



September 30, 2024

Clerks' Office
California Air Resources Board
1001 I St. Sacramento, CA 95814

Submitted electronically at <https://ww2.arb.ca.gov/lispub/comm/bclist.php>

RE: Recirculated EIA for Proposed Low Carbon Fuel Standard Amendments

Dear Members of the Board:

The Center for Biological Diversity submits the following comments on the California Air Resources Board's (CARB) recirculated Draft Environmental Impact Analysis (EIA) for the proposed Low Carbon Fuel Standard (LCFS) amendments. We are commenting on the revised Proposed Amendments, specifically the revised project description and associated air quality and greenhouse gas (GHG) assessments which were updated through 15-day changes released on August 12, 2024.

Please note that we are submitting the references cited herein for CARB's convenience. Those references are available here: <https://diversity.box.com/s/8jcli9f2vwyof9cbq1qx5sna1m0d0hsb>. We also incorporate our previous comments submitted on the Proposed LCFS Amendments on August 26, 2024 and February 20, 2024.

The EIA has several significant flaws with respect to the revised impacts analyses and mitigation measures, which result in under-estimates of the air quality and GHG harms that will be caused by implementation of the Proposed Amendments.

The EIA states that the revised Proposed Amendments will allow hydrogen production from woody biomass feedstocks including forest and agricultural residues;¹ allow electricity production from forest and agricultural residues;² and allow the development and construction of CCS (carbon capture and storage) projects.³ The EIA further states that foreseeable compliance with the Proposed Amendments will result in: (1) an increase in the construction and operation of biomass gasification and pyrolysis facilities to produce hydrogen and renewable natural gas

¹ EIA at 19

² EIA at 19

³ EIA at 37-38

(methane), the associated “increase in removal of forest litter and agricultural residues,”⁴ and the construction and operation of new infrastructure such as new hydrogen pipelines or truck transport;⁵ and (2) “modification to existing or new industrial facilities to capture CO₂ emissions” and associated “construction of new infrastructure such as pipelines, wells and other surface facilities.”⁶ The EIA concludes that these presumed “low-CI” hydrogen, electricity, and fuels produced using CCS “may result in reductions in criteria pollutants and air toxics”⁷ and will result in lower GHGs, compared with fossil fuels.⁸

Critically, however, the EIA fails to adequately assess the air pollution and GHG impacts that will result from hydrogen and electricity production using woody biomass feedstocks and from fuels produced using CCS, under the revised amendments. The EIA’s impacts assessment likely significantly under-estimates the GHGs and air pollution that will result from incentivizing these “fuels” under the LCFS program and fails to provide mitigation measures to address these foreseeable impacts. The EIA cannot reliably conclude that the Proposed Amendments will lower GHG emissions and potentially lower air pollutant emissions without conducting the required science-based assessments of the GHG and air pollution impacts from the production of hydrogen and electricity from woody biomass feedstocks, and fuels produced using CCS.

For these reasons, CARB should prepare and circulate a revised analysis that complies with the information and mitigation requirements CEQA.

(1) The EIA fails to adequately assess the GHG and air pollution impacts that will result from the construction and operation of gasification/pyrolysis facilities to produce hydrogen from woody biomass feedstocks, and fails to mitigate these impacts.

CARB’s LCFS program does not have a carbon intensity (CI) calculator for hydrogen produced using forest or agricultural feedstocks. CARB’s proposed hydrogen CI calculator only covers hydrogen produced via steam methane reformation and electrolysis. Therefore, the EIA cannot and has not adequately assessed the GHG and air pollution impacts of producing hydrogen from the gasification or pyrolysis of forest and agricultural feedstocks.

As we detailed in our February 20, 2024 comments on the LCFS amendments, the best-available science demonstrates that producing hydrogen from the gasification and pyrolysis of forest and agricultural biomass feedstocks releases large amounts of planet-heating CO₂ and toxic air pollutants, as summarized below.

⁴ EIA at 38, 40, 43, 51, 57

⁵ EIA at 31

⁶ EIA at 37-38

⁷ EIA at 44

⁸ EIA at 60-61

(a) Gasification and pyrolysis of woody feedstocks to make hydrogen produce large amounts of CO₂.

The gasification of biomass at high temperatures (800-1200°C) produces a “syngas” containing large amounts of CO₂, as well as methane (CH₄), carbon monoxide (CO), and hydrogen (H₂), in addition to liquid hydrocarbons and tar, solid char and ash residues, and a wide array of air pollutants.⁹ The pyrolysis of biomass additionally produces pyrolytic oil and larger quantities of char. Therefore, similar to biomass combustion, gasification and pyrolysis of biomass produce large quantities of CO₂ as well as methane emissions.

(b) Woody biomass is not a carbon neutral feedstock: 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.

Biomass-derived hydrogen is often falsely promoted as being carbon neutral based on the inaccurate claim that woody biomass is a carbon neutral feedstock. This claim has been thoroughly discredited. Cutting trees ends their carbon storage and sequestration; significant upstream emissions are emitted during cutting, extracting, trucking, and processing woody biomass;¹⁰ and significant downstream CO₂ emissions are produced from gasification, pyrolysis, or combustion.¹¹

To claim biomass energy is carbon neutral, proponents try to discount the CO₂ that is released by taking credit for the carbon that will be absorbed by future tree growth. 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. Instead, 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.¹²

⁹ 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>.

¹⁰ 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](https://doi.org/10.1016/j.biombioe.2015.03.030).

¹¹ John Stermann et al., *Does wood bioenergy help or harm the climate?*, 78 *Bulletin of the Atomic Scientists* 128 (2022), DOI: 10.1080/00963402.2022.2062933.

¹² 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>; Laganriere, 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>; Stermann, John et al., *Does wood bioenergy help or harm the climate?*, 78 *Bulletin of the Atomic Scientists* 128 (2022).

Numerous scientific bodies have established that woody biomass energy should not be assumed to be carbon neutral. The EPA's Scientific Advisory Board advised the agency that *no* type of biomass should be considered automatically carbon neutral.¹³ That Board's opinion comports with Intergovernmental Panel on Climate Change assessments (IPCC) which states 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."¹⁴

Research also 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 (N₂O) emissions, "greenhouse 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."¹⁵

(c) Biomass gasification and pyrolysis to make hydrogen produce a wide range of health-harming pollutants.

The EIA fails to assess the impacts of the wide range of health-harming pollutants produced by biomass gasification and pyrolysis. These pollutants include fine particulate matter, NO_x, SO_x, 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).¹⁶ 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.¹⁷ Fine particulate matter

¹³ 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."

¹⁴ IPCC, Task Force on National GHG Inventories, FAQs at Energy Q2-10, <https://www.ipcc-nggip.iges.or.jp/faq/faq.html>.

¹⁵ 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.

¹⁶ 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>.

¹⁷ 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>.

pollution is linked to a higher risk of premature death, heart disease, stroke, and aggravated asthma.¹⁸

The formation of NO_x precursors, including NH₃, HCN and HNCO, during biomass pyrolysis has been widely reported, where NO_x damages the respiratory system and contributes to acid rain, harming ecosystems.¹⁹ 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 processes.²⁰ Methods to clean tar from equipment would create large amounts of toxic wastewater, with resulting environmental and community harms.²¹

(d) The EIA fails to address the GHG impacts of using forest residues for fuels production.

The Proposed Amendments' specifications for forest residues are that they are "[s]mall-diameter, non-merchantable forestry residues removed for the purpose of forest fire fuel reduction or forest stand improvement and from a treatment where no-clear cutting occurred."²² These specifications are too vague to limit forest degradation nor will they meaningfully reduce the foreseeable harms to the climate.

Almost all forest logging and thinning projects are done under the justification that they will "promote forest health and resilience and/or are needed for fuels reduction." Trees and other forest vegetation of any size can be lopped and masticated into "small-diameter" residues and called "non-merchantable." Incentivizing the commodification of forest materials under the LCFS will lead to the removal of more trees and other habitat from the forest than would happen if these materials were not commodified, threatening forest ecosystems and forest carbon storage and sequestration. In terms of climate impacts, research shows that broad-scale thinning for wildfire management leads to more carbon emissions than it prevents from being released in a wildfire, and results in a net increase of carbon emissions to the atmosphere and net decrease in

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 Chen, Hongyuan et al., *A review on the NO_x precursors release during biomass pyrolysis*, 451 Chemical Engineering Journal 138979 (2022), <https://doi.org/10.1016/j.ccej.2022.138979>.

²⁰ 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>.

²¹ 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>.

²² Appendix A-1 at 145

forest carbon storage.²³ The EIA fails to account for the significant GHG impacts that would result from incentivizing forest residues to be used for fuels production under the LCFS program.

(2) The EIA fails to adequately assess the GHG and air pollution impacts that will result from the production of electricity from woody biomass feedstocks, and fails to mitigate these impacts.

CARB's LCFS program does not have a carbon intensity calculator for electricity produced using forest feedstocks. Therefore, the EIA cannot and has not adequately assessed the GHG and air pollution impacts of producing electricity from these feedstocks. The best-available science shows that woody biomass energy is highly polluting for the climate and communities. Burning trees and other woody materials for electricity releases more CO₂ at the smokestack than coal per unit of energy produced.²⁴ As a result, biomass power plants are much more climate polluting than other electricity sources in California. Biomass power plants are also among the largest emitters of particulate matter (PM) and nitrogen oxide (NO_x) in the state, imperiling neighboring communities, in addition to emitting large amounts of hazardous air pollutants, such as dioxins, benzene, formaldehyde, arsenic, lead, and mercury.²⁵ Biomass power plants are often concentrated in communities of color and low-wealth communities in the Central Valley already suffering from high pollution burdens, worsening environmental injustice.

(3) The EIA fails to adequately assess the GHG and air pollution impacts that will result from the construction and operation of CCS projects, CO₂ pipelines, and associated infrastructure, and fails to mitigate these impacts.

The EIA fails to base its assessment of the GHG and air pollution impacts of CCS projects on the real-world performance of these projects. Instead, the EIA appears to make unrealistic assumptions about the carbon capture efficiency and energy penalty of CCS projects that lead to an underestimate of the GHG and air pollution harms of these projects.

²³ Bartowitz, Kristina J. et al., Forest carbon emission sources are not equal: putting fire, harvest, and fossil fuel emissions in context, 5 *Frontiers in Forests and Global Change* 867112 (2022), <https://doi.org/10.3389/ffgc.2022.867112>; Law, Beverly E. et al., Creating strategic reserves to protect forest carbon and reduce biodiversity losses in the United States, 11 *Land* 721 (2022), <https://doi.org/10.3390/land11050721>; Chad Hanson, Cumulative severity of thinned and unthinned forests in a large California wildfire, 11 *Land* 373 (2022), <https://doi.org/10.3390/land11030373>; Baker, B.C. and C.T. Hanson, Cumulative tree mortality from commercial thinning and a large wildfire in the Sierra Nevada, California, 11 *Land* 995 (2022).

²⁴ 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.

²⁵ Partnership for Pol'y 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>.

CARB assumes that CCS projects meet a 90% carbon capture rate, but this is far from what is achieved in reality. CCS projects around the world have failed drastically—and repeatedly—to meet their promised carbon capture rates, often by large margins.²⁶ For example, the Petra Nova²⁷ CCS facility in Texas which was promised to capture 90 percent of the power plant’s total CO₂ emissions only captured 7 percent.²⁸ One recent real-world California example is the Aera CarbonFrontier project proposed in Kern County. That Project’s CEQA review shows that for at least the first seven years, the project will be *net positive* in GHG emissions, even while running CCS on its natural gas-fired power plants.²⁹

CCS operations are also very energy-intensive given the high energy requirements needed to separate, compress, transport, and inject CO₂, typically requiring at least 15-40% more energy, which results in increased greenhouse gas and air pollution emissions.³⁰ Thus, the installation of CCS and its concomitant energy penalty drives even more air pollution at the facility and upstream, which appears to be unaccounted for in CARB’s air quality modeling. Furthermore, the EIA does not appear to account for the impacts of inevitable ruptures of CO₂ pipelines and leaks from underground CO₂ storage that not only harm the climate but can sicken and even kill people.³¹

²⁶ Institute for Energy Economics and Financial Analysis (IEEFA), *The Carbon Capture Crux: Lessons Learned* (Sept. 2022), <https://ieefa.org/resources/carbon-capture-crux-lessons-learned>; Oil Change International, *Funding Failure: Carbon Capture and Fossil Hydrogen Subsidies Exposed* (August 29, 2024), <https://www.oilchange.org/publications/funding-failure-carbon-capture-and-fossil-hydrogen-subsidies-exposed/>

²⁷ Petra Nova was shut down in 2020 due to plunging oil prices but will soon restore operations. Kevin Crowley, *The World’s Largest Carbon Capture Plant Gets a Second Chance in Texas*, Bloomberg (Feb. 8, 2023), <https://www.bloomberg.com/news/articles/2023-02-08/the-world-s-largest-carbon-capture-plant-gets-a-second-chance-in-texas#xj4y7vzkg>.

²⁸ Ctr. for Int’l Env’t. L., *Confronting the Myth of Carbon-Free Fossil Fuels: Why Carbon Capture Is Not a Climate Solution*, 8 (2021), <https://www.ciel.org/wp-content/uploads/2021/07/Confronting-the-Myth-of-Carbon-Free-Fossil-Fuels.pdf> at 2; Jacobson, Mark Z, 2019, The health and climate impacts of carbon capture and direct air capture, 12 *Energy Env’t. Sci.* 3567, <https://doi.org/10.1039/C9EE02709B>

²⁹ See Draft EIR CarbonFrontier CCS Project by Aera Energy, LLC, SCH 2023060293, <https://ceqanet.opr.ca.gov/2023060293/2> at pages 4.8-32, 33. Moreover, the construction emissions to build the CCS infrastructure will release 27,975 MT CO₂/e. *Id.* at 4.8-24.

³⁰ 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>.

³¹ 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/>.

Conclusion

Because the EIA fails to adequately assess and mitigate the increased air and climate impacts from its Amendments, the EIA is defective as an informational document and should be redone in line with best available science. Ultimately, however, as detailed in our prior comments, we urge CARB to remove the production of fuels, hydrogen, and electricity from woody biomass feedstocks and dairy biogas from the LCFS program due to their significant harms to the climate, communities, and ecosystems. We urge CARB to remove CCS projects from the LCFS program, including credits to projects outside of California that produce oil using captured carbon dioxide.

Thank you for consideration of these comments.

Sincerely,

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