Wheelabrator Shasta Energy biomass plant, photo by Trip Jennings

BIOMASS ENERGY IS POLLUTING:
A FALSE CLIMATE SOLUTION THAT WORSENS THE CLIMATE CRISIS

Biomass is currently categorized as a "renewable" energy source along with solar and wind, but the reality is that biomass energy has more in common with fossil fuels. Like coal and oil, biomass is a carbon-burning form of energy production that emits carbon dioxide and contributes to the climate crisis. In fact, biomass power plants are California's dirtiest electricity source—releasing more carbon at the smokestack than coal. Adding to these harms, cutting trees for biomass energy reduces the forest's ability to sequester and store carbon. All in all, biomass power is a double whammy for the climate: it emits more carbon at the smokestack and leaves less carbon stored in the forest.

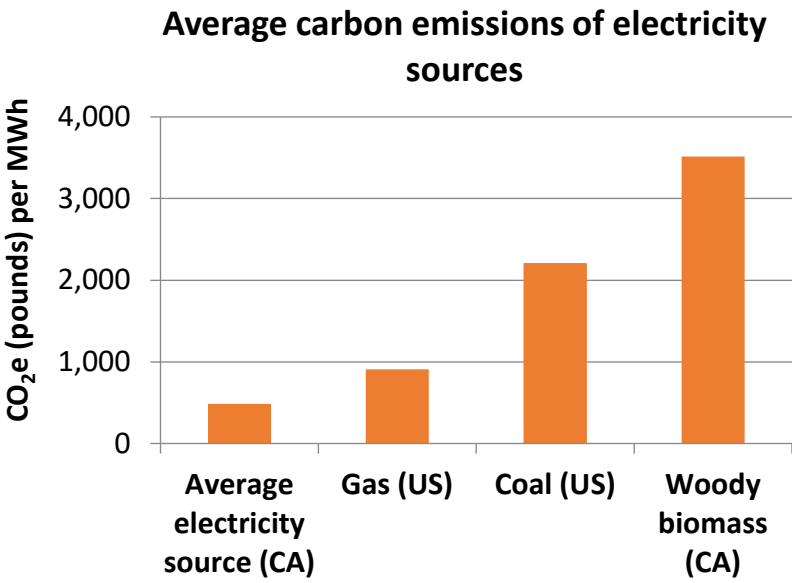
Biomass power plants are California's dirtiest electricity source.

Biomass power plants are ***much more*** climate-polluting than other electricity sources in California. The average greenhouse gas emission rate for California's current electricity portfolio is about 485 pounds carbon dioxide equivalent (CO_2e) per megawatt hour (MWh).[1] In 2018 woody biomass power plants in California emitted more than seven times that amount, averaging 3,500 pounds CO_2e per net MWh for the non-cogeneration facilities.[2] Smaller-scale biomass power plants using gasification technology are similarly carbon-intensive.[3]

Biomass power plant emissions in 2018	Capacity (MW)	Total CO_2e (pounds) per net MWh
Ampersand Chowchilla Biomass Power	12.5	2,996
Burney Forest Products (BioRAM) (cogen)	31	3,768
Collins Pine Biomass Power (cogen)	12	19,120
DG Fairhaven	15	3,877
DTE Stockton Biomass Power (cogen)	50	3,298
HL Power (BioRAM)	35.5	2,980
Humboldt Sawmill Company (cogen)	32.5	5,016
Merced Power	12.5	3,220
Mt. Poso Cogeneration (cogen)	63.6	2,507
Pacific Ultrapower Chinese Station (BioRAM)	25.7	4,418
Rio Bravo Fresno Biomass Power (BioRAM)	27.8	3,150
Rio Bravo Rocklin Biomass Power (BioRAM)	27.8	3,435
Roseburg Forest Products (cogen)	13.4	4,967
SPI Anderson Biomass Power II (cogen)	30.1	4,480
SPI Burney Biomass Power (cogen)	20	4,736
SPI Lincoln Biomass Power (cogen)	19.2	5,314
SPI Quincy Biomass Power (cogen)	35.3	6,215
SPI Sonora Standard Biomass Power (cogen)	7.5	11,540
Wheelabrator Shasta Energy (BioRAM)	62.8	3,900
Woodland Biomass Power	28	3,464
Average for non-cogeneration plants		**3,515**

Biomass energy is more climate-polluting than coal.

At the smokestack, biomass power plants release more carbon pollution than coal for the same amount of electricity produced.[4] Woody biomass energy generation in California emits more than one-and-a-half times the carbon pollution of coal-fired power per unit of electricity—and almost four times the carbon pollution of gas-generated power.[5] This is because incinerating trees is a remarkably inefficient way to generate electricity, resulting in high carbon emissions and high costs of production. In contrast, solar and wind energy provide truly carbon-free sources of power.



Biomass energy is not carbon neutral.

Despite the substantial carbon pollution from biomass power, biomass proponents claim that cutting and incinerating forests is inherently "carbon neutral"—that it does not cause net greenhouse gas emissions. The reality is biomass energy worsens carbon pollution, at a time when global emissions must be cut in half in the next decade to limit the worst damages of the climate crisis.

To claim biomass energy is carbon neutral, biomass proponents try to discount the carbon released by biomass power plants by taking credit for the carbon absorbed by future tree growth. But there is no requirement that forests cut down for biomass energy be allowed to regrow instead of being cut again and again, and or that forests won't be developed into other land uses. In short, there is no guarantee that new forests will be allowed to grow large enough to sequester as much carbon as the older, complex, carbon-rich forests that were cut.

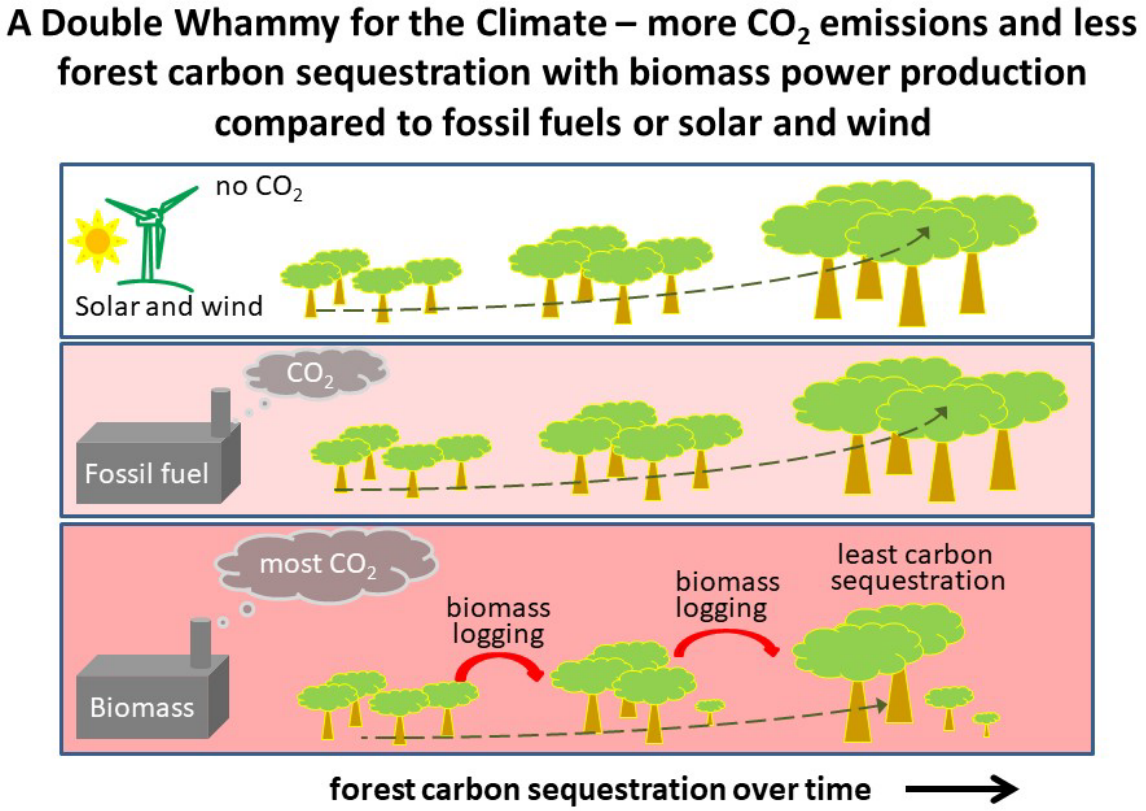
Even if trees are allowed to regrow, numerous studies show that it takes many decades to more than a century, if ever, for new trees to grow large enough to capture the carbon that was released. [6] One study concluded that the increase in atmospheric greenhouse gases may be permanent.[7] In the meantime, that carbon pollution worsens the climate crisis and contributes to the probability of surpassing climate tipping points, causing irreversible harms.

Biomass energy reduces carbon stored in forests.

Cutting trees for biomass energy reduces the forest's ability to sequester and store carbon. When trees are cut to fuel a power plant, it ends their carbon sequestration. If these trees had instead been allowed to continue growing, they would have continued to pull carbon out of the atmosphere and increased the total amount of carbon stored in the forest. Even dead trees left in the forest will continue storing much of their carbon for decades or even centuries, while also providing important wildlife habitat, and eventually becoming soil that

nourishes more forest growth. All these benefits are lost when a tree is hauled away to a biomass facility. Thus, biomass power is a double-whammy for the climate—it emits more carbon at the smokestack and it leaves less carbon stored in the forest than if the trees had not been cut.

Intact forests are a vital part of the climate solution because they pull carbon out of the air and provide long-term, natural storage.[8] Instead of cutting our natural carbon stores, we should support genuine forest protection, allowing trees to keep growing and sequestering carbon, in addition to the many other benefits that intact forests provide such as wildlife habitat, recreation, flood control, clean air and water.



Adapted from figure by Partnership for Policy Integrity

Promoting biomass energy to avoid wildfire emissions is damaging to the climate.

The bioenergy industry promotes cutting forests and incinerating forest materials for bioenergy as a way to avoid carbon emissions from forest fire. However, this claim is contradicted by scientific research and practical realities. Studies show that thinning forests to control fire actually reduces forest carbon stocks and increases overall carbon emissions.[9] Because the probability of a fire occurring on any given acre of forest is relatively low, many more acres must be thinned than will actually burn during the timeframe in which the thinning has an effect, so thinning ends up removing more carbon than would be released in a fire. One study estimated that thinning operations typically tend to remove about three times as much carbon from the forest as would be avoided in wildfire emissions.[10] Furthermore, field studies of large fires find only about 11% of forest carbon is

consumed in a fire, and only 3% of the carbon in trees,[11] and vigorous post-fire regrowth returns forests to carbon sinks within several years.[12] In contrast, when forest biomass is extracted for bioenergy production, 100% of that carbon is immediately emitted to the atmosphere.

California's current policies do not account for greenhouse gas pollution from biomass energy, undermining the state's climate goals.

Despite the high carbon emissions from biomass power, California policies avoid accounting for this greenhouse gas pollution, implicitly treating the cutting and incinerating of forests as carbon neutral. For example, California's greenhouse gas cap-and-trade program does not count bioenergy emissions when calculating the amount of carbon pollution that electricity companies are allowed to emit. California's renewable portfolio standard treats biomass energy as an eligible energy source indistinguishable from non-carbon-burning energy like solar and wind,[13] completely ignoring the fact that biomass energy is extremely carbon intensive. California's Forest Carbon Action Plan and Vegetation Treatment Program both promote biomass energy as an economic driver for forest thinning projects that remove trees from the forest. Each of these policies includes a de facto assumption that biomass energy is carbon neutral, without explicitly stating that assumption or providing any analysis of the actual carbon impacts of forest bioenergy. The reality is that incinerating trees to make electricity increases carbon pollution in the atmosphere and undermines California's ability to meet its climate goals.

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[1] California Air Resources Board, California Greenhouse Gas Emissions for 2000 to 2018, Trends of Emissions and Other Indicators (2020 Edition) at Figure 9 (GHG Intensity of Electricity Generation); *See also* California Air Resources Board, 2000-2018 Emissions Trends Repot Data (2020 Edition) at Figure 9, showing the overall GHG Intensity of Electricity Generation in 2018 of 0.22 tonnes CO_2e per MWh, which is equal to 485 pounds per MWh.

[2] Total CO_2e emissions for each facility in 2018 come from California Air Resources Board Mandatory GHG Reporting Emissions data, available at https://ww2.arb.ca.gov/mrr-data. Data on net MWh produced by each facility in 2018 come from the California Energy Commission California Biomass and Waste-To-Energy Statistics and Data, available at https://ww2.energy.ca.gov/almanac/renewables_data/biomass/index_cms.php. Total CO_2e produced by the 9 electricity-only, non-cogeneration active woody biomass facilities with available data totaled 2,127,693 metric tons, and net MWh in 2018 from these 9 facilities totaled 1,334,346 MWh, for an average of 1.59 metric tons CO_2e per net MWh, equal to 3,515 pounds CO_2e per net MWh. The average of 3,515 pounds CO_2e per MWh includes electricity-only plants; cogeneration plants are excluded because some of their CO_2 emissions are from heat-related fuel consumption.

[3] For example, the Cabin Creek bioenergy project approved by Placer County would have an emissions rate of more than 3,300 lbs CO_2/MWh. *See* Ascent Environmental, Cabin Creek Biomass Facility Project Draft Environmental Impact Report, App. D (July 27, 2012) (describing 2 MW gasification plant with estimated combustion emissions of 26,526 tonnes CO_2e per year and generating 17,520 MWh per year of electricity, resulting in emissions of 3,338 lbs CO_2e per MWh).
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[5] Overall average GHG Intensity of electricity generation in California comes from California Air Resources Board, 2000-2018 Emissions Trends Repot Data (2020 Edition); Average CO_2 emissions per MWh for gas and coal in the United States in 2019 are from U.S. Energy Information Administration, How much carbon dioxide is produced per kilowatt hour of U.S. electricity generation?
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[8] 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, doi: 10.3389/ffgc.2019.00027 (2019)
[9] Mitchell, S.R. et al., Forest fuel reduction alters fire severity and long-term carbon storage in three Pacific Northwest ecosystems, 19 Ecological Applications 643 (2009); Campbell, J.L. and A.A. Ager, Forest wildfire, fuel reduction treatment, and landscape carbon stocks: a sensitivity analysis, 121 Journal of Environmental Management 124 (2013); DellaSala, D.A. and M. Koopman, Thinning Combined with Biomass Energy Production Impacts Fire-Adapted Forests in Western United States and May Increase Greenhouse Gas Emissions, Reference Module in Earth Systems and Environmental Sciences (2016).
[10] Campbell, J.L. et al., Can fuel-reduction treatments really increase forest carbon storage in the western US by reducing future fire emissions? 10 Frontiers in Ecology and Environment 83 (2012).
[11] Campbell, J., et al., Pyrogenic carbon emission from a large wildfire in Oregon, United States, 112 Journal of Geophysical Research Biogeosciences G04014 (2007)
[12] Meigs, G., et al., Forest fire impacts on carbon uptake, storage, and emission: The role of burn severity in the Eastern Cascades, Oregon, 12 Ecosystems 8 (2009)
[13] The bill that set the RPS in 2002—AB 1078 (Sher)—deferred to the existing definition of "in-state renewable electricity generation technology" in the Public Utilities code: Cal. Pub. Utilities Code § 3.99.12(e) [def of "renewable source"]; Cal. Pub. Resources Code § 25741(a)(1) ("The facility uses biomass, solar thermal, photovoltaic, wind, geothermal, fuel cells using renewable fuels, small hydroelectric generation of 30 megawatts or less, digester gas, municipal solid waste conversion, landfill gas, ocean wave, ocean thermal, or tidal current, and any additions or enhancements to the facility using that technology.").