November 14, 2022

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

Via Email to: Cleanh2standard@ee.doe.gov

Re: Comments on the Clean Hydrogen Production Standard

Dear Department of Energy:

The Bioenergy Association of California (BAC) submits these comments on the Clean Hydrogen Production Standard (CHPS). BAC strongly supports the proposed CHPS, with one recommended change, as it will promote a diversity of low-carbon hydrogen sources that reduce climate and air pollution and produce low carbon hydrogen for electricity generation, transportation, energy storage, and hard to electrify end uses. In particular, BAC supports:

- The inclusion of biomass and biogas in the CHPS,
- A lifecycle carbon intensity approach, and
- The emphasis on promoting diverse, low carbon sources of hydrogen.

BAC's only recommended change to the draft guidance is to explicitly include avoided black carbon emissions, in addition to avoided methane, as a goal of the CHPS.

BAC represents over 100 members working to promote sustainable bioenergy development in California. BAC's public sector members include cities and counties, local air districts and environmental agencies, public utilities, environmental and community groups, public research institutions, and others. BAC's private sector members include energy and technology firms, investors, agriculture and food processing companies, waste haulers, investor owned utilities, and others.

Many BAC members are developing organic waste to hydrogen projects to help achieve California's climate change, air quality, wildfire reduction, and landfill waste reduction goals. BAC members are developing projects to generate hydrogen from forest waste, dairy manure, landfill gas, and organic waste diverted from landfills. All of these forms of hydrogen will help to advance the Biden Administration's and California's climate change and clean energy goals.

BAC supports the proposed CHPS for the reasons described below and proposes one addition to the CHPS guidance.

1. **Inclusion of Biomass and Biogas as Sources of Clean Hydrogen**

BAC strongly supports the inclusion of biomass and biogas as eligible feedstocks under the CHPS. Organic waste and biogas are the only feedstocks for hydrogen that can provide carbon negative hydrogen while reducing methane and black carbon emissions, wildfire risks, and landfill waste.

a. Hydrogen from Organic Waste Can Provide Carbon Negative Emissions

As the table below, from the California Air Resources Board, shows, hydrogen from organic waste can provide significant carbon negative emissions.

- CI of hydrogen varies by production method and source of feedstock

H2 Pathways Examples for a Light Duty Vehicle	Avg Carbon Intensity (g CO2e/MJ)*
H2 from dairy biomethane via SMR	-94
H2 from electrolysis (wind/solar electricity)	4
H2 from landfill gas via SMR	46
H2 from natural gas via SMR	58
H2 from electrolysis (Grid electricity)	66

*Adjusted for use in a light-duty vehicle

CALIFORNIA AIR RESOURCES BOARD

Source: California Air Resources Board presentation March 14, 2022, slide 4.

Lawrence Livermore National Lab, in its groundbreaking report on how California can achieve carbon neutrality, also found that converting organic waste to hydrogen can provide two-thirds of all the carbon negative emissions that California needs to reach carbon neutrality by mid-century.[1]

b. Hydrogen from Organic Waste Cuts Climate Super Pollutants Methane and Black Carbon

Hydrogen generated from organic waste is also the only form of hydrogen that reduces the climate super pollutants – also known as Short-Lived Climate Pollutants (SLCPs) –

[1] Lawrence Livermore National Lab, *Getting to Neutral – Options for Negative Carbon Emissions in California,* January 2020, at page 2.

methane and black carbon. Converting dairy manure and organic waste diverted from landfills helps to reduce fugitive methane emissions, which President Biden has said must be our highest climate priority in the near term. The head of the United Nations Environment Program has also said that "Cutting methane is the strongest lever we have to slow climate change over the next 25 years . . .[we] need to urgently reduce methane emissions as much as possible this decade."[2]

Recent monitoring by NASA's Jet Propulsion Lab shows that landfill leaks are the largest source of methane emissions in California, so reducing organic landfill waste is a critical strategy to reduce overall methane emissions.[3] Converting dairy manure and other livestock waste to hydrogen will further reduce methane emissions.

Converting forest and agricultural waste biomass to hydrogen will help to reduce black carbon and methane emissions from controlled burns and wildfires, which are one of the biggest and fastest growing sources of climate pollution in the western United States. California and the U.S. Forest Service have agreed to forest fuel removal on one million acres per year, which will generate approximately 10 million bone dry tons of forest biomass.[4] Converting that biomass to hydrogen instead of pile and burn (which releases black carbon) or pile and decay (which releases methane) will provide enormous benefits for the climate and air quality, as well as providing a low carbon form of energy.

c. Hydrogen from Organic Waste Provides Most Cost-Effective Carbon Reductions

Converting organic waste or biogas to hydrogen is significantly less expensive than green electrolytic hydrogen.[5] Even more important than the cost of the hydrogen itself, is the cost per ton of carbon reduction, which is the over-arching goal of converting our energy sector to cleaner and renewable sources. According to Lawrence Livermore National Lab, converting organic waste to hydrogen with Carbon Capture and Storage is an extremely cost-effective way to reduce carbon emissions, averaging only $29 to $64 per ton of carbon reduction.[6] In other words, converting organic waste to energy provides a less expensive path to generate clean hydrogen and the lowest cost per ton of carbon reduction of any form of hydrogen.

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[2] See United Nations Press Release "Global Assessment: Urgent steps must be taken to reduce methane emissions this decade" issued May 6, 2021. Available at: https://www.unep.org/news-and-stories/press-release/global-assessment.

[3] http://methane.jpl.nasa.gov/. See also: https://www.jpl.nasa.gov/news/a-third-of-california-methane-traced-to-a-few-super-emitters.

[4] *Agreement for Shared Stewardship of California's Forest and Rangelands Between the State of California and the USDA, Forest Service, Pacific Southwest Region,* August 2020.

[55] https://www.iea.org/data-and-statistics/charts/global-average-levelised-cost-of-hydrogen-production-by-energy-source-and-technology-2019-and-2050.

[6] LLNL report, footnote 1 above, at page 8.

2. Basing Carbon Intensity on Lifecycle Emissions

The CHPS is correctly based on lifecycle carbon emissions, which is the only accurate way to compare emissions from different sources and to ensure that clean hydrogen is in fact providing significant carbon reductions. Considering only the emissions at the point of hydrogen production, by contrast, would ignore the potential for significant additional emissions from the feedstocks, process fuels, and transportation. Considering only emissions at the point of hydrogen production also ignores the significant potential for emissions reductions (avoided emissions) at the feedstock source. This is particularly important in the case of organic waste or biogas that is converted to hydrogen.

Converting biomass and biogas to hydrogen can cut fugitive emissions of methane and black carbon – in most cases, quite dramatically. For example, converting forest or agricultural waste to hydrogen can cut black carbon and methane emission by 98 percent compared to open burning or wildfire.[7] Similarly, as the California Air Resources Table above shows, converting dairy manure to hydrogen can provide carbon negative emissions on a lifecycle basis even though it generates emissions from steam methane reformation at the point of hydrogen production. Since dairy biogas is so low carbon to begin with, by reducing fugitive emissions from dairy manure, the resulting hydrogen is still carbon negative on a lifecycle basis, but would be excluded from a hydrogen standard that only considers emissions at the point of hydrogen production.

The CHPS is correctly based on lifecycle carbon emissions, which is the only accurate way to assess emissions and reductions of carbon. It is also especially important to capture the value of avoided methane and black carbon emissions that should be our highest climate priority.

3. Promoting a Diverse Portfolio of Clean Hydrogen Sources

BAC agrees with the explicit goal of the CHPS to promote the "use of clean hydrogen from diverse fuel sources" including biomass and biogas.[8] BAC agrees that the CHPS should ensure "support for hydrogen production from diverse low-carbon energy sources, and . . . diverse feedstocks."[9] BAC also supports giving preference to projects that mitigate fugitive methane emissions, projects that use cleaner electricity, employ high rates of CCS, and blend fuels with renewable natural gas or low-carbon biomass.[10] As discussed in section 4, below, the CHPS should also give preference to projects that avoid or reduce black carbon emissions.

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[7] *California Forest Carbon Plan*, adopted by the California Environmental Protection Agency, California Natural Resources Agency, and CalFire in 2018, at page 130.

[8] U.S. Department of Energy, Clean Hydrogen Production Standard (CHPS) Draft Guidance, at page 1.

[9] Id. at page 2.

[10] Id. at page 3.

Each feedstock and technology provides particular benefits and has particular limitations. For example, green electrolytic hydrogen can use excess solar or wind power to provide renewable hydrogen for use when solar and wind are not available. This avoids having to dump excess clean power and also provides energy storage. On the other hand, green electrolytic hydrogen does not reduce methane or black carbon emissions and does not provide carbon negative emissions. Electrolytic hydrogen also depends on significant quantities of water that may not always be available in all locations.

By contrast, hydrogen from organic waste and biogas can reduce methane and black carbon emissions, provide carbon negative hydrogen, and help to reduce landfill waste, wildfires, and open burning of biomass waste. But hydrogen from organic waste is limited to the quantity of organic waste that is technically and economically available.

Including a diverse portfolio of eligible feedstocks and technologies will ensure that the CHPS provides maximum benefits with minimum impacts. It also increases the likelihood of achieving the Administration's goal of slashing hydrogen production costs.

4. The CHPS Should Explicitly Include Avoided Black Carbon Emissions

US DOE should include avoided black carbon, as well as avoided methane, in the background discussion, justification, and proposed priorities for the CHPS. Black carbon, like methane, is a Short-Lived Climate Pollutant that is also known as a climate super pollutant. Whereas methane is 85 times more damaging to the climate than carbon dioxide, black carbon is 900 to 3200 times more damaging on a 20-year basis.[11] Fortunately, it does not remain in the atmosphere for long, so reducing black carbon is one of the most immediately beneficial steps we can take to address climate change.

Converting forest and agricultural waste to hydrogen can avoid fugitive black carbon emissions from pile and burn, prescribed fire (controlled burns in the forest or grasslands), and wildfires. Reducing black carbon is critical to the climate and also protects public health since black carbon includes PM 2.5, a toxic air contaminant. Reducing black carbon provides enormous climate and public health benefits that should be included in the background discussion and the priorities of the CHPS. The CHPS should explicitly include avoided black carbon emissions along with avoided methane as priorities for the program.

In California, the biggest opportunity for carbon negative hydrogen is from forest waste that is removed for wildfire mitigation and forest health purposes.[12] Converting that biomass waste to hydrogen instead of open burning it or having it burn up in a wildfire will reduce black carbon emissions significantly. The CHPS should include black carbon emissions – along with the reduction of fugitive methane emissions – as an

[11] IPCC and *California Short-Lived Climate Pollutant Reduction Strategy*, adopted by the California Air Resources Board in March 2017 at page 40.

[12] See, Lawrence Livermore National Lab report, footnote 1 above.

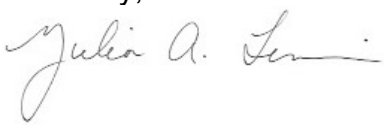
explicit priority of the program. Doing so will accelerate development of carbon negative hydrogen and help mitigate the wildfire crisis across the western United States.

Conclusion

The draft guidance on CHPS provides a science-based and pragmatic approach to clean hydrogen. BAC especially supports the inclusion of diverse feedstocks, including organic waste, biomass and biogas, and the focus on lifecycle carbon emissions. BAC urges US DOE, however, to add the reduction of black carbon emissions as an explicit goal of the CHPS, which will accelerate the conversion of forest and agricultural waste to hydrogen and help to reduce wildfire and restore healthy forests in the western United States.

Thank you for your consideration of these comments.

Sincerely,



Julia A. Levin
Executive Director