

Docket No.: R.20-11-003
Exhibit No.: SC-05
Witness: Mary Booth, PhD

**BEFORE THE PUBLIC UTILITIES COMMISSION
OF THE STATE OF CALIFORNIA**

Order Instituting Rulemaking to Establish
Policies, Processes, and Rules to Ensure
Reliable Electric Service in California in the
Event of an Extreme Weather Event in 2021.

Rulemaking 20-11-003
Filed November 19, 2020

**PREPARED PHASE 2 REPLY TESTIMONY OF
MARY S. BOOTH, PH.D**

ON BEHALF OF SIERRA CLUB

SEPTEMBER 10, 2021

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1 **I. VERIFICATION**

2 **Q. Please state your name, occupation, and business address.**

3 **A.** My name is Mary S. Booth, PhD. I am the Director of the Partnership for Policy Integrity
4 (“PFPI”). My business address is 54 Arnold Rd, Pelham, MA 01002.

5 **Q. On whose behalf are you testifying?**

6 **A.** I am testifying on behalf of Sierra Club.

7 **Q. Was this material prepared by you or under your supervision?**

8 **A.** Yes, it was.

9 **Q. To the extent this material is factual in nature, do you believe it to be correct?**

10 **A.** Yes, I do.

11 **Q. To the extent this material is opinion or judgment, does it represent your best
12 judgment?**

13 **A.** Yes, it does.

14 **Q. Do you adopt this testimony as your sworn testimony in this proceeding?**

15 **A.** Yes, I do.

16 **II. SUMMARY OF TESTIMONY AND FINDINGS**

17 **Q. What are your main recommendations in this testimony?**

18 **A.** Through this testimony, I recommend that the Commission provide no additional
19 incentive or authorization for the procurement of biomass capacity from either existing or
20 new facilities.

21 **Q. Have you previously testified before the California Public Utilities Commission?**

22 **A.** Yes, I sponsored testimony on behalf of Sierra Club (Exhibit SC-02) in Phase 1 of this
23 Extreme Weather proceeding in January.

1 **Q. Could you please summarize your earlier testimony in this proceeding?**

2 **A.** Yes. In my previous testimony, I outlined the climate, public health, and air quality
3 impacts that biomass facilities produce. I also explained why the environmental and
4 public health impacts from biomass plants far outweigh the potential benefits in further
5 contracting with biomass facilities in preventing future grid emergencies due to extreme
6 weather.

7 **Q. Does your current testimony incorporate your previous testimony in this**
8 **proceeding?**

9 **A.** Yes. My previous testimony remains directly relevant to the issues before the
10 Commission in this Phase 2 of the proceeding. The potential climate, public health, and
11 air quality impacts from biomass facilities for the 2022 and 2023 summers remain as
12 dangerous as they had been in this current summer.

13 **Q. Please summarize your current testimony.**

14 **A.** In this testimony, I reiterate my concerns regarding additional contracting of biomass
15 facilities in California and also provide a direct response to the opening testimony of the
16 Green Power Institute in their Phase 2 opening testimony.

17 **III. THE COMMISSION SHOULD NOT INCLUDE BIOMASS FACILITIES IN ANY**
18 **PHASE 2 PROCUREMENT BECAUSE THE CLIMATE AND AIR QUALITY**
19 **IMPACTS ARE SO SEVERE.**

20 **Q. In Phase 2 opening testimony, the Green Power Institutes proposed contracting with**
21 **existing biomass operators for excess capacity to meet demand during both the 2022**
22 **and 2023 summers.¹ Do you agree with this recommendation?**

23 **A.** No.

¹ GPI Phase 2 Opening Testimony at 4:4-13 (Sept. 1, 2021).

1 **Q. Why not?**

2 **A.** Biomass facilities in California have high emissions of criteria and toxic pollutants per
3 megawatt-hour, they are carbon-intensive, and they are very expensive. Emission rates of
4 these pollutants exceed those from fossil fuel plants in most cases.

5 **Q. Please summarize the criteria pollutant emissions from biomass facilities.**

6 **A.** As I described in Phase 1 testimony,² biomass facilities have very high emissions factors,
7 meaning that they emit large amounts of pollutants per megawatt-hour of generation.
8 Even the cleanest-operating biomass plant emits more criteria pollutants than a typical
9 coal plant of the same size, emitting over 150% the nitrogen oxides, over 600% the
10 volatile organic compounds, over 190% the particulate matter, and over 125% the carbon
11 monoxide per megawatt-hour.³ Emissions from a biomass plant can exceed those from a
12 natural gas fired power plant by more than 800% for every major pollutant.⁴ This is
13 because, compared to fossil fuels, biomass fuels are carbon-rich, but not energy-rich.⁵
14 Additionally, biomass plants tend to be much less efficient than gas and coal-fired plants,
15 in part because biomass fuels tend to have far more water content to burn off to produce
16 “useful” energy.⁶

17 **Q. Are those numbers representative of California biomass plants?**

18 **A.** Yes, I believe so. The Commission noted the intense emissions factors for biomass
19 facilities in the Integrated Resource Planning (“IRP”) proceeding. There, Commission
20 staff recently improved on previous iterations of criteria emissions modeling by including

² Phase 1 Exhibit SC-02, Prepared Reply Testimony of Mary S. Booth, Ph.D on Behalf of Sierra Club (Jan. 19, 2021) at 3:19-5:16.

³ Phase 1 Exhibit SC-02-B. Mary S. Booth, *Trees, Trash, and Toxics: How Biomass Energy Has Become the New Coal*, Partnership for Policy Integrity, at 5 (Apr. 2, 2014) [hereinafter “Biomass is the New Coal”].

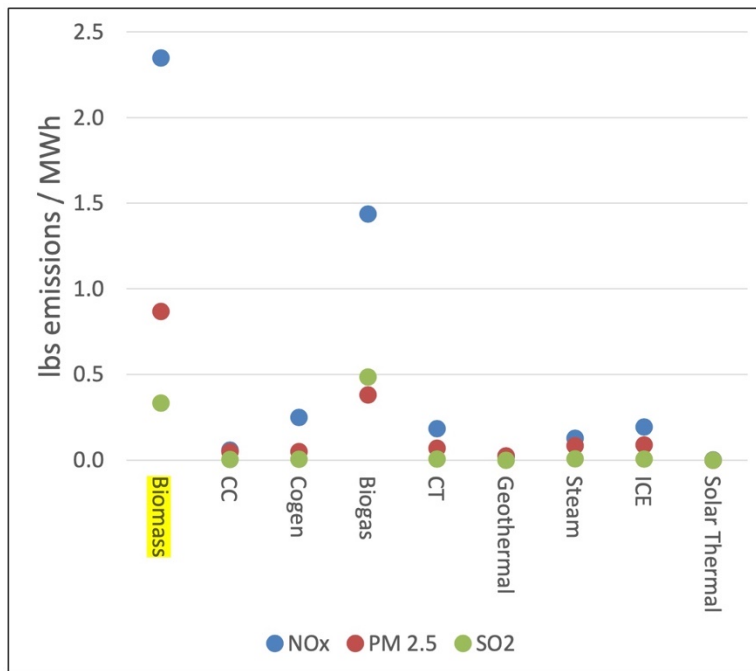
⁴ *Id.*

⁵ *Id.* at 16.

⁶ Typical moisture content for green wood chips, a very common fuel for bioenergy facilities, is around 45%, meaning by weight, the fuel is almost one-half water.

1 biomass facilities in its analysis.⁷ Commission staff cited that biomass plants have high
2 total emissions due to high emissions factors for nitrogen oxides, fine particulate matter,
3 and sulfur oxides.⁸ The table below shows the modeled emissions factors for each
4 resource type modeled in the Commission’s Updated Criteria Pollutant Analysis.⁹

5 **Figure 1: Modeled emissions factors, lbs/MWh, by resource type from CPUC Updated**
6 **Criteria Pollutant Analysis¹⁰**



7
8 Comparing the average biomass facility’s emissions factors against the average
9 California combustion turbine gas plant, a biomass facility would produce nearly 13
10 times the NOx emissions, just over 12 times the PM_{2.5} emissions, and over 49 times the
11 SO₂ emissions that the gas plant would produce for the same quantity of energy
12 generation.¹¹ Those emissions have harmful impacts on human health.

⁷ Energy Division, Updated Criteria Pollutant Analysis at Slide 3 (Feb. 20, 2020), *available at* <https://www.cpuc.ca.gov/General.aspx?id=6442459770> [hereinafter “Updated Criteria Pollutant Analysis”].

⁸ *Id.* at Slides 6-7.

⁹ *Id.* at Slide 7.

¹⁰ *Id.*

¹¹ Using the emissions factors used by the Commission to in its Updated Criteria Pollutant Analysis (*see* slide 17), the biomass emissions factor divided by the combustion turbine emissions factor result in the

1 **Q. Please summarize the carbon-intensity of biomass facilities.**

2 **A.** Biomass power plants generate enormous quantities of greenhouse gas emissions. On
 3 average, a plant burning wood chips will emit nearly 50 percent more carbon dioxide per
 4 megawatt-hour of electricity than a coal plant.¹² Some of these emissions can
 5 theoretically be offset by regrowth of trees, or, if fuel is sourced from forestry residues
 6 that would have decomposed and emitted CO₂, the emissions can be treated as if they
 7 would have occurred anyway if the fuel had been left in the forest. However, there are
 8 numerous scientific studies that show that cumulative CO₂ emissions from a biomass
 9 plant can exceed emissions from a fossil fuel-burning plant for several decades.¹³ This
 10 extra CO₂ warms the atmosphere just as effectively as CO₂ derived from burning fossil
 11 fuels.

12 **Figure 2: Biomass power plants emit more CO₂ than coal or gas plants¹⁴**

Technology	Fuel CO₂ emissions (lb/MMBtu heat input)	Facility efficiency	MMBtu required to produce one MWh	Lb CO₂ emitted per MWh
Gas combined cycle	117.1	45%	7.54	883
Gas steam turbine	117.1	33%	10.40	1,218
Coal steam turbine	206	34%	10.15	2,086
Biomass steam turbine	213	24%	14.22	3,029

13

following calculations: Biomass average NOx emissions factor (2.3482 lbs/MWh) divided by CT average NOx emissions factor (0.1835 lbs/MWh) yields 12.797 times the NOx emissions. Biomass average PM_{2.5} emissions factor (0.8684 lbs/MWh) divided by CT average PM_{2.5} emissions factor (0.0701 lbs/MWh) yields 12.388 times the PM_{2.5} emissions. Biomass average SO₂ factor (0.3340 lbs/MWh) divided by CT average SO₂ factor (0.0068 lbs/MWh) yields 49.118 times the SO₂ emissions.

¹² Phase 1 Ex. SC-02-B at 5.

¹³ See Tara W. Hudiburg et al., *Regional carbon dioxide implications of forest bioenergy production*, Vol. 1 Nature Climate Change 419 (2011), available at <http://dx.doi.org/10.1038/nclimate1264>; Jérôme Laganière et al., *Range and uncertainties in estimating delays in greenhouse gas mitigation potential of forest bioenergy sourced from Canadian forests*, Vol. 9 GCB Bioenergy 358 (2017), available at <http://dx.doi.org/10.1111/gcbb.12327>; Dominick A DellaSala and M. Koopman, *Thinning Combined With Biomass Energy Production May Increase, Rather Than Reduce, Greenhouse Gas Emissions*, Geos Institute (2015), available at http://www.energyjustice.net/files/biomass/library/biomass_thinning_study.pdf.

¹⁴ Phase 1 Ex. SC-02 at 3:7-8 (internal citations omitted).

1 **Q. Are there any other types of emissions from biomass power plants?**

2 **A.** Yes, in addition to greenhouse gases and criteria pollutants, biomass facilities emit
3 hazardous materials, including dioxins, lead, arsenic, mercury, and even emerging
4 contaminants like phthalates.¹⁵ All of these are dangerous to human health.

5 **Q. Please describe why you say that biomass facilities are very expensive.**

6 **A.** California’s biomass facilities are very expensive, as evident from the Commission’s
7 BioMAT program. In 2018, the Commission produced a report on the program due to the
8 very small number of facilities participating in the program.¹⁶ The report noted that the
9 costs of procuring biomass energy remain high compared to other resources, including
10 \$187.72/MWh for dairy and other agricultural biogas BioMAT projects and
11 \$199.72/MWh for “sustainable forest” BioMAT projects.¹⁷ These prices are higher than
12 the market price for energy at nearly all hours. In the past year, the CAISO 15-minute
13 hour-ahead locational marginal pricing for the NP-15 node cleared \$199.72/MWh for
14 only a total of 70 hours (about 0.8 percent of the year), primarily only during peak load
15 conditions on extremely hot days.¹⁸ These prices also far exceed the average costs for
16 non-emitting alternatives, such as wind, solar, and hydro.

17 **Q. Would these limited hours of peak pricing be sufficient to sustain mothballed**
18 **biomass plants or biomass plants with expiring contracts?**

19 **A.** It is unclear whether these limited hours would provide sufficient incentive for biomass
20 facilities to provide the additional capacity of these resources during peak load
21 conditions. GPI’s opening testimony suggested that biomass facilities with expiring
22 contracts and mothballed plants would “probably need baseload energy contracts of some

¹⁵ Phase 1 Ex. SC-02-B at 6.

¹⁶ California Public Utilities Commission, Draft BioMAT Program Review and Staff Proposal, at 7-8 (Oct. 30, 2018), *available at* https://www.cpuc.ca.gov/sb_1122/ (noting that less than five unaffiliated applicants are in the statewide queue for each BioMAT category and only 22 contracts signed for 33 MW of capacity, or 13% of the 250 MW BioMAT procurement goal).

¹⁷ *Id.* at 8.

¹⁸ S&P Capital IQ CAISO Power NP-15 Data, 15 minute hour ahead Locational Marginal Pricing (“LMP”) from Sept. 8, 2020 through Sept. 8, 2021 showed a total of 70 hours during which the 15 minute hour ahead LMP exceeded \$199.72/MWh.

1 sort in order to participate.”¹⁹ Outside of the economics of that decision for any given
2 plants, the intense environmental and public health impacts of these plants further
3 deteriorate their value proposition.

4 **Q. Do you recommend that the Commission consider authorizing purchase contracts**
5 **for additional biomass capacity at prices similar to those seen in the BioMAT**
6 **proceeding?**

7 **A.** Absolutely not. Because of the high cost of biomass energy plus the environmental and
8 public health impacts of these plants, I recommend that the Commission require load-
9 serving entities to pursue cleaner alternatives to meet peak demand in the next two years.

10 **Q. GPI states that “State policy clearly favors the production of biomass power in**
11 **order to obtain these services for the people of California.” Do you agree with that**
12 **statement?**

13 **A.** No, not at all. As I mentioned in my Phase 1 testimony, California’s policy favoring
14 biomass energy is limited and under review. For example, the Commission manages the
15 BioMAT program, which is a specific procurement mandate to provide procurement
16 contracts for a small number of biomass facilities. In 2018, the Commission produced a
17 report on the program due to the very small number of facilities participating in the
18 program.²⁰ The report noted that biomass energy remains far higher than other
19 resources.²¹

20 **Q. Does this conclude your testimony?**

21 **A.** Yes.

¹⁹ GPI Phase 2 Opening Testimony at 5:32-6:1.

²⁰ Draft BioMAT Program Review and Staff Proposal, at 7-8.

²¹ *Id.* at 8.