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 more than eight times more climate-polluting, on average, 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 (CO₂e) per megawatt hour (MWh). Woody biomass power plants in California emit more than eight times that amount, averaging nearly 4,000 pounds per MWh in 2017. Smaller-scale biomass power plants using gasification technology are similarly carbon-intensive.
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. In California, woody biomass energy generation emits about double the carbon pollution per unit of electricity of coal-fired power—and four and a half times the carbon pollution of gas-generated power. This is because burning 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. One study concluded that the increase in atmospheric greenhouse gases may be permanent. 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. 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.

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. 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. 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, and vigorous post-fire regrowth returns forests to

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**A Double Whammy for the Climate – more CO₂ emissions and less forest carbon sequestration with biomass power production compared to fossil fuels or solar and wind**

Adapted from figure by Partnership for Policy Integrity
carbon sinks within several years. 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, 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 2017, Trends of Emissions and Other Indicators, [https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf](https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/ghg_inventory_trends_00-17.pdf) at Figure 9 (GHG Intensity of Electricity Generation). See also 2000-2017 Trends Figure Data, [https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/2000_2017_ghg_inventory_trends_figures.xlsx](https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2017/2000_2017_ghg_inventory_trends_figures.xlsx) at Figure 9 showing the overall GHG intensity of Electricity Generation in 2017 of 0.22 tonnes CO₂e per MWh, which is equal to 485 pounds per MWh.

2 CO₂e emissions for each facility in 2017 come from the California Air Resources Board Mandatory GHG Reporting Emissions data, available at [https://ww2.arb.ca.gov/mrr-data](https://ww2.arb.ca.gov/mrr-data). Data on MWh produced by each facility in 2017 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](https://ww2.energy.ca.gov/almanac/renewables_data/biomass/index_cms.php). Total CO₂e produced by the 21 active woody biomass facilities with available data totaled 5,093,628 metric tons, while total net MWh in 2017 from these 21 facilities totaled 2,858,996 MWh, for an average of 1.78 metric tons CO₂e per MWh, equal to 3,928 pounds CO₂e per MWh.

3 For example, the Cabin Creek bioenergy project approved by Placer County would have an emissions rate of more than 3,300 lbs CO₂/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 CO₂e per year and generating 17,520 MWh per year of electricity, resulting in an emissions rate of 3,338 lbs CO₂e per MWh).

4 Searchinger, Timothy D. et al., Europe’s renewable energy directive poised to harm global forests, 9 Nature Communications 3741 (2018)


7 Holtsmark, Bjart, The outcome is in the assumptions: Analyzing the effects on atmospheric CO₂ levels of increased use of bioenergy from forest biomass, 5 GCB Bioenergy 467 (2012)


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.”).