



August 21, 2023

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Cc: Matthew Marshall, Richard Engel

Dear RCEA Board Members,

The three undersigned members of the Biomass Technical Advisory Group submitted a slightly revised version of the attached analysis of the Humboldt Sawmill contract to RCEA staff and other BTAG members and to the CAC.

We are concerned that RCEA staff are pressing you to move ahead with actions which further lock in commitments to continued greenhouse gas emissions of 295,000 metric tons a year and many times more pollutants and toxic contaminants than produced by the Humboldt Bay Generating Station. You have two advisory bodies that you need to hear from before making decisions that go contrary to your Board's desire to learn about alternative uses of the biomass currently combusted by this antiquated biomass power plant. First the BTAG and second the CAC. The BTAG has not yet met. You have received requests from the CAC to be provided much

more information, especially about the air pollution the plant produces and past and present violations of air quality standards. [The documents Humboldt Sawmill submitted in June noted over twice the allowable emission of particulate matter in one boiler a year ago and a second also exceeded the standard.]

The RCEA staff is continuing to try to get the Humboldt Sawmill plant locked in to the RCEA power procurement portfolio while brushing aside climate and health concerns. We request that you deny the staff recommendation 8.2 on the agenda for August 24<sup>th</sup> or table it until you have final reports from the CAC and the BTAG. In the meantime, we hope you will consider the attached comments. At the least, they will help you formulate questions we hope you will ask the North Coast Unified Air Quality Management District, Humboldt Sawmill Company, and RCEA staff. And we recommend that RCEA contract with a nationally recognized air quality expert to explain the hazards of the Humboldt Sawmill's emissions, both those which are permitted and the effects of the multiple violations of existing standards.

Thank you for giving us the opportunity to present this information to you.

Sincerely,

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## A betrayal of public trust

The Redwood Coast Energy Authority has taken many actions to make Humboldt County a leader in the transition to clean renewable energy. The prize-winning micro-grid at the airport, the two large long-term solar contracts, and the new 17MW battery storage at the old Fairhaven plant are clear examples. RCEA has also led the effort to get floating offshore wind. At the same time, it has foisted onto the public biomass power, an inefficient, polluting and greenhouse gas-intensive anomaly – the flaw in the diamond.



In 2019 the Arcata City Council, the Eureka City Council, the Humboldt County Board of Supervisors, and the Redwood Coast Energy Authority each passed a resolution – proposed by 350 Humboldt – committing to use only “clean, renewable” energy starting in 2025. All of those public officials believed that this would be possible. It would have meant eliminating biomass power when the current contract expired. Instead, in 2021 RCEA proposed to the RCEA Board that a ten-year contract with Humboldt Sawmill Company (HSC)<sup>1</sup> provide biomass electricity through 2031. Not only did RCEA go back on its commitment to clean, renewable energy by 2025, but by doing so they violated their trust with customers and voters.

There are several key facts that support this view. They are stated here and documented in the body of our comments.

- The ten-year contract was not required. Richard Engel stated in the RCEA Board meeting that the state’s requirement for long-term renewable energy could have been achieved by adding more solar power.
- The HSC electricity thus replaced energy that is actually clean and renewable.
- The reason the state allows biomass power to be called “renewable” is that if the wood burned is replaced from sustainable forests the carbon cycle will sequester the CO<sub>2</sub> that is released by burning the biomass. However, it is not renewable in a way that will help mitigate the climate crisis in the timeframe needed. Reductions in emissions are most critical between now and 2030 according to the Intergovernmental Panel on Climate Change and have to be at net zero by 2050. Emissions from burning biomass to make electricity will not be paid back by CO<sub>2</sub> uptake for many years after those dates, if at all. In essence, burning biomass creates a carbon debt that cannot be repaid within the time limits the climate crisis requires. There are lucrative alternative uses for biomass that the Humboldt Sawmill Company (HSC) can adopt that have far lower greenhouse gas emissions and far less air pollution.
- In the context of the energy revolution, “clean” energy means both a) it produces only very small amounts of greenhouse gases, and b) it does not produce the air pollution associated with fossil fuels, which cause seven million premature deaths a year around the world.<sup>2</sup> It seems very clear that the government entities that signed the resolution committing to clean, renewable energy by 2025 could not have intended it to mean emitting annually as much greenhouse gases as 75% of our passenger vehicles<sup>3</sup> and

emitting more particulate matter and other “criteria pollutants” than coal would for an equivalent amount of electricity produced.

- Not only does HSC produce massive amounts of air pollution in the normal course of its operation, but it has also violated the Clean Air Act and other public health regulations multiple times. Again, HSC biopower cannot be considered “clean” renewable energy.

As a response to this betrayal of public trust we propose the RCEA Board take three actions:

Recommendation 1: No other biomass shall be contracted for beyond the HSC contract.

Recommendation 2: The HSC contract shall not be extended.

Recommendation 3: Due to the numerous air quality violations of HSC, the HSC contract should be cancelled as soon as the long-term renewable energy that it provides in the RCEA portfolio can be replaced by additive solar or wind.

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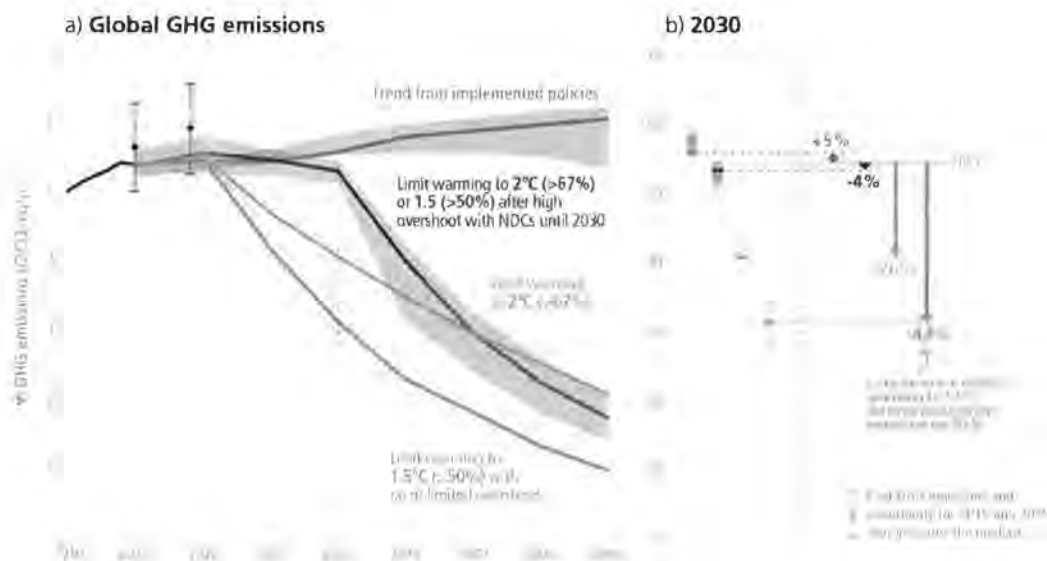


The greenhouse gas emissions from Humboldt Sawmill must be eliminated before 2030 because the next seven years are the most crucial humanity and other living things have ever faced.

Climate scientists have calculated how much more CO<sub>2</sub>e (CO<sub>2</sub> or its equivalent in warming potential from another gas like methane or nitrous oxide) can be emitted without committing the earth to more than 1.5°C (2.7°F) warming. That is to say, they have calculated a carbon “budget” that is compatible with 1.5°C. If we exceed this emissions budget, warming will exceed 1.5°C.

The graph below from the 2022 IPCC AR6 report shows different warming trajectories depending on how much we cut emissions. The red line at the top indicates an increase of emissions of 5%, which is where we are with current implementation of the pledges all countries have made. The possible trajectories on the left are translated into how large a reduction there would have to be to achieve 2°C or 1.5°C. If we only reduce 4% by 2030, we will have a very steep reduction after 2030 and still only be able to limit warming to 2°C (unless we pull huge amounts of CO<sub>2</sub> out of the atmosphere). To limit warming to 1.5°C the world must cut emissions by 43% before 2030. Climate scientists have found that every one year of delay before the world reverses the growth of emissions reduces by two years the time we have to

**Figure 1: Projected global GHG emissions from NDCs announced prior to COP26 would make it likely that warming will exceed 1.5°C and also make it harder after 2030 to limit warming to below 2°C.**



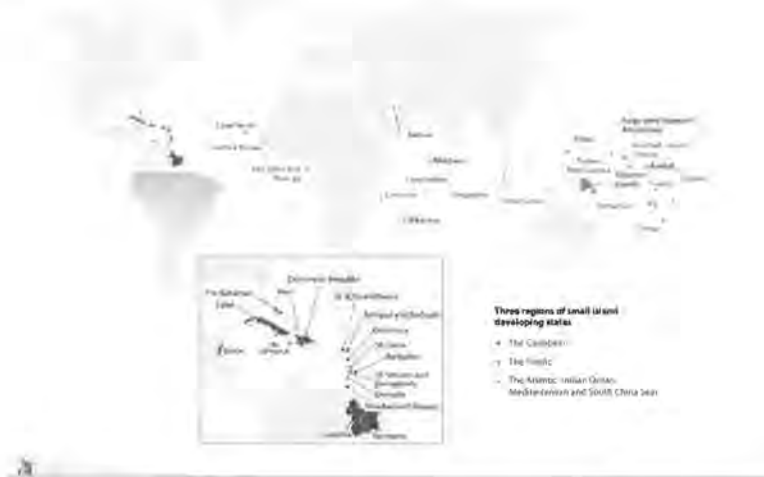
reach net zero at or below 1.5°C.<sup>4</sup>

Why is 1.5°C the IPCC's standard?

The IPCC has determined we must meet 1.5°C in order avoid potentially disastrous consequences.<sup>5</sup> What are these consequences?

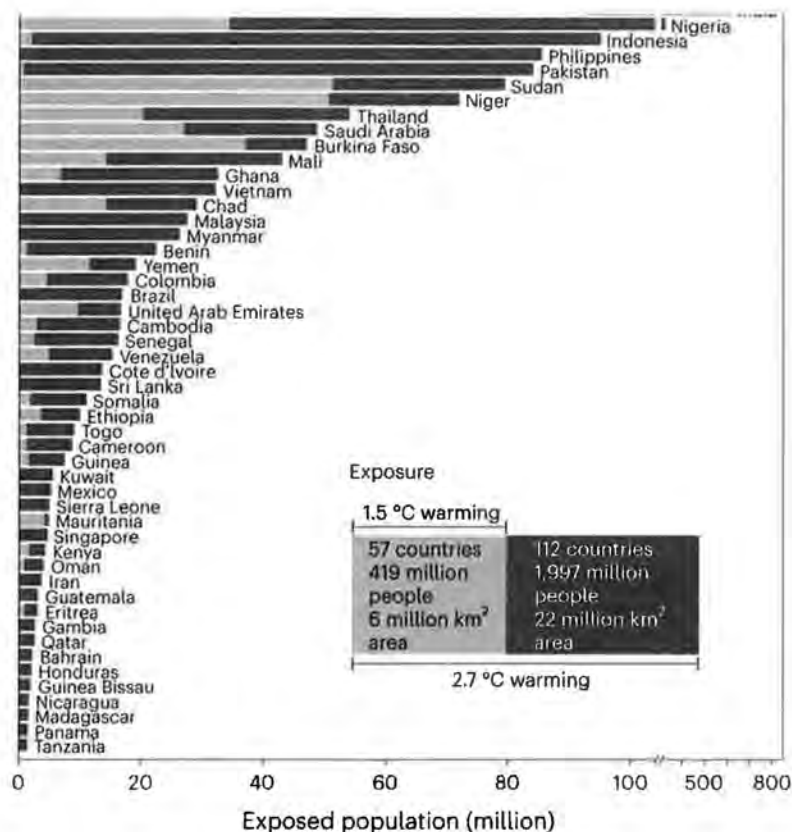
- We lose our island nations.<sup>6</sup>

Figure 2.



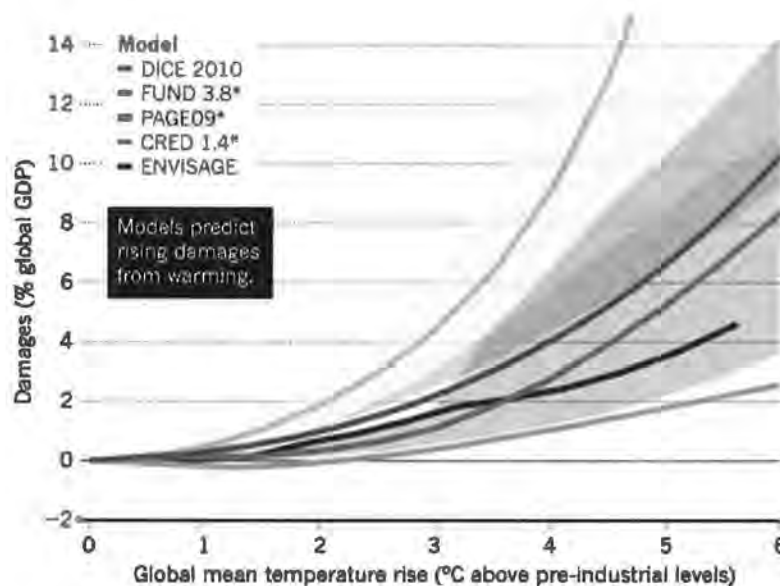
- If we continue on our current trajectory to 2.7°C, the number of people who will be living outside of the human-survivable climate niche of average temperatures of 12.7° to 27.2°C. (55° to 81°F.) will almost quadruple over a 1.5°C. increase: from 419 million to two billion people. That is, a billion and a half more people in an additional 55 countries will be living at average temperatures over 81°F. Please see the graph below.<sup>7</sup> Dark bars are the increase over 1.5°C.

Figure 3.



- We increase the likelihood of passing “tipping points.” Melting of the permafrost is already irreversible and two other tipping points may have already occurred. Such events are increasingly likely when warming over preindustrial times exceeds 1.5°C.<sup>8</sup>
  - Melting of the Greenland Ice Sheet
  - Melting of Arctic Sea Ice
  - Melting of the West Antarctic ice sheet
  - Melting and thawing of East Antarctic sub-glacial basins
  - Melting East Antarctic ice sheet
  - Shifting of the North Atlantic sub-polar gyre / Labrador Sea convection
  - Changes in the Atlantic meridional overturning circulation
  - Death of boreal forests
  - Extinction of low-latitude coral reefs
  - The end of the Amazon rainforest’s ability to sequester carbon
  - Massive CO<sub>2</sub> and methane releases from melting permafrost – already passed the tipping point
- Climate models show damage from global warming increases at a much faster rate than warming; some climate models show a near exponential rate.<sup>9</sup>

**Figure 4.**



This disproportionality has at least two consequences:

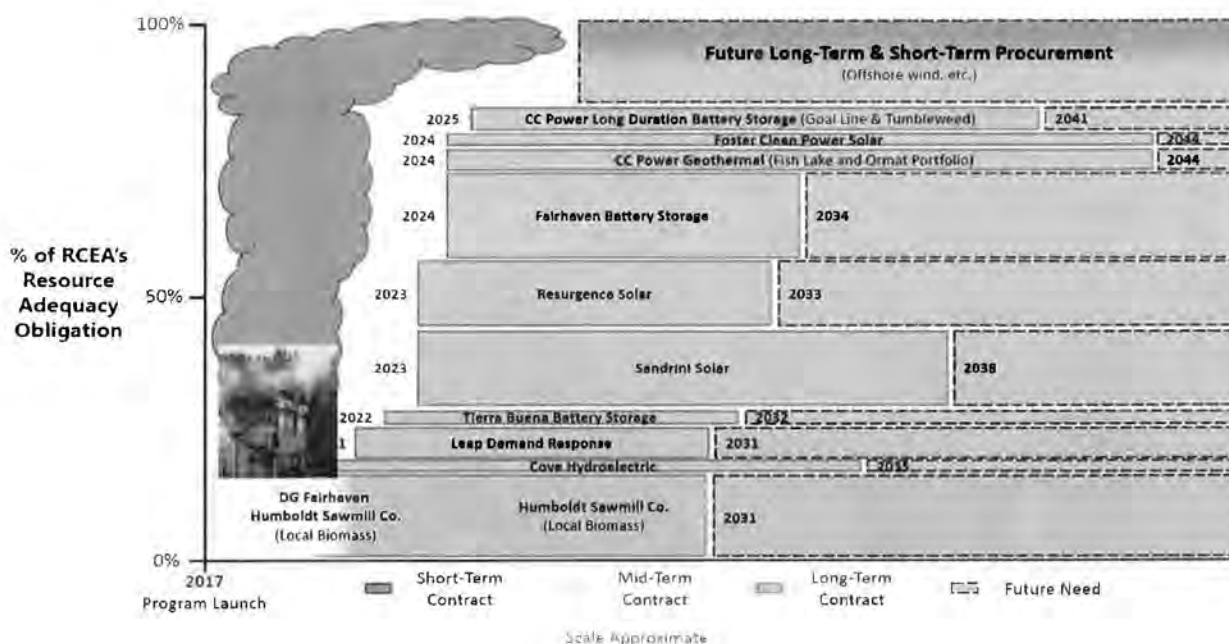
- a) We must frontload our major efforts for climate mitigation, not push them off past 2030; and,
- b) If we don't act rapidly, paying for adaptation and reconstruction after climate disasters is going to take up more and more of our resources leaving far too little for mitigation. The Bezos 10 billion dollar Earth Fund CEO, Andrew Steer, warned in a May interview: “This is the decisive decade....if we don't get it right this

decade, actually next decade it will be impossibly expensive to do anything and will quite frankly be too late.”<sup>10</sup>

How do RCEA’s resource procurement plans align with the need to drastically (at least 43%<sup>11</sup>) reduce emissions by 2030?

RCEA recently held two community workshops on their projections of sources of energy for 2030 and later. From the report used for the workshops<sup>12</sup> we find this illustration of how RCEA plans to provide adequate resources (we have added the likely source of the peculiar cloud running up the side of the graph).

**Figure 5. RCEA Resource Adequacy Timeline**



The text says: “RCEA has set out to provide our customers with 100% renewable and carbon-free energy by 2025 and 100% local renewable energy by 2030. Specifically, our Strategic Plan states that ‘By 2030 Humboldt County will be a net exporter of renewable electricity and RCEA’s power mix will consist of 100% local, net-zero-carbon- emission renewable sources.’”

That is, RCEA uses some misleading phrasing to avoid saying that they will continue to use the highly polluting Humboldt sawmill through at least 2030. They do this by relying on the word “renewable” and putting it in the same sentence as “carbon free.” While some forms of renewable energy, like solar, are almost carbon free, “renewable” itself has no implications for carbon intensity, certainly not in the timeframe of 2030 or even 2050. See page 10 below.

When RCEA staff asked the RCEA Board to approve a new ten-year contract, this is the rationale they gave:



If RCEA does not extend its contract with HSC, we will need to seek other means of ensuring SB 350 compliance. This will likely involve issuing a new solicitation for long-term renewable energy that can begin delivering within the next few years. Given our strategic goal of procuring 100% of our energy from local, renewable resources by 2030, and the long lead times for developing new renewable energy projects, it is unlikely that a solicitation issued by RCEA this year would lead to a new local project coming online in time to ensure SB 350 compliance by at least a 10% margin. *The most likely outcome would be a contract for an existing renewable energy project outside of Humboldt County, constituting a missed opportunity for RCEA to pursue its strategic local energy development goal.*<sup>13</sup> [Our italics.]

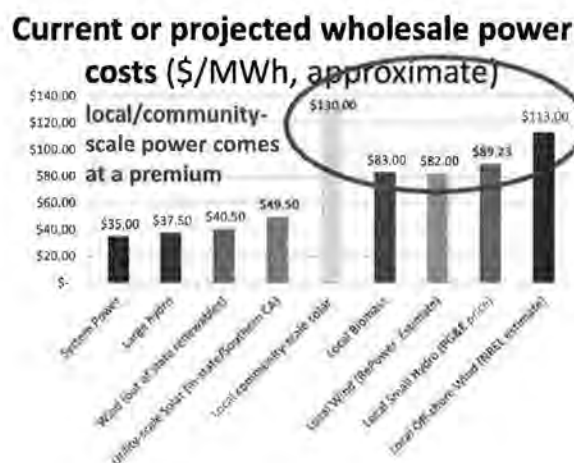
In short, the staff admit that compliance with the state's requirement for a source of long-term renewable energy could be met with clean renewable energy from outside Humboldt, which means the biomass plant is supplanting solar in the supply of long-term renewable energy.

The answer to the question of how RCEA's plans line up with the need to reduce emissions drastically by 2030, is that despite being able to meet long-term procurement standards with solar, RCEA plans to continue to put 295,000 metric tons of CO<sub>2</sub>e into the environment annually from biomass power. That is approximately two million metric tons of warming emissions, before 2031.

Does it matter that biomass power is "local?"

RCEA staff have always made a point of saying the Board wanted our power to be local. Strikingly, in the new 2023 report the staff have backed off this notion of local procurement. They point out that procuring local renewable energy is often incompatible with other state requirements. Only when floating offshore wind comes on-line would the predominance of "local" actually be achievable.<sup>14</sup> The graph below is from a 2017 RCEA presentation and shows that the commitment to "local" procurement cost us a lot of money when the preference for local power was adopted. The preference for "local" was a political choice that made limited sense in 2017 and that RCEA administrators have found not to be workable in any case.

**Figure 6.**



In 2020 biomass accounted for roughly \$15 million a year, by far the biggest among local RCEA expenditures. In fact, in 2020, 96% of local payments went to biomass. Please see the table of local expenditures below. It almost looks as if the purpose of RCEA is to keep biomass power afloat.

**Figure 7.**

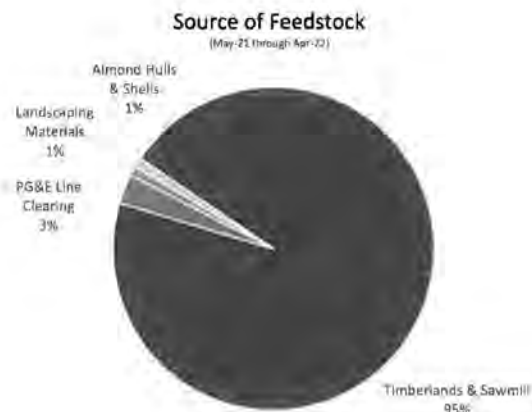
Expense Category	Sum of 2020 Spend
Power Purchase - Biomass	\$ 14,941,751.87
Professional Services	\$ 369,124.40
Net Energy Metering customer payouts	\$ 115,442.80
RCEA facility costs	\$ 86,972.05
Electric Bike incentives	\$ 41,350.00
Electric Vehicle Charging Network	\$ 31,222.24
Supplies	\$ 31,050.55
Outreach	\$ 7,861.87
<b>Grand Total</b>	<b>\$ 15,624,775.78</b>

Although RCEA staff say the price paid Humboldt Sawmill is now competitive, the base price actually has only been reduced from \$83 per MWh in 2017 to \$63 in the 2021 Power Purchase Agreement and if demand increases, there is an \$11 per MWh bonus. We don't know what RCEA is paying for the Sandrini utility-scale solar because it is redacted from the Power Purchase Agreement available to the public, but it is likely about \$20 per MWhour.<sup>15</sup> So replacing biomass with solar would have given RCEA roughly \$10 million more to spend on local incentives and assistance in meeting the goals of our Climate Action Plan.<sup>16</sup>

Does Humboldt Sawmill burn mill waste or forest residues? Answer: Both

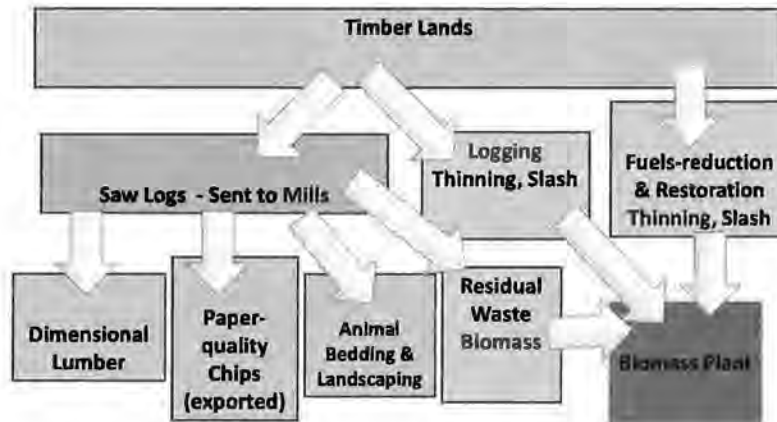
Since 2019 we have heard that Humboldt Sawmill burns "mill waste." This is potentially important because some of the greenhouse gas emissions attributable to forest residues may not accrue to mill waste. In general, about half of a sawlog becomes residue at a sawmill, some of which is made into useful products; about 15% to 20% is waste that must be disposed of.<sup>17</sup> Here is a graph that was supplied to the Technical Advisory Group in June 2023 by Humboldt Sawmill. It shows that a combination of forest residues ("timberlands") and mill waste make up 95% of the feedstock in 2022.

**Figure 8.**



Although no proportions between forest residues and mill waste have been supplied by Humboldt Sawmill, a presentation to the RCEA Board at the time the 2017 Power Purchase Agreement was signed makes it very clear that both mill waste and forest residues (slash) plus fuel load reduction make up the feedstock for the biomass power plant.<sup>18</sup> The amount of biomass used for biopower in April 2022 – May 2023 was 191,624 tons.<sup>19</sup> However, we need HSC to specify the current proportions of mill waste, forest residues and fuel load reduction.

**Figure 9.**



Why burning biomass for electricity is not carbon-free and being “renewable” will not help us by 2030 or 2045

California classifies biomass power as “renewable” and the CPUC echoes the outdated idea that it is not carbon intensive – although perhaps not for long.<sup>20</sup> California policymakers lag the science on this issue because, although renewable in theory, scientists find that biomass power is carbon intensive in a 50 to 100-year time frame, and much more intensive in the IPCC’s 2030 – 2050 time frame.

Mary S. Booth wrote in 2018:

[O]n one aspect of bioenergy carbon accounting there is wide agreement: that when biomass is sourced from residues from forestry, wood products manufacturing, or agriculture, net carbon emissions are properly assessed as the difference between emissions from their use as fuel (which can include emissions from fuel manufacturing and transport), and emissions from an alternative fate, such as leaving material on-site to decompose or burning it without energy recovery. Studies using this approach generally conclude net bioenergy emissions are not zero over varying periods of time. Nonetheless, many policies still treat bioenergy as having zero or negligible emissions.<sup>21</sup>

Kevin Fingerma’s research at Cal Poly Humboldt on the greenhouse gas emissions of California biopower is an excellent example of the approach which compares biopower to alternative uses of forest residues or fuel load reduction. This information is from the peer-reviewed 2023 overview article presenting his research.<sup>22</sup>

“[Recent] literature has called this assumption [biomass carbon neutrality] into question, pointing out that near-term emissions lead to increased climate forcing over policy-relevant time frames even if it is assumed that the CO<sub>2</sub> emitted is eventually re-sequestered in forest regrowth or, as in the case of residues, would have been emitted later by decay or wildfire.” [Specifically,] “We find that the life cycle ‘carbon footprint’ of biopower from woody residues generated by recent forest treatments in California ranges widely—from comparable with solar photovoltaic on the low end to comparable with natural gas on the high end.”

This research focuses on forest treatments for fuel load reduction and shows that burning woody biomass for power is carbon intensive, not carbon neutral or negative *over a 100 year period*. In the aggregate, the only alternative that produces more greenhouse gases in the 100 years than biopower in Fingerman’s and other models is burning the forest residues on site.<sup>23</sup>

An analysis of bioenergy in Oregon found:

Wood bioenergy production is interpreted as being carbon-neutral by assuming that trees regrow to replace those that burned. However, this does not account for reduced forest carbon stocks that took decades to centuries to sequester, degraded productive capacity, emissions from transportation and the production process, and biogenic/direct emissions at the facility....[In this study] utilizing harvest residues for bioenergy production instead of leaving them in forests to decompose increased emissions in the short-term (50 y).<sup>24</sup>

Fingerman’s model is designed to consider multiple variables, including those specific to local sites all over California. Other models are more general. John D. Sterman, a MIT professor, says: “A molecule of CO<sub>2</sub> emitted today has the same impact on radiative forcing whether it comes from coal or biomass.... Assuming biofuels are carbon neutral may worsen irreversible impacts of climate change before benefits accrue.” For forest thinning, he calculates that after 100 years 62% of the carbon debt caused by burning the biomass for electricity is unrecovered. “Because combustion and processing efficiencies for wood are less than coal, the immediate impact of substituting wood for coal is an increase in atmospheric CO<sub>2</sub> relative to coal. The payback time for this carbon debt ranges from 44 –104 years after clearcut, depending on forest type—assuming the land remains forest.”<sup>25</sup>

And Laganier finds, looking only at the emissions from biomass power that exceed those from natural gas, that the carbon debt for burning forest waste for electricity is not made up within 100 years.<sup>26</sup> In contrast the early, less sophisticated, Manomet study found it only took 35 years for the excess emissions over natural gas to be made up.<sup>27</sup> These sources, and there are many others,<sup>28</sup> indicate that burning biomass is not carbon neutral within a climate-policy relevant time frame. Yet in Humboldt we are talking about a “carbon debt” of 2 million metric tons from burning biomass in the next eight years of the Humboldt Sawmill contract that, impossibly, would have to be paid back by 2030 or at latest 2045.<sup>29</sup>

Exactly how carbon intensive the Humboldt Sawmill plant is can only be determined by a Life Cycle Assessment of this particular plant. There are numerous variables that affect such an analysis including those relating to harvest of the timber or thinning of fuel load, transportation, storage of materials, sustainability of the forestry, and the efficiency of the



plant. A potentially large, but unmeasured, factor is the amount of methane produced during storage of the wood chips and sawdust.<sup>30</sup> 350 Humboldt first asked RCEA to conduct such a study in 2019 and 350 Humboldt members have requested it at other points in time, to no avail.

A number of political entities have reversed their policies on biomass recently.

Biomass power in California is subsidized and supported by the government in multiple ways: by requiring investor-owned utilities to buy 125 megawatts of biopower; by the bioMAT program for small biopower facilities; by the CPUC exempting biopower from greenhouse gas requirements; and by including biomass power in the Renewable Portfolio Standard. All of these policies are holdovers from when it was assumed bioenergy to be carbon neutral. In other places, these government supports have started to be challenged and eliminated.

- In 2022 Massachusetts passed *An Act Driving Clean Energy and Offshore Wind*, which will expand clean energy development and end renewable energy subsidies for wood-burning power plants. The new law also makes Massachusetts the first state in the nation to remove woody biomass from its Renewable Energy Portfolio Standard.<sup>31</sup>
- The Australian Government has acted to exclude electricity generated from burning native forest wood waste from eligibility under the Renewable Energy Target.<sup>32</sup>
- In 2021 five hundred environmental scientists from around the world wrote an open letter to President Biden, the European Council, and Japan and South Korea opposing the use of biomass electricity generation. The letter said, “Regrowing trees and displacement of fossil fuels may eventually pay off this carbon debt, but regrowth takes time the world does not have to solve climate change. As numerous studies have shown, this burning of wood will increase warming for decades to centuries. That is true even when the wood replaces coal, oil or natural gas.” It called for governments, including the United States, to “end subsidies and other incentives that today exist for the burning of wood whether from their forests or others.”<sup>33</sup>
- In March of 2023 the Hawaiian Supreme Court unanimously turned down an appeal from a biomass power plant owner whose application for a license had been denied by the Hawaiian public utilities commission. The grounds for the denial were the high CO2 emissions (8 million tons over 30 years) and the added costs to electricity consumers.

Humboldt Sawmill emits large amounts of CO2e and much more per kilowatt hour than natural gas.

We have been considering whether emissions from biomass electricity can be considered to be carbon neutral or negative. Since that is not the case in any time frame that is relevant to the climate crisis, we need to compare the biomass emissions with those of other sources of electricity. Figure 10 shows that using the IPCC carbon intensity values, burning biomass for power is far less efficient and far more carbon intensive than either coal or natural gas.



**Figure 10. CO2 emissions for biopower, coal and gas<sup>34</sup>**

Fuel	IPCC data on CO2 per mmbtu	Power plant efficiency	mmbtu/ MWh	kg CO2/MWh	lb CO2/MWh	Wood % greater than fossil fuels
Wood and Wood Residuals at 22.7% effic.	93.8	0.227	3.143	1,299	2,863	
Anthracite coal at 34% effic.	103.69	0.341	3.143	956	2,107	36%
Bituminous coal at 34% effic.	93.28	0.341	3.143	860	1,895	51%
Natural gas at 45.5% effic.	52.07	0.455	3.143	360	793	261%
Natural gas at 63% effic.	52.07	0.63	3.143	260	573	400%

Both biomass power and natural gas power have far more greenhouse gas emissions than the other renewable and carbon free sources in RCEA's resource plan (Figure 5). However, when compared to the natural gas-fired Humboldt Bay Generating Station, HSC 2020 greenhouse gas emissions are 30% greater for the biomass plant despite the fact that Humboldt Sawmill produced only 27% as much power (130,427 vs 484,333 megawatt hours).<sup>35</sup> That translates to 2.27 tons of CO2e for Humboldt Sawmill per megawatt hour vs. 0.47 for the Humboldt Bay Generating station. It is true these local figures omit upstream emissions for both natural gas and biopower, but they are a small proportion of the total emissions locally.<sup>36</sup> The local data accurately represent the contributions specific to Humboldt County. As Sterman noted, biomass power creates more CO2 in the present than even coal and "payback" times go well beyond 2050.

How do biomass power plants get away with emitting so much CO2? In a 2007 rulemaking, the California Public Utilities Commission set an Emissions Performance Standard (EPS) for all Load Serving Entities (LSEs) at 1,100 pounds (lbs) of carbon dioxide (CO2) per megawatt hour (MWh) but exempted many biomass power plants.<sup>37</sup> However, biomass plants were exempted on an "interim" basis.

Here are the pounds per MWh for Humboldt Sawmill Company in Scotia, which has existed since 1989 and uses the oldest least efficient technology (Stoker)<sup>38</sup>

- MWh for HSC in 2021: 125,537
- CO2e for HSC in 2020: 295,562
- Emissions per megawatt hour = 5,182 per pound.
- Statewide average is 375 lbs CO2e per MWh for in-state electricity.

HSC emits almost 5 times the EPS standard, and 13 times the average of powerplants in this state. The Center for Biological Diversity has filed an official petition asking the CPUC to eliminate this exception to the EPS.<sup>39</sup>

Whether and how much closing the Humboldt Sawmill biopower plant (or cuttings its emissions significantly) would help the climate over the crucial next 7 to 32 years depends in part on what the RCEA Board would do instead. We have suggested that the biopower should be replaced by the purchase of new wind or solar, even if it is necessary to wait a couple of years for additional resources to come online. That would be a net reduction in emissions of about 2 million metric tons of CO2e by 2030. But if RCEA chooses to use more natural gas as dispatchable power to

replace the biopower, it would reduce the climate benefits in the long-term (40 to 100+ years) though minimally in the crucial years until 2030 (and 2045).

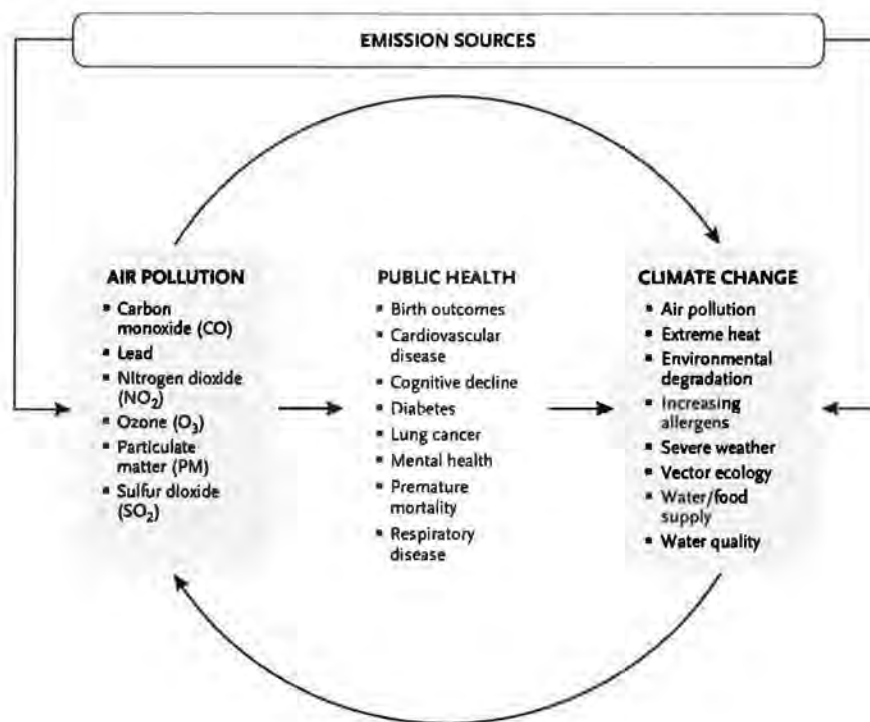
Air pollution and public health consequences of local biomass power

“Criteria pollutants” consist of particulate matter, carbon monoxide, nitrogen oxide, sulfur dioxide, lead, and reactive organic gases. They are regulated by the US Environmental Protection Agency under the National Ambient Air Quality Standards (NAAQS).

Although there is some variability among the health effects of the six NAAQS pollutants, each has been linked to multiple adverse health effects including, among others, premature death, hospitalizations and emergency department visits for exacerbated chronic disease, and increased symptoms such as coughing and wheezing.<sup>40</sup>

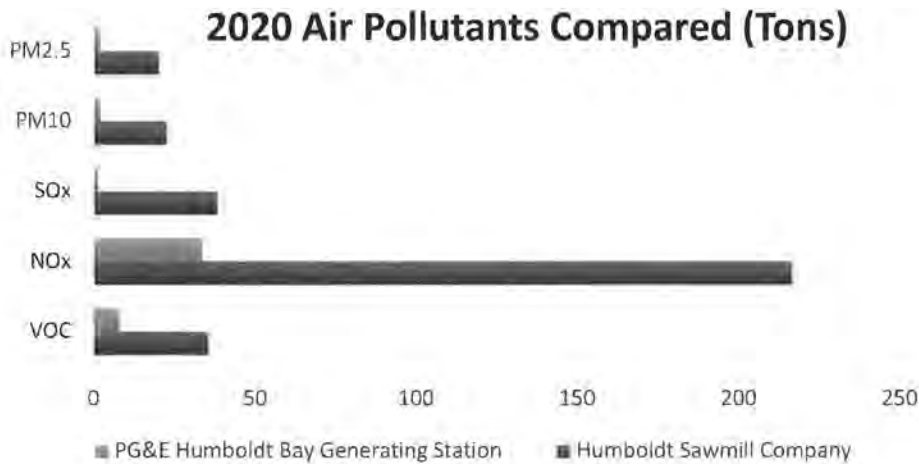
The figure below, from the New England Journal of Medicine, shows some of the ways critical pollutants harms health and are related to climate change in a feedback loop.<sup>41</sup>

**Figure 11**



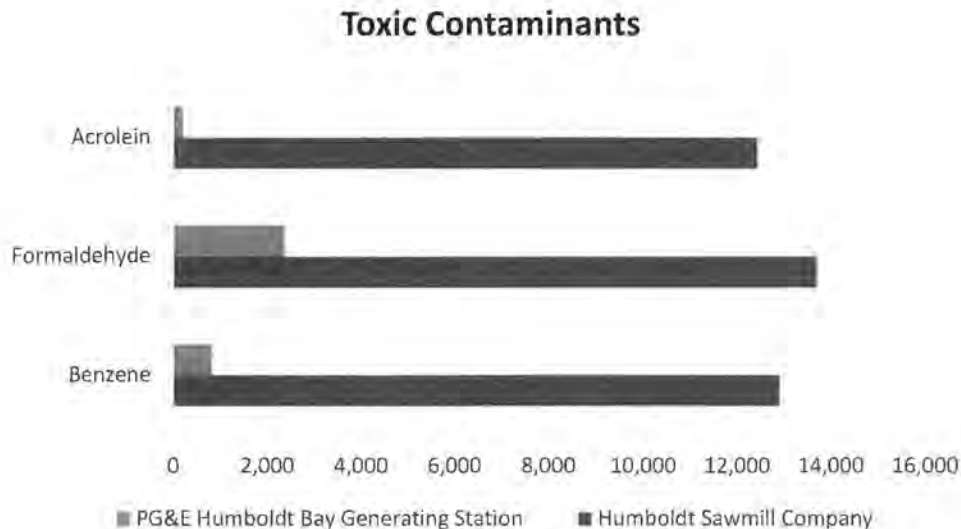
The graph below shows how the HBGS compares to the HSC in particulate matter, sulfur dioxide, nitrogen oxide, and volatile organic gases. (Lead is not part of CARB's data.<sup>42</sup>) Recall that although all the pollutants are emitted at far higher rates by HSC, HSC produces only 26% as much power.

**Figure 12.**



Another category of pollutants is Toxic Air Contaminants. The three chief ones emitted by HBGS and HSC are benzene, formaldehyde and acrolein. Toxic Air Contaminants are defined by CARB as "an air pollutant which may cause or contribute to an increase in mortality or an increase in serious illness, or which may pose a present or potential hazard to human health."<sup>43</sup> HSC emits thousands of metric tons of each per year: 5.8 times the formaldehyde, 15.6 times the benzene and 55 times the acrolein emitted by HBGS, despite producing far less electricity.<sup>44</sup>

**Figure 13. Metric Tons of Toxic Air Contaminants**



It is no wonder biomass power is considered a public health threat. Locally the Humboldt Del Norte Medical Society has called on RCEA to drop biomass from its energy mix. In 2016 a number of health organizations sent a letter to every member of Congress opposing the burning of biomass.<sup>45</sup> These included the Allergy & Asthma Network, the American Academy of Pediatrics, the American Lung Association, the American Public Health Association, the Asthma and Allergy Foundation of America, the National Association of County & City Health Officials, the National Environmental Health Association, and Physicians for Social Responsibility.

Although these criteria pollutants and toxic contaminants are the main public health threat from HSC, a pattern of violations of Clean Air Act and other public health and safety regulations by HSC call into question the capacity of the plant to meet even the minimal regulatory standards that apply to it. A 2022 investigation by Wendy Ring, MD, MPH, found the following.

When the biomass plant bid for its original contract with RCEA in 2016, it reported only 1 air quality violation. From November 2015 through November 2016 the plant failed to submit monthly monitoring reports to the air district. When submitted, these reports subsequently showed over 700 violations of emissions limits.<sup>46</sup> While the plant has been under contract with RCEA, it has received 10 notices of violation of the Clean Air Act,<sup>47</sup> one settlement order for multi-year violations of the Clean Water Act,<sup>48</sup> and three serious OSHA violations resulting in worker injury.<sup>49</sup> Reviewing public documents obtained from the North Coast Unified Air Quality Management District, I found multiple longstanding failures to enforce state and federal pollution laws at the biomass plant,<sup>50</sup> including more instances of emissions above federal limits and a multi-year failure to ensure proper performance of particulate monitors, which may have caused excess emissions for as long as 2 years and several million dollars in health damages.<sup>51</sup> Humboldt Sawmill Company continues to display its disregard for community health by rejecting state guidelines for Toxic Emissions Inventories, proposing instead a non-science based alternative which was recently rejected by the North Coast Unified Air Quality Management District.<sup>52</sup> This failed attempt to make its toxic emissions appear less so has delayed a long overdue risk assessment of the impact of these emissions on community health.

Through a public records request, Dr. Ring obtained an April 14, 2017 letter from NCUAQMD Director Brian Wilson to Matthew Marshall, Director of RCEA, explaining the Humboldt Sawmill violations.<sup>53</sup> [See Appendix,] This letter was received just about a month *after* the approval of the Power Purchase Agreement contract between RCEA and HSC. The contract included an appendix in which HSC reported only one emissions violation and two others going back to 2013. Here are a number of quotations from Brian Wilson's letter:

- "To date, HRC has over 1,044 violations since its restart which are available to the public through a Public Records Request....
- "The District has many concerns about the nature and pattern of these multiple violations and the ability of HRC to continue to operate the biomass boilers in compliance with District permits and applicable air quality regulations, as these violations span an entire year for both boilers. In addition, the District has received over 60 complaints of ash and soot fallout from citizens in the towns of Scotia and Rio Dell just



since December 2016.

- “In accordance with EPA policy, the EPA has been notified of HRC’s High Priority Violations of numerous federally enforceable regulations authorized by the Clean Air Act. In order to resolve the various violations, the District has provided a Settlement Agreement to HRC to settle and provide a path to ensure compliance. If HRC cannot come to agreement with the District that will bring them into compliance, the District will be forced to pursue alternate enforcement remedies. These may include action to suspend HRC’s permits, obtain injunctive relief, obtain an abatement order and/or civil penalty recoveries.”

The 1,043 violations included 897 emissions violations by HSC in the previous two years as well as another 147 violations having to do with equipment and monitoring.

In addition to the recent violations noted by Dr. Ring, Humboldt Sawmill Company submitted to the Technical Advisory Group two environmental engineering reports from the fall of 2022. The first showed that particulate matter was being released by two of the three boilers at a rate that exceeded the standard. For one boiler, it was more than double the rate allowed.<sup>54</sup>

RCEA’s power purchase agreement with HSC allows RCEA to terminate the contract if “any representation or warranty made by such Party is false or misleading” and for “failure to operate the Project in compliance with all applicable Laws.”<sup>55</sup> Should RCEA be persuaded that continuing the contract with HSC is not in the public’s interest, the fact that the contract was obtained by concealing multiple serious violations should allow a default without penalty.

In 2020 RCEA contracted with Michael Furniss, from Cal Poly Humboldt, for a report to the Board on biomass power. It concludes with this statement:<sup>56</sup>

Ideally, the biomass plants would use the Best Available Control Technology (BACT) to limit air pollution effects. This is not currently the case as the plants were built and permitted long ago. Implementing state-of-the-art control of air pollution is a reasonable goal for any power purchased by RCEA, as the emissions are directly connected to the purchases, and public health is an agency responsibility. RCEA could consider adding financial incentives and contract language to provide air quality protection beyond what the State requires and be able to cancel contracts if emissions performance is substandard.

To the best of our knowledge this advice was not followed then but should be now.

Can the Humboldt Sawmill biopower plant be made cleaner?

First, how does HSC compare to other California biomass plants in terms of pounds of CO<sub>2</sub> per net megawatt hour?<sup>57</sup> In Figure 14, there are two outliers with very high emissions per MWh. Of the other facilities, HSC is the third highest. Thus, there is reason to think HSC could improve its emissions performance.



**Figure 14.**

<b>Biomass power plant emissions in 2018</b>	<b>Capacity (MW)</b>	<b>Total CO<sub>2</sub>e (pounds) per net MWh</b>
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
OTE 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
<b>Average for non-cogeneration plants</b>		<b>3,515</b>

SB 1109 (Caballero) of 2022 required electrical corporations, including community choice aggregators like RCEA, to contract for electrical power from biomass plants. RCEA says the law does not apply to the RCEA/HSC contract. If it did the following provision would be applicable: "For purposes of this section, any incremental procurement of electricity products from bioenergy resources by a new contract or contract extension of five years or longer in duration shall be from a resource that meets emission limits equivalent to, or more stringent than, the applicable best available retrofit control technology, as determined by the local air pollution control district or air quality management district."<sup>58</sup> This is an attempt to at modestly clean-up emissions from the generally ancient fleet of biomass plants. But RCEA dodged the bullet.

It is not clear what such a retrofit control technology would look like. HSC uses the oldest of biopower technologies to create electricity from combusting woody biomass, called Riley Stoker travelling grate stoker boilers.<sup>59</sup> One step up is a technology called "fluidized bed technology." A much higher degree of emissions control is possible with gasification, as gasification heats at a very high temperatures without combustion to create syngas, which can be converted to vehicle fuel or combusted to make electricity.<sup>60</sup> In Dr. Fingerman's model, the biopower technology includes three options: a) current generation combustion plant, b) current generation integrated gasification and combustion plant, and c) next generation thermochemical plant.<sup>61</sup>

Figure 15 provides detailed data on different technology options.<sup>62</sup> "Just switching from a direct fired boiler to an integrated gasification combustion unit, criteria pollutant emissions are reduced by an order of magnitude."<sup>63</sup>

**Figure 15.**

<i>Characteristic</i>	<i>Current- Generation Biomass Combustion Power Plant</i>	<i>Current- Generation Integrated Gasification/ Combustion Power Plant</i>	<i>Next- Generation Thermochemical Conversion Power Plant</i>	<i>Next- Generation Thermochemical Conversion Bioalcohol and Power Plant</i>
<i>Plant size (BDT/day)</i>	450	450	450	450
<i>Electricity (kWhr/BDT)</i>	1000	1200	1400	550
<i>Alcohol fuel (gallons/BDT)</i>	—	—	—	80
<i>Diesel fuel</i>	—	—	—	50
<i>Average net energy efficiency</i>	20%	22%	28%	50%
<i>Emissions (lb/MMBTU output)</i>				
NOx	0.329	0.067	0.008	0.005
SOx	0.125	0.01	0.002	0.001
PM	0.269	0.03	0.032	0.018
CO	0.897	0.07	0.042	0.023
VOC	0.085	0.018	0.003	0.002
CO2	972	884	694	389

Alternative uses for biomass.

In 2021 the RCEA Board, clearly uncomfortable with a ten-year contract extension for biomass power, voted to create an MOU between RCEA and HSC that would ensure HSC considered alternatives to burning biomass that would emit fewer pollutants and be less warming.

In 2022 HSC said:<sup>64</sup>

*Biofuels Opportunity*

- In July 2021 consultant ICF provided HSC's sister company Humboldt Redwood Company with a proposal to perform a study on using forest biomass to make energy products as a Low Carbon Fuel Standard (LCFS) business opportunity and issue a follow-up request for information (RFI) to identify interested developers
- HSC's sister company Mendocino Forest Products issued an RFI in February 2022 seeking interest in development of a biofuels facility using feedstock from the company's Mendocino and/or Humboldt County operations
- They received several responses but consider most of them to require too much capital investment to be viable
- They are in discussions with the companies with the most attractive offers

In 2023 no written report was given but an oral statement to Richard Engel indicated that the company has continued to explore hydrogen fuel as a potential alternative biomass feedstock use.

Because RCEA has offered such a sweet deal over ten years, HSC has little incentive to consider alternatives. The MOU has no requirements specifying when HSC would need to choose an

alternative. It doesn't even contain a list of alternatives to be evaluated each year, such as the one in the Michael Furness report to the Board.

We have compiled a list of references to projects or processes which provide alternative uses for woody biomass. The endnotes contain several links to existing projects for each alternative.

1. Grant incentivized alternatives: The US Department of Agriculture has made a number of grants under the Inflation Reduction Act for bioenergy projects. Projects, some in California, include biochar, a gasification plan in Placer County, hydrogen from biomass, a kiln and boiler system upgrade.<sup>65</sup> California is investing \$3 million in awards for projects in the Sierra Nevada that will create a Biomass Carbon Removal and Storage system that creates hydrogen, produce biofuels from forest waste using thermochemical conversion, a gasification plant on tribal land that produces carbon-negative liquid hydrogen fuel, and other biomass to hydrogen projects.<sup>66</sup>
2. Woody biomass for compost<sup>67</sup>
3. Bio-Char in conjunction with existing biopower plants.<sup>68</sup>
4. Biofuels. These are heavily incentivized by the Low Carbon Fuel Standard and the Inflation Reduction Act.<sup>69</sup>
5. Biomass to hydrogen.<sup>70</sup>
6. Durable wood products like GluLam and Oriented Strand Board.<sup>71</sup>
7. Nano-cellulose<sup>72</sup>
8. Biomass to plastics<sup>73</sup>

## Recommendations

In order not to have RCEA, and all of us who are its customers, allowing HSC to continue to put 300,000 metric tons of CO<sub>2</sub>e into the atmosphere each year the RCEA Board needs to act.

Recommendation 1: No other biomass shall be contracted for beyond the HSC contract.

Recommendation 2: The HSC contract shall not be extended.

Recommendation 3: Due to the numerous air quality violations of HSC, the HSC contract should be cancelled as soon as the long-term renewable energy that it provides in the RCEA portfolio can be replaced by additive solar or wind.

**North Coast Unified  
Air Quality Management District**

707 L Street, Eureka, CA 95501  
Telephone (707) 443-3093 FAX (707) 443-3099  
<http://www.ncuaqmd.org>



April 14, 2017

Mr. Matthew Marshall Executive  
Director  
Redwood Coast Energy Authority (RCEA) 633  
3<sup>rd</sup> Street  
Eureka, CA 95501

**Re: Status of HRC Non-Compliance and Notice of Violations**

Dear Mr. Marshall:

This correspondence is in response to your inquiry as to the compliance status of the Humboldt Redwood Company (HRC) Title V Operating Permit #NCU 060-12 for the Scotia Sawmill (SSM) facility.

To date, the North Coast Unified Air Quality Management District (District) has issued numerous Notices of Violations (NOVs) to HRC for violations of its federally enforceable Title V Operating Permit at the SSM facility and additionally for its Hot Mix Asphalt Plant (#00974-1). To date, HRC has over 1,044 violations since its restart which are available to the public through a Public Records Request and are summarized as follows:

- 54 violations for exceeding Carbon Monoxide (CO) emission limitations from Boiler A (November 2015 through November 2016)
- 7 violations for exceeding CO emission limitations from Boiler A (December 2016 through February 2017)
- 45 violations for exceeding CO emission limitations from Boiler B (November 2015 through November 2016)
- 9 violations for exceeding CO emission limitations from Boiler A (December 2016 through February 2017)
- 407 violations for exceeding opacity limitations from Boiler A (April 2016 through December 2016)
- 57 violations for exceeding opacity limitations from Boiler A (January 2017 through February 2017)
- 318 violations for exceeding opacity limitations from Boiler B (April 2016 through December 2016)
- 88 violations for exceeding opacity limitations from Boiler B (January 2017 through February 2017)
- Violations for failure to maintain an operation COMS for both Boiler A and Boiler B (from November 2015 through February 2016)

- Violations for failure to provide semi-annual compliance certification for both Boiler A and Boiler B (for January 2016 to June 2016 period)
- Violations for failure to provide monthly monitoring reports (November 2015 through November 2016)
- Violation for failure to conduct a source test of the package-type natural gas-fueled boiler
- Violation for failure to maintain an hourly log of the pressure drop across the baghouse of the HMA plant (April 5, 2016)
- Violation for failure to continuously record the temperature at the outlet of HMA plant mixing drum ((April 5, 2016 through June 15, 2016)
- Violation for failure to log and maintain the finished HMA temperature (June 10, 2016)
- Violations for three separate failures to maintain the finished HMA temperature (June 14, 2016)
- Violations for beginning construction of the Dry Kilns #4 & #5 without an ATC permit (September 1, 2016 through October 12, 2016)

The District has many concerns about the nature and pattern of these multiple violations and the ability of HRC to continue to operate the biomass boilers in compliance with District permits and applicable air quality regulations, as these violations span an entire year for both boilers. In addition, the District has received over 60 complaints of ash and soot fallout from citizens in the towns of Scotia and Rio Dell just since December 2016.

In accordance with EPA policy, the EPA has been notified of HRC's High Priority Violations of numerous federally enforceable regulations authorized by the Clean Air Act. In order to resolve the various violations, the District has provided a Settlement Agreement to HRC to settle and provide a path to ensure compliance. If HRC cannot come to agreement with the District that will bring them into compliance, the District will be forced to pursue alternate enforcement remedies. These may include action to suspend HRC's permits, obtain injunctive relief, obtain an abatement order and/or civil penalty recoveries.

If you have any further questions or need additional information, please feel free to contact me.

Sincerely,



Brian Wilson  
Air Pollution Control Officer



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#### Endnotes:

<sup>1</sup> The relationships between Humboldt Sawmill Company, Humboldt Redwood Company, and Mendocino Redwood Company are explained at: [https://www.getredwood.com/our-story#:~:text=Humboldt%20Redwood%20Company%2C%20LLC%20\(HRC,timberlands%20in%20Humboldt%20County%2C%20California. And: https://www.hrcilc.com/palco-press-articles/scotia-back-lumber-business-former-pacific-lumber-sawmill-returns-work](https://www.getredwood.com/our-story#:~:text=Humboldt%20Redwood%20Company%2C%20LLC%20(HRC,timberlands%20in%20Humboldt%20County%2C%20California. And: https://www.hrcilc.com/palco-press-articles/scotia-back-lumber-business-former-pacific-lumber-sawmill-returns-work)

<sup>2</sup> [https://www.who.int/health-topics/air-pollution#tab=tab\\_1](https://www.who.int/health-topics/air-pollution#tab=tab_1)

<sup>3</sup> Humboldt County 2015 Emissions Inventory data show 819,212 metric tons of mobile transportation emissions, of which 48.1% is emitted by passenger vehicles, which equals: 394,041 metric tons. The 2020 Humboldt Sawmill emissions of 295,562 is 75% of all passenger vehicle emissions. Fun fact: all 34 Los Angeles police helicopters, which fly 365 days 24 hours a day "burned more than 1.2 million gallons of fuel, thereby releasing approximately 11,100 metric tons of carbon dioxide [in a year]." Humboldt Sawmill released 27 times more CO<sub>2</sub> than the helicopters. <https://heated.world/p/the-climate-cost-of-las-police-choppers>

<sup>4</sup> Nicholas J. Leach, et al. "Current level and rate of warming determine emissions budgets under ambitious mitigation." *Nature Geoscience* 11, no. 8 (2018): 574-579.

<sup>5</sup> Allen, Myles, Mustafa Babiker, Yang Chen, and Heleen C. de Coninck. "IPCC SR15: Summary for policymakers." In *IPCC Special Report Global Warming of 1.5 °C*. Intergovernmental Panel on Climate Change, 2018.

<sup>6</sup> Thomas, Adelle, April Baptiste, Rosanne Martyr-Koller, Patrick Pringle, and Kevon Rhiney. "Climate change and small island developing states." *Annual Review of Environment and Resources* 45 (2020): 1-27. <https://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-012320-083355>

<sup>7</sup> <https://www.nature.com/articles/s41893-023-01132-6/figures/5>

<sup>8</sup> <https://www.science.org/doi/abs/10.1126/science.abn7950> A full-text preprint is available at: <https://ore.exeter.ac.uk/repository/bitstream/handle/10871/131584/Tipping%20points.pdf?sequence=1> Note that to have avoided tipping points the authors say we would have had to limit warming to 1.0°C.

<sup>9</sup> Revesz, Richard L., Peter H. Howard, Kenneth Arrow, Lawrence H. Goulder, Robert E. Kopp, Michael A. Livermore, Michael Oppenheimer, and Thomas Sterner. "Global warming: Improve economic models of climate change." *Nature* 508, no. 7495 (2014): 173-175. <https://www.nature.com/articles/508173a>

<sup>10</sup> <https://www.bloomberg.com/news/articles/2023-05-04/transcript-zero-episode-37-how-the-bezos-earth-fund-spends-its-billions#xj4y7vzkg>

<sup>11</sup> 43% is the figure the world must reduce emissions. The US is the second largest emitter and California the second largest state emitter of greenhouse gases. The Paris Accord agreed that developing countries would not be held to the same standard as the developed countries that have caused global warming through fossil fuel use. So countries like the US have to reduce more than the average.

<sup>12</sup> Humboldt's Electric Future: How the Redwood Coast Energy Authority is Buying and Building Local Renewable Power Resources...and How You Can Participate. RCEA. April 2023

<sup>13</sup> Staff Report. Agenda Item # 5.2, February 25, 2021, to RCEA Board of Directors from Richard Engel, Director of Power Resources, Biomass Power Purchase Agreement with Humboldt Sawmill Company.

<sup>14</sup> See page 9 of Humboldt's Electric Future: How the Redwood Coast Energy Authority is Buying and Building Local Renewable Power Resources...and How You Can Participate. RCEA. April 2023.

<sup>15</sup> "Prices from a sample of recent contracts average around \$20/MWh (levelized) in the West and \$30-40/MWh elsewhere in the continental US." Lawrence Berkeley National Laboratory, 2022 Utility Scale Solar. <https://emp.lbl.gov/utility-scale-solar#:~:text=Prices%20from%20a%20sample%20of,elsewhere%20in%20the%20continental%20US.>

<sup>16</sup> Some additional dispatchable electricity from the gas-powered Humboldt Generating Station would also need to be purchased. However, as the 2023 RCEA report notes, it doesn't matter where the electrons come from in our electricity, it only matters what is in the grid. Buying new solar instead of biomass electricity puts that amount into the grid. See below for why even natural gas is preferable to biomass.

- <sup>17</sup> Morris, G., 2000. *Biomass Energy Production in California: The Case for a Biomass Policy Initiative; Final Report* (No. NREL/SR-570-28805). National Renewable Energy Lab.(NREL), Golden, CO (United States). <https://www.nrel.gov/docs/fy01osti/28805.pdf>
- <sup>18</sup> <https://redwoodenergy.org/wp-content/uploads/2017/08/RCEA-Board-Meeting-Slides-3-20-17.pdf>
- <sup>19</sup> HSC RCEA MOU Data Reporting Template Feedstock, Reporting Period: May 1, 2022-April 30, 2023
- <sup>20</sup> The CPUC's 15 year old "interim" provision of a waiver of greenhouse gas emissions for biomass power has recently been challenged by a legal petition requesting a rule-making on this issue. It argues that the exemption was based on erroneous data and cites multiple current sources that show no waiver is justified because biomass power is not carbon neutral. [https://www.biologicaldiversity.org/programs/climate\\_law\\_institute/pdfs/23-06-20-Ctr-Biol-Div-Emission-Performance-Standard-Petition.pdf?\\_gl=1\\*1dg2v01\\*\\_gcl\\_au\\*MjA3MjQwNTg1My4xNjg4MDg4OTk0](https://www.biologicaldiversity.org/programs/climate_law_institute/pdfs/23-06-20-Ctr-Biol-Div-Emission-Performance-Standard-Petition.pdf?_gl=1*1dg2v01*_gcl_au*MjA3MjQwNTg1My4xNjg4MDg4OTk0)
- <sup>21</sup> Mary S. Booth, *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>
- <sup>22</sup> Fingerman, K. R., et al. (2023). "Climate and air pollution impacts of generating biopower from forest management residues in California." *Environmental Research Letters* 18(3).
- <sup>23</sup> Fingerman. Ibid. Also see Jerome Laganier 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>.
- <sup>24</sup> Law, Beverly E., Tara W. Hudiburg, Logan T. Berner, Jeffrey J. Kent, Polly C. Buotte, and Mark E. Harmon. "Land use strategies to mitigate climate change in carbon dense temperate forests." *Proceedings of the National Academy of Sciences* 115, no. 14 (2018): 3663-3668. <https://www.pnas.org/doi/epdf/10.1073/pnas.1720064115>
- <sup>25</sup> John Sterman et al., Does wood bioenergy help or harm the climate?, 78 Bulletin of the Atomic Scientists 128 (2022). Manomet Ctr. for Conservation Scis., *Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources* (2010) at 103, <https://www.mass.gov/doc/manometbiomassreportfullhirezpdf/download>
- <sup>26</sup> Laganier, op cit.
- <sup>27</sup> Manomet Center for Conservation Sciences. 2010. *Massachusetts Biomass Sustainability and Carbon Policy Study: Report to the Commonwealth of Massachusetts Department of Energy Resources*. Walker, T. (Ed.). Contributors: Cardellicchio, P., Colnes, A., Gunn, J., Kittler, B., Perschel, R., Recchia, C., Saah, D., and Walker, T. Natural Capital Initiative Report NCI-2010- 03. Brunswick, Maine.
- <sup>28</sup> A small sampling: IPCC, *Frequently Asked Questions, Intergovernmental Panel on Climate Change (IPCC) Task Force on National Greenhouse Gas Inventories*, <http://www.ipcc-nggip.iges.or.jp/faq/faq.html>; Giuntoli, J., S. Searle, R. Jonsson, A. Agostini, N. Robert, Stefano Amaducci, L. Marelli, and A. Camia. "Carbon accounting of bioenergy and forest management nexus. A reality-check of modeling assumptions and expectations." *Renewable and Sustainable Energy Reviews* 134 (2020): 110368. Giuntoli, J., et al. (2021). "A systems perspective analysis of an increased use of forest bioenergy in Canada: Potential carbon impacts and policy recommendations." *Journal of Cleaner Production* 321. Morris, Gregory. "Bioenergy and greenhouse gases." *Green Power Institute, The Renewable Energy Program of the Pacific Institute* (2008). [https://pacinst.org/wp-content/uploads/2008/05/Bioenergy\\_and\\_Greenhouse\\_Gases.pdf](https://pacinst.org/wp-content/uploads/2008/05/Bioenergy_and_Greenhouse_Gases.pdf). Composting is a better alternative than biopower: Silver, Whendee, Sintana Vergara, Allegra Mayer. (University of California, Berkeley). 2018. *Carbon Sequestration and Greenhouse Gas Mitigation Potential of Composting and Soil Amendments on California's Rangelands*. California's Fourth Climate Change Assessment, California Natural Resources Agency. Publication number: CCCA4-CNRA- 2018-002.
- <sup>29</sup> A different metric than GWP100 would be necessary for these purposes. GWP20, which is in wide use for short-lived climate pollutants like methane, would be a possibility. See: Cooper, S. J. G., et al. (2020). "Exploring temporal aspects of climate-change effects due to bioenergy." *Biomass and Bioenergy* 142.
- <sup>30</sup> Geronimo, Carisse, Sintana E. Vergara, Charles Chamberlin, and Kevin Fingerman. "Overlooked Emissions: Methane Generation from Woody Biomass Storage." *Available at SSRN 3988712*.

<sup>31</sup> <https://www.masslive.com/news/2022/08/wood-burning-power-plants-in-mass-wont-qualify-for-renewable-energy-credits-local-activists-are-celebrating.html>

<sup>32</sup> <https://minister.dcceew.gov.au/bowen/media-releases/native-forest-wood-waste-removed-renewable-energy-target>

<sup>33</sup> <https://www.wwf.eu/?2128466/500-scientists-tell-EU-to-end-tree-burning-for-energy>

<sup>34</sup> <https://forestdefenders.eu/biomass-plant-co2-emissions-an-explanation/>

<sup>35</sup> The total GHG emissions are from California Air Resource Board Pollution Mapping Tool

<https://ww2.arb.ca.gov/capp-resource-center/data-portal/carb-pollution-mapping-tool>. 2020 production of energy is from <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/quarterly-fuel-and-energy-report-qfer-1>. These are direct annual smokestack emissions not the life cycle emissions relevant to carbon neutrality over years.

<sup>36</sup> "[T]he proportion of GHG emissions from each lifecycle stage differs by technology. For fossil-fueled technologies, fuel combustion during operation of the facility emits the vast majority of GHGs." *Life Cycle Greenhouse Gas Emissions from Electricity Generation: Update*. Life 800: 1-000.

<https://www.nrel.gov/docs/fy21osti/80580.pdf> The 2015 Humboldt County Emissions Inventory data show "upstream" emissions for natural gas as 11,162 metric tons, only 5 percent of the HBGS 227,214 emissions in 2020. Upstream emissions for 2020 could not be found.

<sup>37</sup> "The Emissions Performance Standard is a facility-based emissions standard requiring that all new long-term commitments for baseload generation to serve California consumers be with power plants that have emissions no greater than a combined cycle gas turbine plant. That level is established at 1,100 pounds of CO<sub>2</sub> per megawatt-hour." [https://docs.cpuc.ca.gov/published/News\\_release/63997.htm#:~:text=The%20Emissions%20Performance%20Standard%20is,combined%20cycle%20gas%20turbine%20plant](https://docs.cpuc.ca.gov/published/News_release/63997.htm#:~:text=The%20Emissions%20Performance%20Standard%20is,combined%20cycle%20gas%20turbine%20plant).

<sup>38</sup> <https://www.energy.ca.gov/data-reports/energy-almanac/california-electricity-data/quarterly-fuel-and-energy-report-qfer-1>

<sup>39</sup> Op cit. [https://www.biologicaldiversity.org/programs/climate\\_law\\_institute/pdfs/23-06-20-Ctr-Biol-Div-Emission-Performance-Standard-Petition.pdf?\\_gl=1\\*1dg2y01\\*\\_gcl\\_au\\*MjA3MjQwNTg1My4xNjg4MDg4OTk0](https://www.biologicaldiversity.org/programs/climate_law_institute/pdfs/23-06-20-Ctr-Biol-Div-Emission-Performance-Standard-Petition.pdf?_gl=1*1dg2y01*_gcl_au*MjA3MjQwNTg1My4xNjg4MDg4OTk0)

<sup>40</sup> From <https://ww2.arb.ca.gov/criteria-pollutant-emission-inventory-data>

<sup>41</sup> Keswani, Anjeni, Hana Akselrod, and Susan C. Anenberg. "Health and clinical impacts of air pollution and linkages with climate change." *NEJM Evidence* 1, no. 7 (2022): EVIDra2200068.

<https://evidence.nejm.org/doi/pdf/10.1056/EVIDra2200068?download=true>

<sup>42</sup> A more complete list of CARB toxics does show 147 lbs of lead emitted in 2020 for HSC; HBGS is not listed.

[https://www.arb.ca.gov/carbapps/pollution-map/?\\_ga=2.63244207.14248823.1687630012-431780188.1682796728](https://www.arb.ca.gov/carbapps/pollution-map/?_ga=2.63244207.14248823.1687630012-431780188.1682796728)

<sup>43</sup> <https://ww2.arb.ca.gov/resources/documents/carb-identified-toxic-air-contaminants>

<sup>44</sup> Data from: California Air Resource Board Pollution Mapping Tool <https://ww2.arb.ca.gov/capp-resource-center/data-portal/carb-pollution-mapping-tool>.

<sup>45</sup> <https://www.naccho.org/uploads/downloadable-resources/Policy-and-Advocacy/Health-organizational-letter-health-impacts-of-biomass.pdf>

<sup>46</sup> In the application for the initial contract with RCEA, HSC included a "Permit and notice of violation summary." It shows only one violation of emissions limits. In 2016 monthly reports of emissions were required by the NCUAQMD and were not submitted until the contract was signed. After submission the air quality district cited HSC for 700 emissions violations and many others. See the Appendix.

<sup>47</sup> NCUAQMD multiple Notices of Violation obtained via public record request by Wendy Ring MD, MPH

<sup>48</sup> North Coast Regional Water Board Settlement Agreement with Humboldt Sawmill Company [https://www.waterboards.ca.gov/northcoast/board\\_decisions/tentative\\_orders/pdf/2022/220712%20Final%20Stipulated%20Agreement%20HSC.pdf](https://www.waterboards.ca.gov/northcoast/board_decisions/tentative_orders/pdf/2022/220712%20Final%20Stipulated%20Agreement%20HSC.pdf) November 2022

<sup>49</sup> US Department of Labor [https://www.osha.gov/ords/imis/establishment.inspection\\_detail?id=1520807.015](https://www.osha.gov/ords/imis/establishment.inspection_detail?id=1520807.015)

<sup>50</sup> Multiple documents obtained by public record request and absence of requested documents (because they didn't exist but should have) from the North Coast Unified Air Quality Management District.



<sup>51</sup> NCUAQMD 2017-2023 Source Tests and emissions inventories submitted to NCUAQMD by HSC and Notices of Violation issued to HSC by NCUAQMD, HSC's Proposed Toxic Inventory Plan. All documents obtained via public record requests.

<sup>52</sup> NCUAQMD Director Brian Wilson email exchange with Dr. Wendy Ring June 30 and July 7, 2023.

<sup>53</sup> Available at: <https://acrobat.adobe.com/id/urn:aaid:sc:US:4b82b9c6-8bbd-40b5-b826-ac560aea223f>

<sup>54</sup> Source Test Report 2022 Compliance and RATA Testing Humboldt Redwood Company, LLC Scotia Facility Boilers A, B & C. Montrose Air Quality Service, Antioch CA. November 7 2022. A follow-up report dated January 2023 showed the boilers to be emitting only the allowed amounts of particulates.

<sup>55</sup> POWER PURCHASE AGREEMENT Between Redwood Coast Energy Authority (as "Buyer") and Humboldt Redwood Company, LLC (as "Seller"), 2017.

<sup>56</sup> Biomass Power in Humboldt County. Summary of Workshops, Consultations, and Research, Prepared by Michael J. Furniss, Climate and Forests Consultant to Redwood Coast Energy Authority, January 2020; updated October 2021.

<sup>57</sup> Overall average GHG Intensity of electricity generation in California comes from Cal. Air Res. Bd., 2000- 2018 Emissions Trends Report Data (2020 Edition),

[https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000\\_2018/2000\\_2018\\_ghg\\_inventory\\_trends\\_figures.xlsx](https://ww3.arb.ca.gov/cc/inventory/pubs/reports/2000_2018/2000_2018_ghg_inventory_trends_figures.xlsx).

<sup>58</sup> [https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill\\_id=202120220581109](https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=202120220581109) September 16, 2022 (Chapter 364, Statutes of 2022)

<sup>59</sup> <https://www.calbiomass.org/facilities/greenleaf-eel-river-power/>

<sup>60</sup> The process goes back at least to 1807 when syngas was used in London street lamps.

<sup>61</sup> <https://cbrec.schatzcenter.org/forest/forestry.html>

<sup>62</sup> Carreras-Sospedra, M., et al. (2016). "Assessment of the emissions and air quality impacts of biomass and biogas use in California." *J Air Waste Manag Assoc* 66(2): 134-150.

<https://www.tandfonline.com/doi/full/10.1080/10962247.2015.1087892?scroll=top&needAccess=true&role=tab>

<sup>63</sup> Ibid.

<sup>64</sup> First Annual Report on Consultations with Humboldt Sawmill Company Regarding Alternative Biomass Uses. Presentation to RCEA Board of Directors June 23, 2022

<sup>65</sup> <https://biomassmagazine.com/articles/20117/usda-funds-wood-energy-projects>

<sup>66</sup> <https://www.conservation.ca.gov/index/Pages/News/State-Invests-3-Million-Convert-Forest-Waste-into-Carbon-Negative-Fuel.aspx>

<sup>67</sup> [https://www.energy.ca.gov/sites/default/files/2019-11/Agriculture\\_CCCA4-CNRA-2018-002\\_ADA.pdf](https://www.energy.ca.gov/sites/default/files/2019-11/Agriculture_CCCA4-CNRA-2018-002_ADA.pdf),

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<https://calrecycle.ca.gov/organics/erosion/firedamage/>, <https://www.kelowna.ca/city-services/garbage-recycling-yard-waste/okanagan-compost/ogogrow/how-ogogrow-made>, <http://www.sawdustsupply.com/groco-soil-conditioner-mulch>, <https://nwbiosolids.org/whats-happening/member-spotlight/2015/january/city-arlington-wa>, [www.olyfish.com](http://www.olyfish.com)

<sup>68</sup> <https://pacificbiochar.com/how-we-produce-biochar/>

<sup>69</sup> <https://www.canadianbiomassmagazine.ca/california-selects-8-projects-for-forest-biomass-to-biofuels-pilot-program/>, <https://velocys.com/projects/bayou-fuels/>

<sup>70</sup> <https://www.sgh2energy.com/technology/#techheader>, <https://www.yosemiteclean.com/>,

<https://www.enr.com/articles/53219-california-plant-would-convert-wood-waste-into-hydrogen-fuel>

<sup>71</sup> Cabiyo, B., et al. (2021). "Innovative wood use can enable carbon-beneficial forest management in California."

*Proc Natl Acad Sci U S A* 118(49). And <https://www.apawood.org/osb>. And

[https://www.naturallywood.com/projects/?projects\\_type=mass-timber-demonstration-program&projects\\_structural=all&projects\\_material=all&projects\\_location=all&tax=true](https://www.naturallywood.com/projects/?projects_type=mass-timber-demonstration-program&projects_structural=all&projects_material=all&projects_location=all&tax=true). And

<https://www.millwoodinc.com/Wood-Products-Pallets-New-Pallets-Pressed-Wood>

<sup>72</sup> [https://www.fpl.fs.usda.gov/research/facilities/nanocellulose\\_pilot-plant.php](https://www.fpl.fs.usda.gov/research/facilities/nanocellulose_pilot-plant.php)

<sup>73</sup> <https://bioplasticsnews.com/tecnaro/>, <https://woodly.com/products/>,

<https://www.upmformi.com/biocomposite-products/upm-formi-ecoace/>, <https://www.treston.us/news/product>

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