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November 14, 2022

U.S. Department of Energy
Hydrogen and Fuel Cell Technologies Office
Forrestal Building
1000 Independence Avenue, SW
Washington, DC 20585

Submitted via email to cleanh2standard@ee.doe.gov

Re: Stakeholder Comments on Clean Hydrogen Production Standard (CHPS) Draft Guidance

The Center for Biological Diversity (Center) appreciates the opportunity to comment on the Department of Energy's (DOE) draft guidance setting a Clean Hydrogen Production Standard (CHPS). The Center has signed-on to comments submitted by Earthjustice on the proposed CHPS and incorporates them by reference. Here, the Center provides additional comments on certain questions for which Department has requested input.

As the Department notes, it is developing the CHPS in response to requirements recently enacted in Section 40315 of the Infrastructure Investment and Jobs Act of 2021, also known as the Bipartisan Infrastructure Law (BIL). While the standard set for clean hydrogen production under the CHPS will not be mandatory, the hydrogen hubs funded by the BIL will be required to "demonstrably aid achievement" of the CHPS by mitigating emissions across the supply chain to the greatest extent possible. Additionally, future DOE funding opportunities will likely invoke the CHPS when establishing project selection and merit review criteria. Since the CHPS is an aspirational and non-mandatory standard, it is essential that the Department set a stringent and truly clean CHPS for future hydrogen hub and other DOE-funded projects to strive to meet.

Adopting an ambitious standard will push industry to improve performance of the cleanest hydrogen production technologies. Thus, the Center recommends that DOE adopt a CHPS of lifecycle emissions no greater than 1 $kgCO_2e/kgH_2$, and to exclude all non-electrolytic hydrogen powered by wind and solar energy from the clean production standard. Because DOE intends to use the CHPS as an aspirational standard, it is unreasonable to set a weak standard that existing clean scalable commercial technologies can already exceed.

Further, establishing carbon standards alone are insufficient to ensure that hydrogen production is truly "clean." The final CHPS should include strict emissions limits on co-pollutants, criteria pollution and hazardous air pollution. These limits are essential to prevent hydrogen production facilities from harming public health in communities adjacent to such operations.

Finally, the CHPS will only succeed in directing public investment to technologies that are compatible with the Biden Administration's long-term decarbonization goals if DOE implements rigorous carbon accounting practices to ensure producers cannot make unsubstantiated claims regarding the carbon intensity of their hydrogen production processes. To that end, the Center provides the below comments in response to several questions in the CHPS Draft Guidance.

Question 1.d. Mitigating emissions downstream of the site of hydrogen production will require close monitoring of potential CO_2 leakage. What are best practices and technological gaps associated with long-term monitoring of CO_2 emissions from pipelines and storage facilities? What are the economic impacts of closer monitoring?

We urge the agency to exclude blue hydrogen from its definition of "clean" hydrogen and instead define it as solely green electrolytic hydrogen powered by wind and solar. By defining clean hydrogen as solely green electrolytic hydrogen powered by wind and solar energy, the need to monitor CO_2 pipelines and storage facilities for leakage is eliminated, since hydrogen produced via electrolysis yields no direct CO_2 emissions. As acknowledged by the Department's question, relying on carbon capture and storage to facilitate hydrogen production invites readily foreseeable leak and pollution risks.

Carbon capture and storage involves the dangerous step of injecting and storing captured CO_2 underground. It is inevitable that stored CO_2 will escape back into the atmosphere through abandoned oil and gas wells, well failures, earthquakes,[1] and other pathways. Even small leakage rates can lead to large releases of CO_2.[2] Compounding the problem, current U.S. regulations do not require permanent storage of injected CO_2 underground. For CCS to qualify for government subsidies, federal regulations require storage of CO_2 for only 50 years.[3]

Compressed CO_2 is highly hazardous upon release, forming a cold, dense cloud that sinks to the ground and can sicken and asphyxiate people and other animals. CO_2 is odorless and colorless, so people may not be able to tell that there is a harmful leak nearby. Dense clouds of CO_2 can also stop vehicles from operating, making it hard for people to evacuate and for emergency vehicles to arrive. In February 2020, 300 people were evacuated and 45 people hospitalized when a CO_2 pipeline ruptured in rural Yazoo County, Mississippi.[4] Health harms included extreme disorientation, unconsciousness and seizures, with some sickened people found

[1] Zoback, M.D. et al., Earthquake triggering and large-scale geologic storage of carbon dioxide, 109 PNAS 10164 (2012), https://doi.org/10.1073/pnas.1202473109.
[2] Vinca, A. et al., Bearing the cost of stored carbon leakage, 6 Frontiers in Energy Research (2018), https://doi.org/10.3389/fenrg.2018.00040.
[3] Center for International Environmental Law, Carbon Capture and Storage, https://www.ciel.org/issue/carbon-capture-and-storage/ (last visited October 13, 2022).
[4] Zegart, Dan, *The Gassing of Satartia*, The Huffington Post, August 26, 2021, https://www.huffpost.com/entry/gassing-satartia-mississippi-co2-pipeline_n_60ddea9fe4b0ddef8b0ddc8f (last visited October 13, 2022).

gasping for breath, foaming at the mouth, and acting like "zombies." Underground CO_2 storage poses additional risks of leakage, contaminating drinking water and triggering earthquakes.

CO_2 has unique safety hazards and has a potential impact area measured in miles. Further, CO_2 has unique fracture potential, and releases can result in very violent ruptures with the "unzipping" of a pipeline over long distances.[5]

Current Pipeline and Hazardous Materials Safety Administration (PHMSA) regulations very narrowly define the type of CO_2 they cover; they only regulate CO_2 pipelines if transported as a supercritical fluid of >90% purity. If CO_2 is being transported as a gas, or a liquid, or at <90% purity, it is entirely unregulated.[6] Additionally, these regulations do not include a requirement for odorants to be added (like with natural gas) for leak detection safety. The regulations also include no standards on contaminants within transported CO_2; however, it is common for transported CO_2 to contain toxic and corrosive contaminants.

Question 2.b. Use of some biogenic resources in hydrogen production, including waste products that would otherwise have been disposed of (e.g., municipal solid waste, animal waste), may under certain circumstances be calculated as having net zero or negative CO_2 emissions, especially given scenarios wherein biogenic waste stream-derived materials and/or processes would have likely resulted in large GHG emissions if not used for hydrogen production. What frameworks, analytic tools, or data sources can be used to quantify emissions and sequestration associated with these resources in a way that is consistent with the lifecycle definition in the IRA?

We urge the agency to exclude hydrogen produced from woody biomass from its definition of "clean" hydrogen. All methods to convert wood to hydrogen, such as gasification and pyrolysis, produce high lifecycle emissions of CO_2 and other air pollution that harm the climate and communities.

Gasifying woody biomass to produce hydrogen releases virtually all its stored carbon, worsening the climate crisis and ending trees' future carbon sequestration, creating a "carbon debt."[7] Illustrating this, at the smokestack, incinerating wood to generate electricity emits more CO_2 per kilowatt-hour than coal.[8] Biomass gasification also has substantial upstream emissions from cutting the biomass, extracting cut materials, trucking biomass often long distances, drying

[5] Kuprewicz, R.B., Accufacts' Perspectives on the State of Federal Carbon Dioxide Transmission Pipeline Safety Regulations as it Relates to Carbon Capture, Utilization, and Sequestration within the U.S, Pipeline Safety Trust (2022), https://pstrust.org/wp-content/uploads/2022/03/3-23-22-Final-Accufacts-CO2-Pipeline-Report2.pdf.
[6] *Id.*
[7] Sterman, J. 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.
[8] Manomet Center for Conservation Sciences, Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources (2010) at 103, https://www.mass.gov/doc/manometbiomassreportfullhirezpdf/download; Sterman, J. 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.

and chipping, and storage in wood chip piles which releases significant methane emissions.[9] Despite the substantial lifecycle carbon pollution from gasifying or burning biomass, proponents erroneously claim that it is inherently "carbon neutral"—that it does not cause net GHG emissions.[10] Published scientific research has thoroughly refuted this false claim.

To claim that burning or gasifying woody biomass is carbon neutral, proponents try to discount the carbon that is released 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 cutting and incinerating them.[11] Research also shows that burning forest "residue" or "waste"—referring to biomass that would otherwise be disposed of—is similarly not carbon neutral and leads instead to a *net increase* of carbon emissions in the atmosphere for decades.[12] As a result, the IPCC, the federal Environmental Protection Agency's Science Advisory Board, and numerous other scientific bodies have established that woody bioenergy should not be assumed carbon neutral.[13] The reality is biomass energy worsens carbon

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[9] 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 resides, 79 Biomass and Bioenergy 50 (2015), https://doi.org/10.1016/j.biombioe.2015.03.030.

[10] *Id.*

[11] Manomet Center for Conservation Sciences, 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; Hudiburg, T.W. et al., Regional carbon dioxide implications of forest bioenergy production, 1 Nature Climate Change 419 (2011), https://doi.org/10.1038/nclimate1264; Law, B.E. and M.E. Harmon, Forest sector carbon management, measurement and verification, and discussion of policy related to climate change, 2 Carbon Management 73 (2011), https://doi.org/10.4155/cmt.10.40; Holtsmark, Bjart, 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 (2012), https://doi.org/10.1111/gcbb.12015; Mitchell, S.R. 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; Schulze, E.-D. 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; Sterman, John D. et al., Does replacing coal with wood lower CO_2 emissions? Dynamic lifecycle analysis of wood bioenergy, 13 Environmental Research Letters 015007 (2018), https://doi.org/10.1088/1748-9326/aaa512.

[12] 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; Booth, Mary S., Not carbon neutral: Assessing the net emissions impact of residues burned for bioenergy, 13 Environmental Research Letters 035001 (2018), https://doi.org/10.1088/1748-9326/aaac88; Sterman, J. 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.

[13] IPCC Task Force on National Greenhouse Gas Inventories, Frequently Asked Questions, 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); EPA Science Advisory Board, SAB Review of Framework for Assessing Biogenic CO2 Emissions from Stationary Sources (5 March 2019), https://cfpub.epa.gov/si/si_public_file_download.cfm?p_download_id=539269&Lab=OAP

pollution at a time when global emissions must be cut in half in this decade to limit the worst damages of the climate crisis.

Adding to these harms, biomass gasification to make hydrogen produces climate-damaging methane, while pyrolysis additionally produces "bio-oil" which emits CO_2 to the atmosphere when burned. Incentivizing the production of hydrogen from woody biomass would increase forest logging and thinning which degrade wildlife habitat and result in a net loss of carbon storage from forests, at a time when we must be reducing deforestation and protecting forest carbon stores.[14]

In terms of air pollution, bioenergy facilities and wood pellet factories are significant sources of toxic pollutants, harming the vulnerable communities where they are located and worsening environmental injustice. Biomass power plants are among the biggest emitters of particulate matter and NOx,[15] and a significant source of carbon monoxide (CO), sulfur dioxide (SO_2), lead, mercury, benzene, formaldehyde, arsenic and other hazardous air pollutants that harm public health.[16] Similarly wood pellet production facilities emit high levels of particulate matter and VOC pollutants.[17] Fine particulate matter (PM 2.5)—which can get deep into the lungs and even enter the bloodstream—is linked to serious health problems including heart disease, premature death, stroke, and aggravated asthma.[18]

Biomass gasification and pyrolysis processes, while not yet achieving industrial scale production, similarly produce significant quantities of criteria pollutants including particulate matter, NOx, SOx, heavy metals and persistent organic pollutants such as PAHs, based on available data.[19]

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at 2 ("not all biogenic emissions are carbon neutral nor net additional to the atmosphere, and assuming so is inconsistent with the underlying science"); Beddington, J. et al., Letter from scientists to the EU parliament regarding forest biomass (9 January 2018), https://empowerplants files.wordpress.com/2018/01/scientist-letter-on-eu-forest-biomass-796-signatories-as-of-january-16-2018.pdf.

[14] 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), https://doi.org/10.3389/ffgc.2019.00027.

[15] For example, in California's heavily polluted San Joaquin Valley air district, two biomass plants—Mount Poso Cogeneration Company and Rio Bravo Fresno—were the 11th and 13th biggest stationary source of fine particulate matter (PM 2.5) in 2017 out of 153 sources. In the Sacramento Valley air district, 7 out of the 10 worst PM 2.5 polluters were biomass plants, according to facility-level emissions data from the California Air Resources Board Pollution Mapping Tool, https://ww3.arb.ca.gov/ei/tools/pollution_map/pollution_map htm

[16] Partnership for Policy Integrity, Air pollution from biomass energy (updated April 2011), https://www.pfpi.net/wp-content/uploads/2011/04/PFPI-air-pollution-and-biomass-April-2011.pdf

[17] *See e.g.,* Dirty Deception: How the Wood Biomass Industry Skirts the Clean Air Act, at https://www.environmentalintegrity.org/wp-content/uploads/2017/02/Biomass-Report.pdf

[18] 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

[19] Liu, Wu-Jun et al., Fates of chemical elements in biomass during its pyrolysis, 117 Chemical Reviews 6367 (2017), https://doi.org/10.1021/acs.chemrev.6b00647; Ahmed, Omar et al., Emissions factors from distributed, small-scale biomass gasification power generation: Comparison to open burning and large-scale biomass power generation, 200 Atmospheric Environment 221 (2019), https://doi.org/10.1016/j.atmosenv.2018.12.024.

Bioenergy facilities and wood pellet factories are often concentrated in vulnerable communities already suffering from high pollution burdens, worsening environmental injustice. In the southeastern US, wood pellet production facilities are 50 percent more likely to be located in environmental justice communities.[20] In the San Joaquin Valley in California, 4 of 5 active biomass plants and 4 of 5 idle biomass plants are located in disadvantaged communities.[21] Most of these communities are within the ninetieth percentile for air pollution burden, and some are in the top percentile. These biomass power plants are guilty of repeated air quality violations.[22] Recently, numerous operating and idled bioenergy facilities are being proposed for conversion to biomass gasification or pyrolysis processes to produce hydrogen which should not qualify as "clean" hydrogen under any reasonable or just definition.

Conclusion

We urge the DOE to adopt a more stringent CHPS that accounts for co-pollutants other than carbon and is truly "clean to focus investments of taxpayer funds on the zero-emission hydrogen production technologies that can play a meaningful role in meeting the Biden Administration's 2050 carbon goals and avoiding the most catastrophic impacts of climate change. DOE must require industry to demonstrate compliance with that standard through rigorous carbon accounting. We further urge DOE to make good on the Biden Administration's commitment to environmental justice by ensuring that the DOE meaningfully engages with environmental justice communities affected by hydrogen production, and that the hydrogen hubs do not perpetuate, exacerbate, or create pollution burdens in communities that have already disproportionately suffered the negative effects of fossil fuel development and use.

Please contact Margaret Coulter, Senior Attorney at the Center for Biological Diversity (mcoulter@biologicaldiversity.org) if you have any questions regarding these comments. We appreciate your careful consideration of our comments and thank you again for the opportunity to provide feedback on the proposed clean hydrogen production standard.

Respectfully submitted,

Center for Biological Diversity

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[20] Koester Stefan & Sam Davis, Siting of Wood Pellet Production Facilities in Environmental Justice Communities in the Southeastern United States, 11 Environmental Justice 64 (2018), http://doi.org/10.1089/env.2017.0025; https://scalawagmagazine.org/2020/10/wood-pellet-environmental-racism-part-one/ and https://scalawagmagazine.org/2020/10/wood-pellet-environmental-racism-part-two/

[21] Four active biomass plants (Rio Bravo Fresno, DTE Stockton, Merced Power, and Ampersand Chowchilla) and four idle biomass plants (Community Recycling Madera Power, Covanta Mendota, Dinuba Energy, and Covanta Delano) are in census tracts designated as disadvantaged under SB 535, https://oehha.ca.gov/calenviroscreen/sb535

[22] Based on the EPA Enforcement and Compliance History Online Database, https://echo.epa.gov/, and other public records.