February 9, 2024

California Environmental Protection Agency
California Air Resources Board

Submitted electronically via: https://ww2.arb.ca.gov/public-comments/public-comments-webinars-draft-priority-climate-action-plan-under-us-epa-climate

RE: California's Draft Priority Climate Action Plan (PCAP)

Thank you for the opportunity to submit comments on California's Draft Priority Climate Action Plan (PCAP) created under U.S. EPA's Climate Pollution Reduction Grants (CPRG) Program. These comments are submitted on behalf of the Center for Biological Diversity.

While the PCAP includes many good climate measures, we strongly oppose the inclusion of measures that promote and expand biomass, biofuel, and dairy biogas projects, including the conversion of woody biomass and dairy digester gas to hydrogen. These projects are polluting for the climate, harm community health and safety, worsen environmental injustice, and threaten forest ecosystems (in the case of forest biofuels and bioenergy). IRA funding should not be used for these dirty projects.

Specifically, we strongly oppose the inclusion of these measures:
(1) Energy Measure 4: Bolster Healthy Landscapes and Resilient Communities through Expanding the Biomass to Carbon Negative Biofuels Program
(2) Energy Measure 5: Implement Bioenergy Projects
(3) Agriculture Measure 2: Reduce Methane Emissions by Expanding California's existing Dairy Digester Research and Development Program (DDRDP)

We also would like to point you to the February 5, 2024, petition to the California Energy Commission submitted on behalf of 16 conservation, environmental justice and local government groups asking the agency to consider the full social and environmental costs and benefits when making decisions about the state's clean energy future, as state law requires.[1] The petition identifies biomass and biofuel facilities and dairy methane production as harmful projects.

[1] https://biologicaldiversity.org/w/news/press-releases/california-regulators-urged-to-consider-environment-public-health-in-energy-decisions-2024-02-05/.

(1) The Biomass to Carbon Negative Biofuels Program and Implementation of Bioenergy Projects Should Not Be Included.

These programs seek to fund the conversion of biomass—forest and agricultural materials—to hydrogen and other fuels, with the potential use of carbon capture and storage (CCS), claiming these fuels will be "carbon negative." The science-based reality is that these projects would be polluting for the climate and communities, likely to worsen environmental injustice, and harm forest ecosystems. These projects are far from being "carbon negative."

As detailed below, the gasification and pyrolysis of woody biomass to make hydrogen and biofuels releases large amounts of planet-heating CO_2 and toxic air pollutants, worsening the climate emergency and harming public health. California incorrectly treats forest feedstocks as carbon neutral, when scientific research instead 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. Biomass facilities often concentrate pollution in communities of color and low-income communities, worsening environmental injustice.[2] Adding CCS to biomass gasification, pyrolysis, or combustion would still result in significant climate and air pollution and threaten public and safety, given CCS has proven to be ineffective, unsafe, and energy-intensive.[3] Incentivizing hydrogen production from forests 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. These projects are not part of a clean, just energy future.

(a) Gasification and pyrolysis of biomass to produce hydrogen and biofuels produce large amounts of CO_2 and health-harming pollutants.

Gasification and pyrolysis are the primary processes being promoted to produce hydrogen and biofuels 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 (CH4), 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. 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.[4] Biomass gasification and pyrolysis processes to produce hydrogen are still in the initial development phase, have not been demonstrated at any meaningful scale, are technically difficult, and expensive.

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[2] Center for Biological Diversity, Forest Biomass Energy is a False Solution (2021). https://www.biologicaldiversity.org/campaigns/debunking_the_biomass_myth/pdfs/Forest-Bioenergy-Briefing-Book-March-2021.pdf.

[3] 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

[4] 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.

(b) 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).[5] 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.[6] Fine particulate matter pollution is linked to a higher risk of premature death, heart disease, stroke, and aggravated asthma.[7]

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.[8] Of the BTEX compounds produced during gasification and pyrolysis, benzene is a known human carcinogen, and toluene and xylenes damage the brain and nervous system, respiratory system, kidneys, and liver.[9]

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.[10] Methods to clean tar from equipment would create large amounts of toxic wastewater, with resulting environmental and community harms.[11]

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[5] 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.

[6] 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.

[7] 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.

[8] 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.

[9] Suh, H. H. et al., Criteria air pollutants and toxic air pollutants, 108 Environmental Health Perspectives Suppl 4, 625 (2000); ATSDR A-Z Index; Jia, C., & Batterman, S., A critical review of naphthalene sources and exposures relevant to indoor and outdoor air, 7 International Journal of Environmental Research and Public Health 7 (2010).

[10] 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.

[11] Luo, Xiang et al., Biomass gasification: an overview of technological barriers and socio-environmental impact. In *Gasification for Low-Grade Feedstock* (2018): 1-15, https://www.intechopen.com/chapters/59423.

(c) Climate-heating CO_2

Similar to biomass combustion, gasification and pyrolysis of biomass produce large quantities of CO_2 as well as methane emissions that worsen the climate emergency. Biomass-derived hydrogen and biofuels are often falsely promoted as being carbon neutral or carbon negative (i.e., meaning that they will lead to a net removal of CO_2 from the atmosphere) 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 process. The claim that woody biomass is a carbon neutral feedstock has been thoroughly debunked,[12] given the lost carbon storage and sequestration from extracting biomass, and the significant CO_2 emissions during biomass processing and gasification, pyrolysis, or combustion.[13] For example, 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.[14] 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.[15]

Furthermore, CCS has consistently proven to be exceptionally ineffective, unsafe, expensive, and targets environmental justice communities.[16] 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 emissions.[17] CCS projects around the world have consistently failed to meet their

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[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; 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.

[13] 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, https://www.fern.org/fileadmin/uploads/fern/Documents/2022/Six_problems_with_BECCS_-_2022.pdf.

[14] *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.

[15] 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; Mirjam Roder 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 residue, 79 Biomass and Bioenergy 50 (2015), DOI: 10.1016/j.biombioe.2015.03.030; 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).

[16] 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.

[17] 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.

carbon-capture promises, often by large margins.[18] 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,[19] worsening the climate emergency. 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 inevitable ruptures of CO_2 pipelines and leaks from underground CO_2 storage that can sicken and even kill people.[20] In short, putting CCS equipment on biomass gasification and pyrolysis facilities (BECCS) would still lead to significant CO_2 and co-pollutants emissions, endangering communities and the climate.

(d) Environmental injustice.

Biomass gasification and pyrolysis project proposals are targeting communities in the Central Valley already overburdened with pollution. For example, idled Central Valley 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.[21] 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,[22] with inevitable harms from air pollution, water pollution, noise pollution, CO_2 leakage, earthquake risks, and ecosystem damage.

(e) 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.[23] This would put extra stress on water supplies in areas already suffering from climate crisis-charged drought.

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[18] IEEFA, The carbon capture crux: Lessons learned (Sept. 2022), https://ieefa.org/resources/carbon-capture-crux-lessons-learned.
[19] Global CCS Institute, https://status22.globalccsinstitute.com/2022-status-report/appendices/.
[20] 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/.
[21] https://www.cleanenergysystems.com/clean-energy-systems-enters-into-an-agreement-to-acquire-the-madera-biomass-power-plant.
[22] LLNL and DOE, Getting to Neutral: Options for Negative Carbon Emissions in California (2019), https://livermorelabfoundation.org/2019/12/19/getting-to-neutral/.
[23] Mehmeti, Andi et al., Life cycle assessment and water footprint of hydrogen production methods: from conventional to emerging technologies, 5 Environments 24 (2018), doi:10.3390/environments5020024 at Table 1

(f) Forest ecosystem harms and lost forest carbon storage and sequestration.

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 and sequestration from forests, at a time when we must be reducing deforestation and protecting forest carbon stores.[24] 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.

(2) Agriculture Measure 2 (Reduce Methane Emissions by Expanding California's existing Dairy Digester Research and Development Program) Should Not Be Included.

We are strongly opposed to this measure, which would promote and expand dairy digester gas and the creation of hydrogen from this gas. As extensively documented by environmental justice, climate, and community groups and supported by published research, dairy digester gas and hydrogen made from dairy digester gas are not clean energy.[25] They pollute the climate, harm environmental justice communities with toxic waste, and entrench factory farming practices.

Thank you for your consideration of these comments.

Sincerely,

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[24] 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), doi: 10.3389/ffgc.2019.00027.
[25] Association of Irritated Residents (AIR), Leadership Counsel for Justice & Accountability, Food & Water Watch, and Animal Legal Defense Fund, October 2021, Petition For Rulemaking To Exclude All Fuels Derived From Biomethane From Dairy And Swine Manure From The Low Carbon Fuel Standard Program, https://leadershipcounsel.org/climate-credits-for-factory-farm-gas-violate-civil-rights-fail-to-achieve-climate-benefits-states-petition-submitted-to-car; Leadership Counsel for Justice & Accountability, Dairy Digesters: Not a Solution (2019), https://leadershipcounsel.org/dairy-digesters-not-a-solution/