to environmental justice communities, and loss of forest carbon storage that accompany hydrogen produced from woody biomass.**

**(2) The 45VH2-GREET 2023 model for hydrogen production from woody biomass and the Argonne GREET Module for Forest Residues to Bio-electricity Pathways are fundamentally flawed in treating forest residue feedstocks as carbon neutral, and must be replaced by corrected, scientifically defensible assessment tools.**

As detailed below, producing hydrogen from woody biomass feedstocks and biomass-powered electricity releases large amounts of planet-heating $CO_2$ and toxic air pollutants, worsening the climate emergency and harming public health. While GREET models incorrectly treat forest residue feedstocks as carbon neutral, scientific research clearly shows that combustion or gasification of trees and other forest material—including residues considered to be "waste"—leads to a net *increase* of carbon emissions in the atmosphere for decades to centuries. Furthermore, biomass facilities often concentrate pollution in communities of color and low-

[1] https://foe.org/wp-content/uploads/2024/02/45V-Comment-Letter.pdf

income communities, worsening environmental injustice. Adding carbon capture and storage ("CCS") technology to biomass gasification, pyrolysis, or combustion processes would still result in significant climate and air pollution and threaten public health and safety, given CCS has proven to be ineffective, unsafe, and energy intensive. Incentivizing hydrogen production from forest biomass risks increasing logging and thinning, which degrade wildlife habitat and result in a net loss of forest carbon storage and sequestration, at a time when we must be protecting forest carbon stores. For these reasons, and as described more fully below, hydrogen production from woody biomass is not part of a clean, just energy future and should not qualify for the 45V clean hydrogen production tax credit.

## I. Hydrogen Made Using Woody Biomass Feedstocks Should Not Be Eligible for the Tax Credit for the Production of Clean Hydrogen.

### A. Gasification and pyrolysis of biomass to produce hydrogen emit large amounts of $CO_2$ and health-harming pollutants.

Gasification and pyrolysis are the primary processes being promoted to produce hydrogen from woody biomass such as trees and agricultural materials. The gasification of biomass at high temperatures (800-1200°C) produces a "syngas" containing large amounts of $CO_2$, as well as methane ($CH_4$), carbon monoxide (CO), and hydrogen ($H_2$), in addition to liquid hydrocarbons and tar, solid char and ash residues, and a wide array of air pollutants.[2] The pyrolysis of biomass additionally produces pyrolytic oil and larger quantities of char. The biomass fuel, gasifier type, temperature, and gasifying agent (*e.g.*, steam, air, oxygen, oxygen-enriched air) influence the composition of the syngas.[3] Biomass gasification and pyrolysis processes to produce hydrogen are technically difficult and expensive.

### B. Climate-heating $CO_2$ from upstream biomass processing and downstream gasification.

Similar to biomass combustion, gasification and pyrolysis of biomass produce large quantities of $CO_2$ as well as methane emissions that worsen the current climate emergency. Biomass-derived hydrogen is often falsely promoted as being carbon neutral or carbon negative based on the inaccurate claims that woody biomass is a carbon neutral feedstock and/or that CCS can be used to capture the $CO_2$ emitted from the production process. However, the claim that woody biomass is a carbon neutral feedstock has been thoroughly discredited,[4] given the lost carbon storage and

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[2] Shayan, E. et al., *Hydrogen production from biomass gasification; a theoretical comparison of using different gasification agents*, 159 Energy Conversion and Management 30 (2018), https://doi.org/10.1016/j.enconman.2017.12.096.

[3] *Id.*

[4] Booth, Mary S, *Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy*, 13 Env't Rsch. Letters 035001 (2018), https://doi.org/10.1088/1748-9326/aaac88; Sterman, John et al., *Does wood bioenergy help or harm the climate?*, 78 Bulletin of the Atomic Scientists 128 (2022), https://doi.org/10.1080/00963402.2022.2062933.

sequestration from extracting biomass, and the significant $CO_2$ emissions during biomass processing and gasification, pyrolysis, or combustion.[5] The Environmental Protection Agency's Scientific Advisory Board advised the agency that *no* type of biomass should be considered automatically carbon neutral.[6] That Board's opinion comports with assessments of the Intergovernmental Panel on Climate Change ("IPCC"), which has taken the position that "IPCC Guidelines do not automatically consider or assume biomass used for energy as 'carbon neutral,' even in cases where the biomass is thought to be produced sustainably."[7]

Instead, substantial upstream emissions are released from cutting and extracting trees and other vegetation which immediately ends their carbon storage and sequestration; the use of fertilizers and pesticides after cutting; transporting biomass often long distances in diesel trucks; and processing biomass through chipping and drying.[8] Research has concluded that the combustion, gasification, and pyrolysis of trees and other forest material—including residues considered to be "waste"— leads to a net increase of carbon emissions in the atmosphere for decades to centuries.[9]

Putting CCS equipment on biomass gasification and pyrolysis facilities ("BECCS") does not abate the negative effects of hydrogen production from woody biomass and would still lead to significant $CO_2$ and co-pollutants emissions, endangering communities and the climate. CCS has consistently proven to be exceptionally ineffective, unsafe, expensive, and targets environmental justice communities.[10] CCS operations are very energy-intensive given the high energy requirements needed to separate, compress, transport, and inject $CO_2$—typically requiring at least 15-25% more energy, which results in increased greenhouse gas and air pollution

[5] Climate Action Network International, *Position: Carbon Capture, Storage, and Utilisation* (January 2021), https://climatenetwork.org/resource/can-position-carbon-capture-storage-and-utilisation/; Fern, 2022, *Six problems with BECCS* (2022), https://www.fern.org/fileadmin/uploads/fern/Documents/2022/Six_problems_with_BECCS_-_2022.pdf.
[6] EPA SAB, *Framework for Assessing Biogenic CO2 Emissions from Stationary Sources* at 8 (Mar. 5, 2019), https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=OAP&dirEntryID=308343. The SAB also cautioned EPA that "biodiversity and ecosystem health are valid concerns worthy of a whole different analysis and policy response." *Id*. at 7.
[7] IPCC, Task Force on National GHG Inventories, FAQs at Energy Q2-10, https://www.ipcc-nggip.iges.or.jp/faq/faq.html.
[8] *See, e.g.*, Roder, Mirjam et al., *How certain are greenhouse gas reductions from bioenergy? Life cycle assessment and uncertainty analysis of wood pellet-to-electricity supply chains from forest residues*, 79 Biomass and Bioenergy 50 (2015), DOI: 10.1016/j.biombioe.2015.03.030.
[9] Booth, Mary S., *Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy*, 13 Env't Rsch. Letters 035001 (2018), https://doi.org/10.1088/1748-9326/aaac88; Laganiere, Jerome et al., *Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests*, 9 GCB Bioenergy 358 (2017), https://doi.org/10.1111/gcbb.12327; Sterman, John et al., *Does wood bioenergy help or harm the climate?*, 78 Bulletin of the Atomic Scientists 128 (2022).
[10] Center for Biological Diversity, *Carbon Capture and Storage is a False Solution for the Climate and Our Communities* (2022), https://biologicaldiversity.org/campaigns/carbon-capture-and-storage/pdfs/CCS-explainer.pdf.

emissions.[11] CCS projects around the world have consistently failed to meet their carbon-capture promises, often by large margins.[12] Moreover, 95% of $CO_2$ captured in the U.S. by CCS is used to pump oil and gas out of the ground in process called enhanced oil recovery,[13] worsening the climate emergency and undercutting any purported climate benefits. CCS poses significant new health, safety, and environmental risks from toxic air pollution emitted from CCS facilities, earthquake risks from underground $CO_2$ injection, and the public health and safety risks that accompany the inevitable ruptures of $CO_2$ pipelines and leaks from underground $CO_2$ storage that can sicken and even kill people.[14]

### C. The 45VH2-GREET 2023 model for hydrogen production from biomass is fundamentally flawed and must be replaced by a corrected assessment tool.

The 45VH2-GREET 2023 model makes several erroneous and scientifically indefensible assumptions in its methodology for calculating the lifecycle GHG emissions for biomass gasification projects, that lead to a significant under-estimate of emissions from this process. Treasury must use a corrected and updated assessment tool.

First, the 45VH2-GREET 2023 model incorrectly assumes carbon neutrality for forest biomass feedstocks, stating that the "45VH2-GREET assumes that biogenic $CO_2$ emissions that result from gasification equal $CO_2$ emissions that were captured during growth of the feedstock."[15] This assertion of carbon neutrality—that gasification emissions are essentially pre-captured during feedstock growth—has been thoroughly discredited.

As noted above, the Intergovernmental Panel on Climate Change (IPCC), Environmental Protection Agency's Science Advisory Board, and numerous other scientific bodies have

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[11] Climate Action Network International, *Position: Carbon Capture, Storage, and Utilisation* (January 2021), https://climatenetwork.org/resource/can-position-carbon-capture-storage-and-utilisation/; IEEFA, *The carbon capture crux: Lessons learned* (Sept. 2022), https://ieefa.org/resources/carbon-capture-crux-lessons-learned.
[12] IEEFA, *The carbon capture crux: Lessons learned* (Sept. 2022), https://ieefa.org/resources/carbon-capture-crux-lessons-learned.
[13] Global CCS Institute, https://status22.globalccsinstitute.com/2022-status-report/appendices/.
[14] Pipeline Safety Trust, *Regulatory and Knowledge Gaps in the Safe Transportation of Carbon Dioxide by Pipeline* (2022), https://pstrust.org/wp-content/uploads/2022/10/CO2-Regulatory-and-Knowledge-Gaps-1.pdf; Dan Zegert, Huffington Post, "The Gassing of Satartia" (Aug. 2021), https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-pipeline_n_60ddea9fe4b0ddef8b0ddc8f; Fowler, Sarah, 'Foaming at the mouth': First responders describe scene after pipeline rupture, gas leak, The Clarion-Ledger (February 27, 2020), https://www.clarionledger.com/story/news/local/2020/02/27/yazoo-county-pipe-rupture-co-2-gas-leak-first-responders-rescues/4871726002/.
[15] U.S. Department of Energy, Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2-GREET 2023 (December 2023), at 13.

established that woody biomass energy should not be assumed to be carbon neutral.[16] Cutting and gasifying trees releases their stored carbon to the atmosphere, immediately increasing $CO_2$ emissions and ending trees' future carbon sequestration, creating a "carbon debt."[17] To claim biomass energy is carbon neutral, proponents try to discount the released $CO_2$ by taking credit for the carbon that will be absorbed by future tree growth—claiming the carbon debt will eventually be repaid. This is misleading because forest regrowth takes time and is highly uncertain—there is no guarantee that cut forests will be allowed to grow back or that forests won't be converted to other land uses. Once trees are cut, numerous studies show it may take many decades to more than a century, if ever, to pay back the carbon that was lost from combusting or gasifying them.[18]

Importantly, research also shows that forest "residues" or "waste" feedstocks—referring to biomass that would otherwise be disposed of—are not carbon neutral. The combustion or gasification of forest residues leads to a *net increase* of carbon emissions in the atmosphere for decades.[19] One recent study found that burning all wood types, including forest residues (defined

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[16] IPCC, *Frequently Asked Questions*, *Intergovernmental Panel on Climate Change (IPCC) Task Force on National Greenhouse Gas Inventories*, http://www.ipcc-nggip.iges.or.jp/faq/faq.html at Q2-10 ("The IPCC Guidelines do not automatically consider biomass used for energy as 'carbon neutral,' even if the biomass is thought to be produced sustainably); Letter from Michael Honeycutt, U.S. EPA Sci. Advisory Bd., to Andrew Wheeler, U.S. EPA Administrator, *SAB Review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources* (Mar. 5, 2019), https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=539269&Lab=OAP at 2 ("not all biogenic emissions are carbon neutral nor net additional to the atmosphere, and assuming so is inconsistent with the underlying science"); Letter from John Beddington, et al. to EU Parliament regarding forest biomass (Jan. 9, 2018), http://empowerplants.files.wordpress.com/2018/01/scientist-letter-on-eu-forest-biomass-796-signatories-as-of-january-16-2018.pdf.

[17] John Sterman et al., *Does wood bioenergy help or harm the climate?*, 78 Bulletin of the Atomic Scientists 128 (2022), DOI: 10.1080/00963402.2022.2062933.

[18] Manomet Ctr. for Conservation Scis., *Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources* (2010), https://www.mass.gov/doc/manometbiomassreportfullhirezpdf/download; Tara W. Hudiburg et al., *Regional carbon dioxide implications of forest bioenergy production*, 1 Nature Climate Change 419 (2011), https://doi.org/10.1038/nclimate1264; B.E. Law & M.E. Harmon, *Forest sector carbon management, measurement and verification, and discussion of policy related to climate change*, 2 Carbon Mgmt. 73 (2011), https://doi.org/10.4155/cmt.10.40; S.R. Mitchell et al., *Carbon debt and carbon sequestration parity in forest bioenergy production*, 4 Global Change Biology Bioenergy 818 (2012), https://doi.org/10.1111/j.1757-1707.2012.01173.x; E.D. Schulze et al., *Large-scale bioenergy from additional harvest of forest biomass is neither sustainable nor greenhouse gas neutral*, 4 Global Change Biology Bioenergy 611 (2012), DOI:10.1111/j.1757-1707.2012.01169.x; Bjart Holtsmark, *The outcome is in the assumptions: Analyzing the effects on atmospheric $CO_2$ levels of increased use of bioenergy from forest biomass*, 5 GCB Bioenergy 467 (2013), https://doi.org/10.1111/gcbb.12015; John Sterman et al., *Does replacing coal with wood lower $CO_2$ emissions? Dynamic lifecycle analysis of wood bioenergy*, 13 Env't Rsch. Letters 015007 (2018), https://doi.org/10.1088/1748-9326/aaa512.

[19] Mary S. Booth, *Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy*, 13 Env't Rsch. Letters 035001 (2018), https://doi.org/10.1088/1748-9326/aaac88; John

as branches, tree tops and bark) and fire-killed trees, to generate electricity increases carbon emissions in the atmosphere for more than a century compared to generating that electricity with fossil gas.[20]

Second, the 45VH2-GREET 2023 model incorrectly assumes that the emissions from decay of forest residues can be treated as instantaneous and automatic:

> *In the case of forest logging residues, as these materials otherwise would have likely decayed over time or been pile-burned, the resulting emissions associated with using the materials to produce hydrogen are expected to be negligible or about the same as if the material were not collected and used.*[21]

The emissions released from forest residue decay are not instantaneous and automatic, unlike the emissions from the biomass gasification process. Forest residues break down over time, releasing nutrients that stimulate forest growth and adding to forest soil carbon, which keeps carbon circulating in forest ecosystems.[22] Coarse woody debris and downed logs provide important wildlife habitat.[23] When forest residues are scattered across the forest floor, without creating deep layers or piles of material, they are unlikely to produce methane emissions, in contrast to the significant methane emissions that are released by the log landings and wood chip piles that are part of the biomass to hydrogen production process.[24] Research indicates that methane emissions from wood chip piles at biomass facilities can be large enough to significantly add to the overall GHG impact of bioenergy production. One study concluded that wood chip piles can cause "remarkable" methane emissions as well as nitrous oxide ($N_2O$) emissions, "greenhouse

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Sterman et al., *Does wood bioenergy help or harm the climate?*, 78 Bulletin of the Atomic Scientists 128 (2022), https://doi.org/10.1080/00963402.2022.2062933.

[20] Jerome Laganiere et al., *Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests*, 9 *GCB Bioenergy* 358 (2017), https://doi.org/10.1111/gcbb.12327.

[21] U.S. Department of Energy, *Guidelines to Determine Well-to-Gate Greenhouse Gas (GHG) Emissions of Hydrogen Production Pathways using 45VH2-GREET 2023* (December 2023), at 13 at footnote 15.

[22] Walmsley, J.D. et al., *Whole tree harvesting can reduce second rotation forest productivity*, 257 Forest Ecology and Management 1104 (2009); Buccholz, Thomas et al., *Mineral soil carbon fluxes in forests and implications for carbon balance assessments*, 6 GCB Bioenergy 305 (2014); Achat, David et al., *Forest soil carbon is threatened by intensive biomass harvesting*, 5 Scientific Reports 15991 (2015), https://www.nature.com/articles/srep15991; Achat, David et al., *Quantifying consequences of removing harvesting residues on forest soils and tree growth – A meta-analysis*, 348 Forest Ecology Management 124 (2015), https://www.sciencedirect.com/science/article/abs/pii/S0378112715001814.

[23] Harmon, M.E. et al., *Ecology of coarse woody debris in temperature ecosystem*, 34 Advances in Ecological Resources 59 (2004).

[24] Research indicates that methane emissions from wood chip piles at biomass facilities can be large enough to significantly add to the overall GHG impact of bioenergy production. See, *e.g.,* Wihersaari, M., *Evaluation of greenhouse gas emission risks from storage of wood residue*, 28 Biomass and Bioenergy 444 (2005); Whittaker, C. et al., *Dry matter losses and methane emissions during wood chip storage: the impacts on full life cycle greenhouse gas savings of short rotation coppice willow for heat*, 9 Bioenergy Research 820 (2016); Vantellingen, J. & S.C. Thomas, *Log landings are methane emissions hotspots in managed forests*, 51 Canadian Journal of Forest Research 1916 (2021).

gas emissions from storage [in wood chip piles] can, in some cases, be much greater than emissions from the rest of the biofuel production and transportation chain."[25]

### D. Health-harming pollutants.

Biomass gasification and pyrolysis produce a wide range of health-harming pollutants including fine particulate matter, NOx, SOx, benzene, toluene and xylenes (BTEX), tars and soot, and persistent organic pollutants such as polycyclic aromatic hydrocarbons (PAHs) (*e.g.*, naphthalene), polychlorinated dibenzo-*p*-dioxins and dibenzofurans (PCDD/Fs).[26] Importantly, gasification and pyrolysis of biomass are significant sources of fine particulate matter (PM 2.5) that can penetrate deeply into the lungs, even enter the bloodstream, and cause serious health problems.[27] Fine particulate matter pollution is linked to a higher risk of premature death, heart disease, stroke, and aggravated asthma.[28]

The formation of NOx precursors, including $NH_3$, HCN and HNCO, during biomass pyrolysis has been widely reported, where NOx damages the respiratory system and contributes to acid rain, harming ecosystems.[29] Of the BTEX compounds produced during gasification and pyrolysis, benzene is a well-known human carcinogen, and toluene and xylenes damage the brain and nervous system, respiratory system, kidneys, and liver.

The formation of liquid tar is an inherent problem in biomass gasification. Tar contains toxic substances such as benzene, toluene, and naphthalene, while tar build-up also lowers energy efficiency, interrupts continuous operation, and increases maintenance costs of gasification

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[25] Wihersaari, M., *Evaluation of greenhouse gas emission risks from storage of wood residue*, 28 Biomass and Bioenergy 444 (2005), doi:10.1016/j.biombioe.2004.11.011.

[26] Partnership for Policy Integrity, *Air pollution from biomass energy*, https://www.pfpi.net/air-pollution-2/; Liu, Wu-Jun et al., *Fates of chemical elements in biomass during its pyrolysis*, 117 Chemical Reviews 6367 (2017), https://pubs.acs.org/doi/10.1021/acs.chemrev.6b00647; Yao, Zhiyi et al., *Particulate emissions from the gasification and pyrolysis of biomass: Concentration, size distributions, respiratory deposition-based control measure evaluation*, 242 Environmental Pollution 1108 (2018), https://doi.org/10.1016/j.envpol.2018.07.126; Saxe, Jennie Perey et al., *Just or bust? Energy justice and the impacts of siting solar pyrolysis biochar production facilities*, 58 Energy Research & Social Science 101259 (2019) https://doi.org/10.1016/j.erss.2019.101259; Pang, Yoong Xin et al., *Analysis of environmental impacts and energy derivation potential of biomass pyrolysis via piper diagram*, 154 Journal of Analytical and Applied Pyrolysis 104995 (2021), https://doi.org/10.1016/j.jaap.2020.104995.

[27] Yao, Zhiyi et al., *Particulate emissions from the gasification and pyrolysis of biomass: Concentration, size distributions, respiratory deposition-based control measure evaluation*, 242 Environmental Pollution 1108 (2018), https://doi.org/10.1016/j.envpol.2018.07.126.

[28] U.S. Environmental Protection Agency, *Health and Environmental Effects of Particulate Matter*, https://www.epa.gov/pm-pollution/health-and-environmental-effects-particulate-matter-pm.

[29] Chen, Hongyuan et al., *A review on the NOx precursors release during biomass pyrolysis*, 451 Chemical Engineering Journal 138979 (2022), https://doi.org/10.1016/j.cej.2022.138979.

processes.[30] Methods to clean tar from equipment would create large amounts of toxic wastewater, with resulting environmental and community harms.[31]

### E. Environmental injustice.

Proposals to produce hydrogen from woody biomass frequently (if not nearly exclusively) target environmental justice communities already overburdened with pollution. For example, in California's Central Valley—which has some of nation's worst air pollution—idled bioenergy facilities in or near communities, such as the Madera biomass facility, are being proposed for conversion to biomass gasification or pyrolysis facilities to produce hydrogen, threatening to worsen environmental injustice for these communities.[32] Another recent proposal envisions a massive build-out of 50 to 100 biomass processing facilities—many of them biomass gasification and pyrolysis facilities—that would be concentrated in the Central Valley, paired with a polluting network of $CO_2$ pipelines, railcars, and trucking, and the injection of 100 million tons of $CO_2$ underground each year,[33] with inevitable harms from air pollution, water pollution, noise pollution, $CO_2$ leakage, earthquake risks, and ecosystem damage.

### F. High water usage.

Biomass gasification to produce hydrogen has extremely high water usage. One recent study estimated that biomass gasification uses 306 kg water per kg of $H_2$ produced, which is orders of magnitude more than electrolysis production pathways estimated at 9 to 18 kg water per kg $H_2$.[34] This would put extra stress on water supplies in areas already suffering from climate crisis-charged drought.

### G. Forest ecosystem harms and lost forest carbon storage and sequestration.

Incentivizing the production and commodification of hydrogen from woody biomass is likely to increase forest logging and thinning, which degrade wildlife habitat and result in a net loss of carbon storage and sequestration from forests, at a time when we must be reducing deforestation

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[30] He, Quing et al., *Soot formation during biomass gasification: A critical review*, 139 Renewable and Sustainable Energy Reviews 110710 (2021), https://doi.org/10.1016/j.rser.2021.110710.
[31] Luo, Xiang et al., "Biomass gasification: an overview of technological barriers and socio-environmental impact" in *Gasification for Low-Grade Feedstock* 1-15 (2018), https://www.intechopen.com/chapters/59423.
[32] Clean Energy Systems, *Clean Energy Systems Enters Into An Agreement to Acquire the Madera Biomass Power Plant* (Jul. 12, 2022), https://www.cleanenergysystems.com/clean-energy-systems-enters-into-an-agreement-to-acquire-the-madera-biomass-power-plant.
[33] LLNL and DOE, *Getting to Neutral: Options for Negative Carbon Emissions in California* (2019), *available at* https://livermorelabfoundation.org/2019/12/19/getting-to-neutral/.
[34] Mehmeti, Andi et al., *Life cycle assessment and water footprint of hydrogen production methods: from conventional to emerging technologies*, 5 Environments 24 (2018).

and protecting forest carbon stores.[35] Logging and thinning trees releases their stored carbon to the atmosphere in a triple whammy for the climate: it increases overall carbon emissions, reduces the forest carbon sink, and requires massive public subsidies, taking resources away from truly low-carbon solar and wind energy.

## II. Hydrogen Made Using Woody Biomass-Powered Electricity Should Not Be Eligible for the Production Tax Credit, and Treasury Must Not Use the Flawed Argonne GREET Module for Forest Residues to Bio-electricity Pathways.

The draft regulations also propose to subsidize biomass-powered electricity for hydrogen production, despite this production being more carbon intensive than the statutory requirement. Biomass power plants are more carbon-polluting at the smokestack than coal per unit of electricity produced[36] and often concentrate pollution in communities of color and low-income communities, worsening environmental injustice. Adding CCS to the production of woody biomass-powered electricity, as proposed, would result in significant climate and air pollution and threaten community health and safety, particularly given that CCS has consistently proven to be ineffective, dangerous, and energy intensive. Like 45VH2-GREET 2023 model, the Argonne GREET Module for Forest Residues to Bio-electricity Pathways (2021)[37] incorrectly assumes that forest residue feedstocks are carbon neutral, and therefore significantly underestimates the carbon emissions from producing electricity from forest residues. This GREET module is fundamentally flawed and inadequate. Treasury must use a corrected and updated assessment tool.

We urge Treasury and IRS not to incentivize these dirty hydrogen production methods, and request that the agencies clarify that hydrogen produced from woody biomass does not qualify for the 45V clean hydrogen production tax credit in their final rule.

Sincerely,

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[35] Moomaw, William R. et al., *Intact Forests in the United States: Proforestation mitigates climate change and serves the greatest good*, Frontiers in Forests and Global Change (2019).

[36] Sterman, John et al., *Does replacing coal with wood lower CO2 emissions? Dynamic lifecycle analysis of wood bioenergy*, 13 Env't Rsch. Letters 015007 (2018), DOI: 10.1088/1748-9326/aaa512; Sterman, John et al., *Does wood bioenergy help or harm the climate?*, 78 Bulletin of the Atomic Scientists 128 (2022), DOI: 10.1080/00963402.2022.2062933.

[37] Xu, H. et al., *Regionalized Life Cycle Greenhouse Gas Emissions of Forest Biomass Use for Electricity Generation in the United States*, Environmental Science & Technology (2021), doi:10.1021/acs.est.1c04301.