IHI POWER SERVICES CORP.

July 9, 2021

Rajinder Sahota
California Air Resources Board
1001 I St.
Sacramento, CA 95814

RE: IHI Comments on Carbon Neutrality Scoping Plan Workshop Kickoff

Dear Ms. Sahota:

IHI Power Services Corp. is pleased to offer these comments on the kickoff workshops for development of the Carbon Neutrality Scoping Plan.

Biomass energy may be the single most important focus for the upcoming Scoping Plan. According to the Lawrence Livermore report, *Getting to Neutral,* biomass energy with carbon capture and sequestration (CCS) offers the most significant, cost-effective negative emissions strategy for achieving carbon neutrality in the state.[1] Moreover, it elucidates the vast potential climate benefits offered by utilizing existing biomass waste streams for energy.

Specifically, the report shows (eg, see Table 40) biomass energy strategies, using only existing waste streams in the state, could cost-effectively provide climate benefits of 143 $MMTCO_2$/year by 2025. The state could achieve these outcomes by building 50-100 new facilities, at an average cost of about \$32/$MTCO_2$. *Doing so would offer the same climate benefits as electrifying every home in the state and removing every passenger vehicle off the state's roads – all within 5 years*.

The opportunity posed by these strategies is undeniable. A focus on biomass energy in the Scoping Plan could undoubtedly lead to cost-effective pathways achieving carbon neutrality well before 2045 and help to maximize net-negative emissions to begin unwinding some of the worst impacts of climate change.

Given this tremendous opportunity, we encourage CARB to include a focus on enabling these outcomes in the Scoping Plan, and to specifically:

- Evaluate the full potential of biomass energy in California, including biomass energy with CCS, to contribute to the State's carbon neutrality goals using California-specific data

[1] https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

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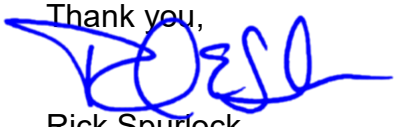
- Identify additional benefits and priority outcomes for the use of biomass energy, including supporting the phase out of agricultural burning and improved forest management
- Identify measures to achieve these outcomes, including:
    - Leverage existing and recently shuttered biomass facilities to achieve climate, energy, and other state priorities
    - Set an electricity sector greenhouse gas planning target of 0 $MMTCO_2$/year by 2035 – in-line with President Biden's target – and a negative emissions planning target for the sector thereafter
    - Support low-cost and low-emissions transport of woody waste from high hazard zones in the forest and agricultural operations through incentives
    - Support demonstration projects for biomass energy with CCS
    - Define biomass energy with CCS as an eligible carbon dioxide removal pathway under the Low Carbon Fuel Standard
    - Commit to revising the Bioenergy Action Plan to further explore how maximize the climate change and other benefits associated with managing the state's biomass resources

Biomass energy provides an array of additional environmental and energy benefits, beyond the level of potential negative and avoided greenhouse gas emissions identified in the Lawrence Livermore report. The attachment below describes many of these benefits and also provides some background on our Rio Bravo Fresno facility, which is centrally located to support CARB's agricultural burn phase out, in addition to providing other important benefits.

If you have any questions, please do not hesitate to reach out to Ryan McCarthy at Weideman Group (ryan@weidemangroup.com) or myself anytime.

Thank you,



Rick Spurlock
Director of Operations – West Region
IHI Power Services Corp.

IHI POWER SERVICES CORP.

Rio Bravo Fresno Overview

Rio Bravo Fresno is a renewable, biomass-fired electrical generating facility with 27 employees located in the heart of California's agricultural region in the community of Malaga. It has a rated capacity of 25 MW (enough to power about 25,000 homes) and operates as a baseload facility, running continuously at full load. The facility uses renewable biomass as fuel, including agricultural prunings, High Hazard Zone Forest residue, and urban wood waste. The power produced by Rio Bravo is purchased by Southern California Edison (SCE) through a 5-year BioRAM contract that expires in September 2022.

If not for the Rio Bravo Fresno facility, the agricultural and forest waste feeding the plant would be primarily open-burned and the urban waste would be landfilled. These alternatives result in significant pollution impacts – including high levels of particulate matter and NOx emissions and significant climate impacts from the production of short-lived climate "super-pollutants," under-utilization of renewable power resources, and associated increased use of fossil fuels.

Rio Bravo Fresno utilizes circulating fluidized bed (CFB) boiler technology to efficiently convert biomass to electricity with low emissions. Compared to the alternative fate of woody biomass wastes, the facility's process significantly reduces levels of particulate matter, black carbon and methane emissions. Rio Bravo Fresno reduces more than twice as much NOx emissions in the region than it produces. With additional investment to align with a renewed contract, new, state-of-the-art pollution control equipment could provide additional air quality benefits for the region and innovative approaches to biomass energy could be demonstrated and scaled in the Central Valley.

Biomass Energy in California: An Important Waste Management Strategy

Biomass power plants in California utilize waste biomass to provide reliable, baseload renewable power to the state. They generate an array of local, regional and statewide benefits, including:

- Significant regional air quality benefits
- An important element of improved forest management
- Reliable and resilient renewable energy
- Jobs and economic benefits, including in rural and low-income communities
- Improved waste management, through avoided landfilling or open burning of biomass residues
- Significant climate benefits

California has an Urgent and Ongoing Need for Firm, Renewable Energy

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Resources

The August 2020 rolling blackouts highlighted energy reliability concerns in California and the urgent need for additional firm and reliable power plant capacity in the state. California's energy agencies have highlighted ongoing vulnerabilities of the electricity grid to extreme heat events in August and September, which are currently exacerbated by significantly below-average hydropower conditions.[2]

In response to the blackouts and subsequent Root Cause Analysis ordered by Governor Newsom,[3] the California Public Utilities Commission (CPUC) recently approved an emergency procurement of additional resources for Summer 2021 and 2022.[4]

Simultaneously, with 6,500 MW of firm, baseload and dispatchable power plant capacity slated to retire in the 2023-2026 timeframe, including the Diablo Canyon nuclear power plant, the state faces an even more significant need for firm capacity beyond 2022. The CPUC recently ordered 11,500 MW of additional procurement in the 2023-2026 timeframe to bolster reliability, and with an emphasis on firm, baseload and renewable zero carbon resources that can replace the role of retiring nuclear and natural gas power plants.[5]

Over the longer term, the state's energy planning shows an ongoing need for firm and baseload renewable resources, as well. In planning to achieve California's 100 percent zero-carbon energy goal under SB 100, the joint energy agencies found that including zero-carbon baseload resources in the state's energy mix reduced the need for new power plant capacity by about 70 GW, or about 40 percent, through 2045.[6] And a common assumption in both midterm and long-term analyses is that existing biomass power plants stay online (through 2045 in studies that look that far).[7]

Biomass Energy Production is a Needed Alternative to Open Burning

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[2] CAISO (2021) 2021 Summer Loads and Resources Assessment, California Independent System Operator, May 12. http://www.caiso.com/Documents/2021-Summer-Loads-and-Resources-Assessment.pdf

[3] CAISO, CPUC, CEC (2021) Final Root Cause Analysis: Mid-August 2020 Extreme Heat Wave, January 13. http://www.caiso.com/Documents/Final-Root-Cause-Analysis-Mid-August-2020-Extreme-Heat-Wave.pdf

[4] https://www.cpuc.ca.gov/summerreadiness/

[5] CPUC (2021) Proposed Decision requiring procurement to address mid-term reliability (2023-2026), Proceeding 20-05-003, May 21. https://docs.cpuc.ca.gov/PublishedDocs/Efile/G000/M385/K026/385026493.PDF

[6] CEC, CPUC, CARB (2021) 2021 SB 100 Joint Agency Report. https://efiling.energy.ca.gov/EFiling/GetFile.aspx?tn=237167&DocumentContentId=70349

[7] CEC (2020) Input & Assumptions - CEC SB 100 Joint Agency Report. https://efiling.energy.ca.gov/getdocument.aspx?tn=234532

Open burning of agricultural material is a significant air quality issue in California. This is particularly true in the Central Valley, where it is a major source of particulate matter, especially in the winter months when PM2.5 levels are elevated.[8] California has worked to reduce the use of open burning and associated health impacts since 1970, and the San Joaquin Valley Air Pollution Control District has taken steps to control agricultural burning in the Valley for 30 years. While the state had made progress in reducing open agricultural burning, burning has increased in recent years, largely due to the drought and associated tree mortality and shuttering of biomass power plants, which provide the most cost-effective alternative to disposing this material.[9] According to CARB's Short-Lived Climate Pollutant Reduction Strategy, "The reduction in bioenergy capacity has already resulted in some increase in agricultural burning due to a lack of cost-effective alternatives."[10]

Following on a 2003 state law (SB 705, Florez) and recent activities by the San Joaquin Valley Air Pollution Control District and California Air Resources Board,[11] open burning of agricultural wastes will be banned in the San Joaquin Valley by 2025. Currently, the most cost-effective alternative to open burning is biomass energy.

The state and region are working to develop additional alternatives to open burning of agricultural biomass, including composting, soil incorporation, and gasification to produce green hydrogen. However, it will take time and additional resources to demonstrate these solutions, then deploy them at scale.

In the meantime, biomass energy remains the primary alternative to open burning and its impacts. Since 2012, however, the Valley has lost six biomass energy facilities and now only has capacity to take about half the agricultural waste that needs to be disposed. Of the remaining five power plants, four have long-term contracts in place that run through 2027-2039.[12]

Rio Bravo Fresno is the fifth and has a contract that expires in September 2022. Yet it may be the most important facility to provide alternatives to open burning of agricultural wastes in the San Joaquin Valley. According to CARB analysis, Rio Bravo Fresno,

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[8] SJVAPCD (2020) Final 2020 Staff Report and Recommendations on Agricultural Burning, San Joaquin Valley Air Pollution Control District, December 17. https://www.valleyair.org/BurnPrograms/open-burn-report-progress/documents/2020-ag-burning-staff-report/2020-Ag-Burn-Report.pdf

[9] CARB (2021) Staff Recommendations: San Joaquin Valley Agricultural Burning Assessment, February 5. https://ww2.arb.ca.gov/sites/default/files/2021-02/Staff_Recommendations_SJV_Ag_Burn.pdf

[10] CARB (2017) Short-Lived Climate Pollutant Reduction Strategy, March. http://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf

[11] https://calmatters.org/environment/2021/02/air-board-san-joaquin-valley-burns/

[12] SJVAPCD (2020) Final 2020 Staff Report and Recommendations on Agricultural Burning, San Joaquin Valley Air Pollution Control District, December 17. https://www.valleyair.org/BurnPrograms/open-burn-report-progress/documents/2020-ag-burning-staff-report/2020-Ag-Burn-Report.pdf

which pulls about 70 percent of its feedstock from agricultural waste streams mostly within 35 miles, is centrally situated amid the region with the highest particulate matter impacts from open burning of agricultural wastes (see Figure 1). Closing this facility prematurely, before additional capacity and alternatives to open burning are in place, would inevitably lead to increased open burning and associated harmful impacts.

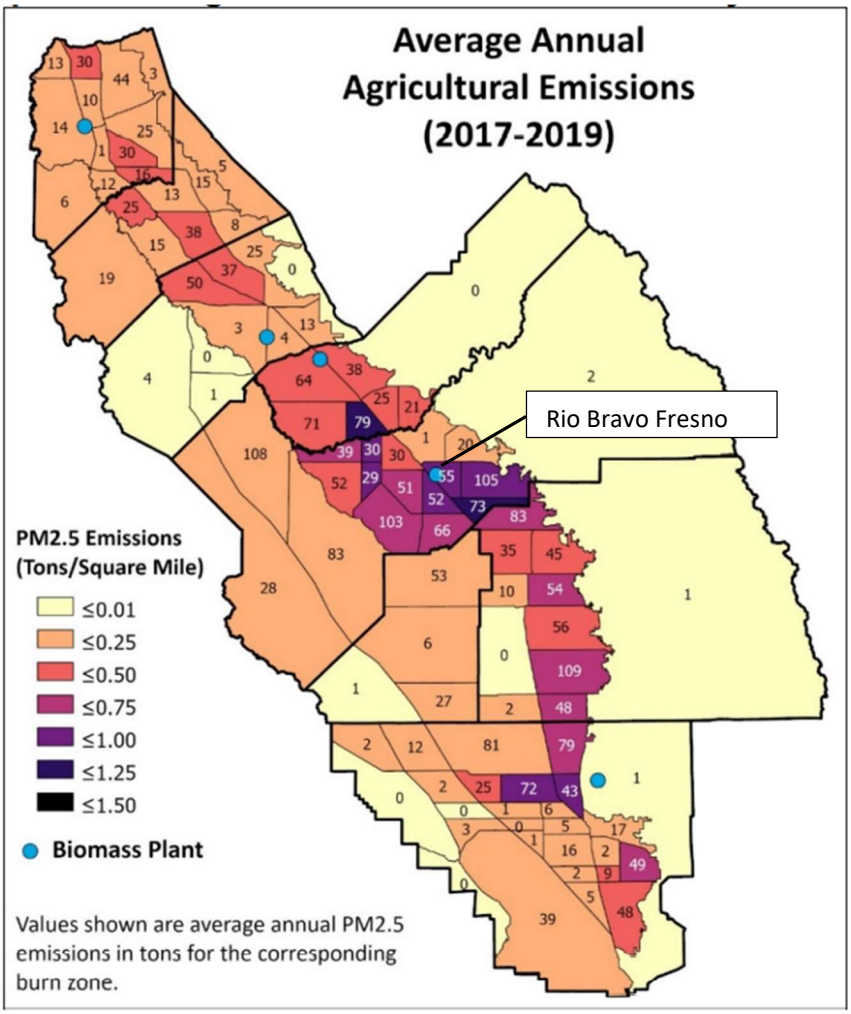

Figure 1. PM2.5 Emissions in the Valley from Open Burning.[13]

Biomass Energy Production is an Important Element of California's Wildfire and Forest Management Strategy

[13] SJVAPCD (2020) Final 2020 Staff Report and Recommendations on Agricultural Burning, San Joaquin Valley Air Pollution Control District, December 17. https://www.valleyair.org/BurnPrograms/open-burn-report-progress/documents/2020-ag-burning-staff-report/2020-Ag-Burn-Report.pdf

Tragically, the impacts of wildfire have become a new normal in California. Among other causes, the drought and other climate change impacts have decimated our forests, leaving nearly 150 million dead and dying trees amid overstocked landscapes.[14]

The state is actively trying to minimize this risk by accelerating and improving forest management. It recently entered into an agreement with the federal government to treat at least 1 million acres of forest and wildlands in the state each year.[15]

Recycling forest byproducts to avoid burning slashpiles is a specific element of this agreement, and the state has a prevailing goal of diverting an additional 50 percent of woody waste from pile burning and open decay through increased biomass utilization, including as energy.[16]

Shuttering Rio Bravo Fresno, which utilizes forest waste biomass for about 15 percent of its feedstock, would set the state back on its efforts to improve forest management in a manner that maximizes climate and health air quality benefits.

Biomass Energy is Integral to Reducing Potent "Super Pollutants"

Biomass energy is also an important strategy help reduce emissions of potent, short-lived climate pollutants (often referred to as "super pollutants," or SLCPs), which are responsible for up to 45 percent of current global warming and millions of premature deaths globally each year.[17,18] Key among these are methane, which lasts in the atmosphere for about a decade and has a global warming impact 84-87 times worse than carbon dioxide over 20 years,[19] and black carbon, which has a climate impact that is thousands of times worse than carbon dioxide, impacts global weather and precipitation patterns, and as a key element of particulate matter, contributes to hundreds of thousands of deaths in the U.S. each year.[20]

Biomass burning is responsible for three-quarters of the state's black carbon inventory –

[14] https://www.fs.usda.gov/detail/catreemortality/toolkit/?cid=FSEPRD609121
[15] (2020) California, U.S. Forest Service Establish Shared Long-Term Strategy to Manage Forests and Rangelands, August 13. https://www.gov.ca.gov/2020/08/13/california-u-s-forest-service-establish-shared-long-term-strategy-to-manage-forests-and-rangelands/
[16] CalEPA, CNRA, CDFA, CARB, SGC (2019) January 2019 Draft California 2030 Natural and Working Lands Climate Change Implementation Plan, https://ww2.arb.ca.gov/resources/documents/nwl-implementation-draft
[17] https://www.ccacoalition.org/en/content/short-lived-climate-pollutants-slcps
[18] https://www.ccacoalition.org/en/content/short-lived-climate-pollutant-solutions
[19] U.S. EPA (2021) Understanding global warming potentials, Accessed June 1, 2021. https://www.epa.gov/ghgemissions/understanding-global-warming-potentials
[20] Smart Freight Centre. Black Carbon Methodology for the Logistics Sector. Global Green Freight Project, 2017. https://www.ccacoalition.org/sites/default/files/resources/2017_black-carbon-methodology-for-logistics.pdf

from wildfires, prescribed fire, agricultural burning, fireplaces and wood stoves.[21] In a modern biomass energy facility, there are virtually no particulate matter or black carbon emissions, significantly reducing climate and health impacts further, compared to alternative disposal methods of biomass residues.

California has developed a leading Short-Lived Climate Pollutant Reduction Strategy, which aims to reduce emissions of SLCPs by 40-50 percent by 2030.[22] Among an integrated set of efforts to reduce emissions of methane, black carbon, and other pollutants, the Strategy incorporates the state's Bioenergy Action Plan, which itself aims to increase energy production from biomass residues, including from agricultural, forest and urban waste streams.[23]
Key elements of the Strategy include diverting organic waste from landfills and generating energy from agricultural waste streams. While wildfire and prescribed fire are excluded from the state's SLCP reduction targets, biomass energy is a key strategy for reducing forest-related black carbon emissions. Indeed, as part of the State's prevailing overarching climate change plan, CARB specifies that biomass waste from agricultural and forestry operations "should be used in a manner that minimizes GHG and black carbon emissions and promotes public and environmental health."[24]

Biomass Energy is Essential for Achieving Carbon Neutrality in California

As California and many other jurisdictions set their sights on erasing their climate footprint and achieving carbon neutrality and net-negative greenhouse gas emissions, carbon removal strategies that pull carbon dioxide out of the air will become critical. These strategies include reforesting and other strategies to increase carbon uptake in natural systems, as well as purpose-built machines that suck carbon dioxide out of the air for use in new products or safe storage underground.

The most promising negative emissions strategy for California is biomass energy with carbon capture and sequestration. A report by Lawrence Livermore National Lab found this provides, by far, the greatest potential for carbon removal and is essential to achieving carbon neutrality in California.[25]

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[21] CARB (2015) GHG Short-Lived Climate Pollutant Inventory, https://ww2.arb.ca.gov/ghg-slcp-inventory
[22] CARB (2017) Short-Lived Climate Pollutant Reduction Strategy, March. http://ww2.arb.ca.gov/sites/default/files/2020-07/final_SLCP_strategy.pdf
[23] O'Neill, Garry (2012) 2012 Bioenergy Action Plan, California Energy Commission, Efficiency and Renewables Division, August. https://resources.ca.gov/CNRALegacyFiles/docs/energy_and_climate_change/2012_Bioenergy_Action_Plan.pdf
[24] CARB (2017) California's 2017 Climate Change Scoping Plan: The strategy for achieving California's 2030 greenhouse gas target, November. https://ww2.arb.ca.gov/sites/default/files/classic//cc/scopingplan/scoping_plan_2017.pdf
[25] Baker, S.E. et al (2020) Getting to Neutral: Options for Negative Carbon Emissions in California,

In fact, it may be California's most overlooked and most promising strategy for addressing climate change. The same report finds that just utilizing existing biomass waste streams in the state could provide the same level of climate benefits as if we eliminated the greenhouse gas emissions from every car and house in California, *combined*.[26] What's more, the report finds these emissions benefits – equal to taking all 25 million cars off California roads and disconnecting all 14 million houses from the natural gas system – could achieved as soon as 2025.

It's no wonder the Governor has proposed to develop a pilot biomass energy facility utilizing forest residues "to create scalable carbon negative pathways for managing the increasing vegetation removed from forests."[27]

California Biomass Energy Facilities Reduce Criteria Pollutant Emissions in California

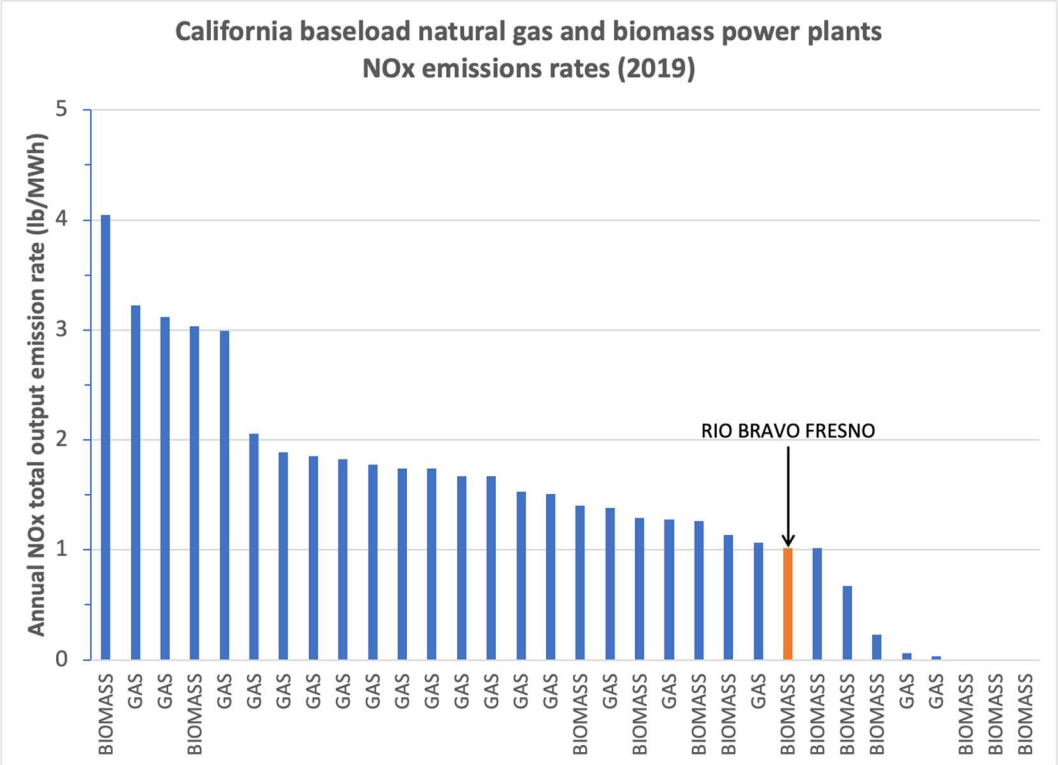
Power plants can serve multiple purposes in addition to providing power to the grid. Some natural gas power plants, for example, provide steam or power to industrial operations that may be cleaner than alternative options. In addition to providing baseload renewable energy for the power grid, California's biomass energy facilities serve the important purpose of helping dispose of agricultural, forest and urban waste streams in ways that reduce regional air pollution and provide significant greenhouse gas benefits.

To understand the emissions impacts associated with an energy facility, it is important to consider the systematic impacts associated with an energy facility's operation – a simple review and comparison of emissions rates at the facility level may not tell the complete story. Still, some claim or assume that biomass energy facilities are inherently dirty and more polluting than other power plants, so a review of the most recent emissions data may be informative.

Lawrence Livermore National Laboratory, LLNL-TR-796100, January. https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf

[26] For example, see Table 40, where biomass-related pathways offer a combined total of 143.3 $MMTCO_2e$ of negative and avoided emissions potential in 2025. According to CARB's 2020 Greenhouse Gas Emissions Inventory, emissions from passenger vehicles were 119.45 $MMTCO_2e$ and emissions from residential fuel use was 25.74 $MMTCO_2e$ in 2018 (the most recent data available), or 145.19 $MMTCO_2e$ combined.
https://ww3.arb.ca.gov/cc/inventory/data/tables/ghg_inventory_scopingplan_sum_2000-18.pdf

[27] https://esd.dof.ca.gov/Documents/bcp/2122/FY2122_ORG3480_BCP4673.pdf



* Includes natural gas and biomass power plants with capacity greater than 20 MW and with capacity factors greater than 60%

Source: US EPA eGRID2019 (*https://www.epa.gov/egrid/download-data*)

The graph above compares NOx emissions rates from baseload natural gas and biomass power plants operating in California, according to the most recent data provided to the U.S. Environmental Protection Agency. Among baseload power plants operating in California, those using biomass have lower average NOx emissions rates than those using natural gas. The NOx emissions rate for Rio Bravo Fresno is in the lowest quartile among those facilities.

California Biomass Energy is Distinct from Practices Elsewhere in the World

There may be valid concerns about the net climate benefits of some biomass energy applications outside of California and the United States, especially biomass energy in Europe or Asia that use imported wood pellets.[28,29]

International greenhouse gas emission accounting protocols track emissions on a country-specific basis. To avoid double counting, they track emissions from biomass

[28] https://www.politico.com/news/magazine/2021/03/26/biomass-carbon-climate-politics-477620
[29] https://www.nytimes.com/2021/04/19/climate/wood-pellet-industry-climate.html

energy in terms of changes in carbon stocks in forests and other natural systems, and not at the point of energy production or use. Therefore, to the extent biomass resources are imported from one country and used in another, the net climate impacts may be difficult to track.

Some environmental advocates with valid concerns about the climate impacts of international biomass trading have begun opposing all biomass energy, including biomass energy in California.

However, these concerns do not apply to biomass that is sourced and used in the same country, or to biomass energy in California. Biomass energy facilities in California, including Rio Bravo Fresno, use local, waste biomass resources, including:

- Dead and dying trees from the state's drought-ravaged forests,
- Agricultural residues, such as orchard prunings, and
- Other biomass waste streams from construction, milling operations, or urban waste.

The net impacts of biomass energy are not uniform across applications or regions and deserve to be evaluated on a case-by-case basis. In the case of Rio Bravo Fresno and other biomass energy facilities in California, the benefits are clear, and clearly distinct from practices in some other parts of the world.

Rio Bravo Fresno: A Necessary Resource Now, and Gateway to the Future of Biomass Energy in California

Rio Bravo Fresno, as well as California's other remaining bioenergy facilities, provide important energy, climate, and regional air quality benefits. While the role of biomass energy may evolve to include carbon capture and sequestration, the ongoing need for biomass energy in California is clear. Rio Bravo Fresno is uniquely situated to serve as a model to bridge the current and future of biomass energy in California.

With a contract that expires in September 2022 – and amid a period of constrained power plant capacity in California and given its central location to agricultural operations in the San Joaquin Valley – keeping the plant online will contribute critically to the state's energy needs and help phase out agricultural burning the Valley. At the same time, the facility can serve as a demonstration of cutting-edge emissions controls and potentially even negative carbon emissions.

Rio Bravo Fresno, and its parent company IHI Power Services, are excited to discuss this opportunity with policymakers and explore ways the facility can further contribute to California's leading environmental objectives, while providing an economic growth

engine in the Central Valley.

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