

February 20, 2024

Chair Liane Randolph and Members of the Board
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Comments of Bloom Energy - Proposed Amendments to the Low Carbon Fuel Standard

Dear Chair Randolph,

Bloom Energy appreciates the opportunity to submit comments in response to the December 19, 2023 Staff Report regarding proposed amendments to the Low Carbon Fuel Standard (LCFS). Acknowledging the complexity and far-reaching nature of the program, we thank the Air Resources Board for steady management over the years while balancing a broad range of interests and stakeholders.

Bloom Energy is a manufacturer of solid oxide fuel cell (SOFC) technology that utilizes an electro-chemical process to power non-combustion microgrids as well as high efficiency electrolyzer systems designed to convert renewable electricity into renewable “green hydrogen.” Bloom Energy’s solid oxide fuel cells and electrolyzers are designed in a modular fault-tolerant format that provides mission critical reliability with no downtime for maintenance. The company has installed over 1000 of its non-combustion solid oxide fuel cell systems for customers in thirteen U.S. states as well as in Japan, South Korea, India and Italy. Bloom Energy’s emission reducing systems have proven resilient through outages caused by hurricanes, winter storms, earthquakes, forest fires, and other extreme weather and natural disasters.

Bloom Energy’s modular design, high efficiency, and ability to utilize biogas without the significant upgrading required for pipeline injection, allows for smaller and remotely located biogas projects to make the most efficient use of this valuable form of renewable energy, producing more electricity for equivalent volumes of biogas than other available technologies. Its electrochemical process produces far fewer criteria pollutants than competing technologies that rely on combustion. Our SOFCs also require virtually no water during operation, mitigating water supply concerns in many areas across the country.

Based on our experience developing projects that consume or generate renewable fuels, we offer the following comments on a few key aspects of the proposal and Staff Report.

Avoided Methane Crediting

Bloom Energy does not support a phaseout of avoided emission credits for biogas to electricity projects, and commends CARB for recognizing the value of these projects by proposing to retain this aspect of the program.

Converting biogas into electricity through scalable, efficient, non-combustion technologies provides outside environmental benefits by eliminating methane emissions and generating reliable clean, firm, renewable electricity. As a short-lived climate pollutant and potent greenhouse gas, methane is a core contributor to climate change and often a difficult pollutant to mitigate. Phasing out avoided methane credits would have the unintended consequence of leaving small or remote methane sources



undeveloped, creating stranded resources that emit methane with no mitigation options. Because small or remote farms or digesters are not biomethane project candidates due to their size and distance from pipelines for injection, in many cases biogas-to-electricity is the only viable option for emissions reductions. In addition, non-combustion biogas-to-electricity projects that supply EV chargers directly serve CARB's goal of improving air quality by reducing vehicle tailpipe emissions through increasing market penetration of Zero Emission Vehicles (ZEVs). As noted in the Staff Report, "[r]educing criteria pollutants and toxic emissions from fuel combustion in line with California's air quality goals requires deploying ZEVs and ensuring the availability of fueling infrastructure to support ZEV deployment."¹ Supporting extremely low carbon intensity (CI) renewable energy to power ZEVs serves both climate and local air quality objectives.

As highly efficient, non-combustion and modular electricity generation systems, fuel cells meet the needs of these small/remote sources. Developing biogas to electricity projects in these locations would deliver critical methane reductions and valuable clean, firm electricity that can be delivered to meet transportation energy demand around the clock. Avoided methane credits are critical to leveraging these resources and developing such projects. And the carbon benefits are not just theoretical; as of this writing, Bloom has three operational non-combustion solid oxide fuel cell biogas-to-electricity projects operational at dairy farms in California. The first project, located in Kerman, CA, received a CARB-certified CI score of -790, the lowest CI score in the history of the LCFS program.²

Book-and-Claim

Currently, biogas-to-electricity projects under the LCFS must physically wheel the power into California, while RNG projects may be located anywhere in North America and utilize book-and-claim accounting to demonstrate use for LCFS compliance. We acknowledge CARB's proposal to limit book-and-claim accounting for RNG starting in 2040 but that is a long time away. We believe that the most efficient, cost-effective way to ensure that the LCFS program enables the most beneficial projects is to maintain a level playing field for pathways that rely on the same feedstock. A major step towards aligning requirements for projects with the same feedstock, and unlocking the untapped emissions reductions of biogas-to-electricity, would be to allow such projects to utilize book-and-claim accounting anywhere in the Western Electricity Coordinating Council (WECC), as is already the case in Oregon under their Clean Fuels Program. This, coupled with the proposed sunset for national book and claim available for RNG projects, would eventually result in regulatory consistency for projects with the same feedstock.

Additionally, Bloom recommends changes that allow biogas-to-electricity projects to qualify when electricity generation and biogas production are not co-located. This is in-line with the California RPS's treatment of "directed biogas" and allows greater project penetration by supporting optimal siting of both the RNG source and the electricity generator rather than requiring co-location. Specifically, where electricity generation is used for on-site EV charging, the project should be permitted to utilize directed biomethane as a power generation fuel provided that the biogas source and the electricity generator are located within the WECC. This additional flexibility would allow many more biogas to electricity projects to participate and would provide for greater deployment of biomethane-fueled microgrids at EV charging stations, which, as noted above, would further CARB's efforts to promote vehicles with zero tailpipe emissions. Of course, this would also bolster California's efforts to address the significant grid capacity

¹ California Air Resources Board. *Public Hearing to Consider the Proposed Amendments to the Low Carbon Fuel Standard, Staff Report: Initial Statement of Reasons*. December 19, 2023.

² Application No. B0490, available at:

https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/b0490_cover.pdf

issues associated with large scale deployment of charging infrastructure across the State by enabling renewable generation to be deployed where it is most needed, rather than where the fuel is generated.

Consideration of Total Environmental Impact

Furthermore, Bloom Energy encourages CARB to reward market participants in the LCFS Program for achieving environmental results beyond carbon reductions. Environmental benefits such as reduced criteria air pollutant emissions in particular warrant consideration as part of the calculation methodology. An increasing body of research has found the economic and health benefits associated with reducing NOx and PM emissions often exceed the economic and health benefits of reducing GHG emissions on a per ton basis.³ Currently, while biogas combustion narrowly serves LCFS program objectives, the associated air pollution runs counter to CARB's broader new and long-standing air quality goals. Alternatively, non-combustion biogas-to-electricity projects meet LCFS objectives while also reducing local air pollution and furthering air quality objectives.

Over the past several years, research has shown that local combustion-related air pollutants are far more harmful to human health and the environment than previously understood. Some key findings that demonstrate the need for clean energy programs to value these impacts include:

- Combustion related air pollution may be as harmful to human lungs as smoking cigarettes;⁴
- Combustion related air pollution increases preterm birth risk;⁵
- Particulate matter (PM) is the largest environmental health risk factor in the nation, and the resulting health impacts are borne disproportionately by disadvantaged communities.⁶

This information is not new to CARB. In fact, the benefits of reduced criteria pollutant emissions are well documented in the Staff Report. To the extent that the proposed amendments do already reduce these emissions, the report states, “[t]he total statewide health benefits derived from criteria emissions reductions is estimated to be approximately \$5 billion, with \$4.9 billion resulting from reduced premature cardiopulmonary mortality and \$85 million resulting the reductions in other adverse health impacts.”⁷

The following table shows the different environmental impacts of non-combustion via a solid oxide fuel cell versus combustion uses of biogas.

³ Institute for Policy Integrity, New York University School of Law, “*How States Can Value Pollution Reductions from Distributed Energy Resources*” July 2018 available at <https://policyintegrity.org/publications/detail/how-states-can-value-pollution-reductions-from-distributed-energy-resources>

⁴ Wang M, Aaron CP, Madrigano J, et al. “*Association Between Long-term Exposure to Ambient Air Pollution and Change in Quantitatively Assessed Emphysema and Lung Function.*” *JAMA*. 2019;322(6):546–556. doi:10.1001/jama.2019.10255 Aubrey, Allison. Air Pollution May Be As Harmful To Your Lungs As Smoking Cigarettes, Study Finds. NPR. 13 August 2019. <https://www.npr.org/sections/health-shots/2019/08/13/750581235/air-pollution-may-be-as-harmful-to-your-lungs-as-smoking-cigarettes-study-finds>

⁵ Mendola, P. et al. “*Air pollution and preterm birth: Do air pollution changes over time influence risk in consecutive pregnancies among low-risk women?*” *International Journal of Environmental Research and Public Health*, 2019. <https://pubmed.ncbi.nlm.nih.gov/31547235/>

⁶ Tessum et al. “*Inequity in consumption of goods and services adds to racial–ethnic disparities in air pollution exposure.*” *PNAS* March 26, 2019 116 (13) 6001-6006; first published March 11, 2019 <https://doi.org/10.1073/pnas.1818859116>

⁷ California Air Resources Board. *Public Hearing to Consider the Proposed Amendments to the Low Carbon Fuel Standard, Staff Report: Initial Statement of Reasons*. December 19, 2023.

Table 1: Comparison of NO_x and SO₂ Emissions

g/MMBtu			
	Non-combustion SOFC ¹	Engine ²	% reduction
NO _x	0.402	385.55	99.9%
SO ₂	0.00039	0.27	99.8%

1. From source testing
2. AP-42 Chapter 3 Section 2 for 2SLB engines

58,000 MMBtu/year of biogas equates to roughly a 1 MW Bloom solid oxide fuel cell system, or 7,900 MWh/year. Using the emissions factors above for an illustrative biogas-to-electricity project and utilizing the corresponding emissions for EPA's Co-Benefits Risk Assessment Health Impacts Screening and Mapping Tool (COBRA),⁸ results in \$1.3 to \$3M of air quality driven health benefits for non-combustion fuel cell over combustion-based generation or flaring. The illustrative 1 MW Bloom project in the above example emits roughly 3,000 MT CO₂e/yr. At the midpoint of the COBRA health benefits calculation (\$2.4M), the additional air quality-driven health benefits of the project equate to roughly \$800/MT. While the LCFS credit market generally values carbon abatement at anywhere from ~\$50 to ~\$200/MT, it does not value air quality benefits at all.

In order to value these significant benefits, Bloom strongly encourages CARB to include a mechanism that appropriately considers criteria air pollutant emission reductions when evaluating electrical generation from biogas and natural gas, across all pathways. One possibility is to include an LCFS credit multiplier such that, when utilizing the same fuel, a project that does not exacerbate air quality issues generates more credits than one that does. Under this model, we recommend setting an emissions threshold of <0.1g/MWh NO_x and <0.01g/MWh SO₂, below which projects receive a credit multiplier of 1.5.⁹ At current and expected LCFS credit prices, this results in far less additional value than the \$800/MT shown above and would be a modest but direct acknowledgement of the societal benefits of improved air quality.

Tier 1 Calculator for Biogas-to-Electricity

For certain fuel pathways the LCFS currently provides Tier 1 CI calculators that help to streamline the application review and validation process. As part of the proposed amendments, Staff proposes to update the calculators to increase usability and further reduce administrative burden on applicants and agency staff. Additionally, the proposed amendments would create a new Tier 1 CI calculator for hydrogen. While the Staff Report justifies the existing Tier I option due to extensive experience reviewing certain pathways, no such claim can be made of hydrogen, which is relatively new and still emerging. This acknowledges the benefits of streamlining without risking the integrity of an existing and robust process.

Bloom supports both of these proposals and the Tier 1 calculators in general. Additionally, we respectfully request that a Tier 1 calculator or other streamlining option be made available for biogas-to-electricity projects. Given the fact that this option is already available for RNG, this would help to provide equal treatment for pathways dependent on the same feedstock.

⁸ <https://www.epa.gov/cobra>

⁹ Note that the emission rates shown in Table 1 are represented in terms of grams per MMBtu.

GREET Model Treatment of CO₂ Storage

With the emergence of various forms of above ground permanent CO₂ storage, such as manufacturing products (including concrete, plastics, etc.) from captured CO₂, we encourage CARB to broaden the definition of permanent CO₂ storage beyond the limited “underground” storage definition currently used. This will incentivize more projects to capture and sequester CO₂, thus achieving even lower carbon intensities and furthering CARB’s goals of aggressive decarbonization of the transportation sector.

A Broader Clean Fuels Standard Will Support Industrial and Commercial Sector Decarbonization

Notwithstanding all of the above, Bloom Energy also wishes to point out that a broader Clean Fuels Standard is necessary to support industrial and commercial sector decarbonization. These sectors have proven hard-to-decarbonize and remain a significant source of GHG emissions that must be addressed to achieve the State’s carbon neutrality goals. As the adopted 2022 Scoping Plan recognizes, changes in fuel use are also critical to reducing GHG emissions from these sectors and biomethane use in these sectors is critical to meeting both 2030 and 2045 Scoping Plan goals.

CARB could and should expand the LCFS program outside of transportation or use the LCFS program as an example to develop and adopt a broader Clean Fuels Standard that would complement the LCFS. Such a standard could impose a decreasing, rate-based target on regulated entities, allowing these sectors to achieve emission reductions in a technology neutral manner by choosing between electrification, procuring low- and zero-carbon and carbon-negative fuels, and/or improving energy efficiency. Such a standard would achieve significant reductions at least cost by enabling compliance flexibilities and harnessing technological innovation. The current LCFS program is providing critical support to the RNG market. Because a significant amount of RNG usage today is occurring in the transportation sector, the LCFS program holds continued importance as the State explores opportunities to incentivize RNG use in other sectors. Competitive pricing and availability of supply will be critical when looking to expand RNG usage to other hard-to-abate sectors. For these reasons, Bloom Energy continues to recommend that discussions about the potential expansion of LCFS or the potential development of a broader standard should happen in parallel with ongoing support provided to the RNG market through the current LCFS.

Bloom Energy appreciates the opportunity to provide comment on this important proceeding. Please do not hesitate to contact the undersigned if we can provide additional information. We look forward to further engagement as stakeholders collaborate to strengthen the LCFS program.

Sincerely,

/s/Jordan Garfinkle

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