August 7, 2022

Cheryl Laskowski
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California Air Resources Board
P.O. Box 2815
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RE: Recommended LCFS Rulemaking Issue- Enabling Low Carbon Intensity Power Sourcing by Fuel Production Facilities

(Comment submitted electronically via https://www.arb.ca.gov/lispub/comm/iframe_bcsubform.php?listname=lcfs-wkshp-jul22-ws&comm_period=1)

Dear Dr. Laskowski,

I am writing to recommend that the California Air Resources Board ("CARB") address the topic of low carbon intensity power ("Low-CI Power") sourcing in the upcoming series of Low Carbon Fuel Standard ("LCFS") public workshops to discuss potential LCFS regulatory revisions. Specifically, I am recommending that CARB authorize the sourcing of Low-CI Power via power purchase agreement ("PPA") for low carbon fuel production facilities. For these facilities, sourcing Low-CI Power can be highly impactful to the fuel pathway's total carbon intensity ("CI") score, particularly for processes such as those that Fulcrum utilizes which are capable of breaking down waste feedstocks. Due to the issue's importance, Fulcrum has been communicating with CARB staff and management on this issue for several years, and has previously submitted similar comments to CARB in communications of June 10, 2020, and again on February 1, 2022.

While our LCFS requested change is unchanged from our prior letters, the necessity of authorizing more flexibility for low carbon fuel production facilities has now been fully demonstrated by:

1. The priorities identified and analysis contained in CARB's Draft 2022 Scoping Plan Update ("Draft Scoping Plan"), and
2. Governor Newsom's recent letter to CARB Chair Randolph regarding new goals and actions to accelerate California's climate goals.

To facilitate efficient review and a complete record, this comment is organized in the following manner:

1. (New) Summary of the crucial determinations made by the Governor and CARB
2. (New) Update on the commissioning of Fulcrum's facility, the first commercial scale municipal solid waste (MSW) to fuel gasification facility preparing to supply fuel to the California market
3. (Previously Submitted) Discussion of Fulcrum's long-term struggle to develop qualifying Low-CI Power and examination of why CARB's carbon neutrality goal necessitates the ability to source Low-CI Power via PPA.

CARB's DRAFT SCOPING PLAN ESTABLISHES THAT TO ACHIEVE CARBON NEUTRALITY BY 2045, CARB MUST AUTHORIZE THE USE OF LOW-CI POWER BY LOW CARBON FACILITIES THAT WILL OTHERWISE BE FORCED TO UTILIZE FOSSIL FUELS FOR HEAT AND PROCESS ENERGY

As stated in the Executive Summary:

"The 2022 Scoping Plan, once final, will be a major milestone, laying out how the fifth largest economy in the world can get to carbon neutrality by 2045 or earlier. This is the first Scoping Plan that adds carbon neutrality as a science-based guide and touchstone beyond statutorily established emission reduction targets. It identifies a technologically feasible, cost-effective and equity-focused path to achieve carbon neutrality by 2045, or earlier, while also assessing the progress the state is making toward reducing its greenhouse gas (GHG) emissions by at least 40 percent below 1990 levels by 2030, as called for in SB 32 and laid out in the 2017 Scoping Plan."[1]

The Transportation sector remains the primary source of GHG emissions in California. The Draft Scoping Plan provides a detailed examination of the sector and contains CARB's Strategies for Achieving Success. The section begins by clearly recognizing the tremendous challenge of transitioning away from liquid fossil fuel reliance:

"The transportation sector has long relied on liquid petroleum fuels as the primary energy source for internal combustion engine (ICE) vehicles, including cars, trucks, locomotives, marine equipment, and aircraft. Combustion of fossil fuels in vehicles emits significant amounts of GHGs, criteria pollutants, and toxic air contaminants. In 2019, the transportation sector accounted for over 50 percent of statewide GHG emissions and thus was by far the single largest sector source of carbon pollution in the state. In addition, the transportation sector accounted for over 75 percent of statewide NOx emissions and the vast majority of particulate matter emissions, 30 percent of which was toxic diesel particulate matter. (…)"[2]

To achieve transformation in fuels, the Draft Scoping Plan recognizes three crucial realities:

"Transitioning away from ICE vehicles is part of the solution, but we must ensure that an adequate supply of zero-carbon alternative fuel is available to power these vehicles."
(…)
"The Low Carbon Fuel Standard is the primary mechanism for transforming California's transportation fuel pool with low-carbon alternatives and has fostered a growing alternative fuel market."
(…)

[1] California Air Resources Board, Draft 2022 Scoping Plan Update (May 10, 2022), at p. 0 of Executive Summary, available at https://ww2.arb.ca.gov/sites/default/files/2022-05/2022-draft-sp.pdf
[2] *Id*. at p. 147 (footnotes omitted).

"*California must use the best available science to ensure that raw materials used to produce transportation fuels do not incentivize feedstocks with little to no GHG reductions from a life cycle perspective.*" [3]

CARB's analysis in the Draft Scoping Plan recognizes that the LCFS is the most powerful policy tool that California has in the transportation sector, that internal combustion ("ICE") vehicles will persist on California's roads beyond 2045, and that to meet carbon neutrality California must tap into fuels made from zero or carbon negative feedstocks. As discussed in a subsequent section of the comment letter, **Fulcrum is doing its level best to be the first zero carbon liquid fuel provider to deliver the zero or subzero CARB fuel that California must have**. However, like all facilities capable of producing liquid fuels from the most promising and abundant second generation feedstocks identified in the Getting to Neutral Report,[4] Fulcrum's gasification process is energy intensive. Thus, while Fulcrum's MSW feedstock is recognized by CARB as carbon negative, Fulcrum's energy use causes the total CI of the pathway to be significantly carbon positive.

As the first gasification facility that will utilize MSW to produce liquid transportation fuels for the California market, Fulcrum is a real-world test case regarding whether California's LCFS can stimulate sufficient demand for zero carbon fuels to enable the full substitution of zero carbon fuels for liquid petroleum fuels by 2045. Unfortunately, Fulcrum's experience reveals that the LCFS contains a critical design flaw in not enabling such a facility to source zero carbon energy.

The need to integrate practically feasible, zero carbon energy sourcing flexibility into the LCFS is further reinforced by Governor Newsom's recent establishment of new goals and actions that he requested be integrated into the final Scoping Plan. In the section entitled, "Moving Away from Fossil Fuels," the Governor stated,

> *"We must look for greater opportunities to reduce our dependence on fossil fuels to achieve our air quality and climate targets, including in our electricity and transportation sectors. To urgently move away from fossil fuels, and accounting for actions that are underway to preserve reliability and accelerate deployment of clean energy,* ***I am requesting that state agencies plan for an energy transition that***

[3] Id. at 152-154.

[4] Sarah E. Baker, Joshuah K. Stolaroff, George Peridas, Simon H. Pang, Hannah M. Goldstein, Felicia R. Lucci, Wenqin Li, Eric W. Slessarev, Jennifer Pett-Ridge, Frederick J. Ryerson, Jeff L. Wagoner, Whitney Kirkendall, Roger D. Aines, Daniel L. Sanchez, Bodie Cabiyo, Joffre Baker, Sean McCoy, Sam Uden, Ron Runnebaum, Jennifer Wilcox, Peter C. Psarras, Hélène Pilorgé, Noah McQueen, Daniel Maynard, Colin McCormick, Getting to Neutral: Options for Negative Carbon Emissions in California, January, 2020, Lawrence Livermore National Laboratory, LLNL-TR-796100, at p. 29, available at https://www-gs.llnl.gov/content/assets/docs/energy/Getting_to_Neutral.pdf (footnotes omitted, hereafter "Getting to Neutral Report"). The Getting to Neutral Report identifies woody biomass from forest treatments, agricultural residues, and MSW as the most promising second generation feedstocks that are abundant and zero carbon.

avoids the need for new natural gas plants to meet our long-term energy goals while ensuring reliability and meeting growing demand for electricity."[5]

Thus Governor Newsom is calling upon CARB to do everything possible not just to reduce liquid petroleum use but also gaseous fossil fuel use. For facilities like Fulcrum's that cannot site solar or wind at their facility location, the facility must source energy from the grid which will create continued demand for fossil natural gas. As described by this comment letter, Fulcrum has gone to great lengths to comply with the current LCFS regulatory requirement for Low-CI Power sourcing. Unfortunately, the siting difficulties and capital costs associated with establishing large scale renewable power generation coupled with the regulatory regimes that govern power sourcing where Fulcrum is planning on building production facilities create additional significant barriers to comply with CARB's Low-CI Power requirements. As a result, under the current version of the LCFS regulation, Fulcrum may have no other option but to source and utilize substantial electrical power from fossil-based electric grids and thereby release unnecessary CO_2 into the atmosphere during the production of low carbon fuels and undercutting California's carbon neutral goal.

By adding Low-CI Power sourcing flexibility for all low carbon fuel production facilities, CARB would decrease demand for fossil power, increase demand for Low-CI Power, and speed fulfillment of California's aggressive decarbonization and petroleum reduction goals. This topic therefore warrants CARB's consideration.

Fulcrum's Next Generation Biofuel Processing Technology

Fulcrum is the parent company of Fulcrum Sierra BioFuels, LLC ("Sierra BioFuels"). Sierra BioFuels owns and operates a commercial scale low carbon fuel production facility comprised of a Feedstock Processing Facility and a biorefinery (together the "Sierra BioFuels Plant"). The Feedstock Processing Facility has been operational since 2017 and is located adjacent to the Lockwood Regional Landfill in Storey County, Nevada. The Feedstock Processing Facility receives MSW that would otherwise be landfilled. A sophisticated feedstock processing system shreds, screens, and sorts the MSW producing a MSW-derived feedstock. The resulting products from the Feedstock Processing Facility include the MSW-derived feedstock and recoverable materials with market value (e.g. ferrous and nonferrous metals and high value plastics).

The biorefinery is fully constructed and is located approximately 20 miles east of Reno in the Tahoe-Reno Industrial Center. The biorefinery is now undergoing commissioning and expected to achieve first production in the late summer or early fall of 2022. The biorefinery will ultimately have the capability to convert the MSW–derived feedstock into very low carbon diesel fuel, jet fuel, and bio-crude using a three-step process comprised of steam reforming, Fischer-Tropsch ("FT") synthesis, and hydroprocessing.

[5] Governor Gavin Newsom Letter of July 22, 2022, to CARB Chair Liane Randolph, at page 2, available at https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf?emrc=1054d6 (emphasis in original).

Initially, the biorefinery will produce bio-crude which will be co-processed at a conventional refinery into finished fuels.

Fulcrum is also in the development stage of comparable facilities, including Fulcrum Centerpoint in Gary, Indiana. Centerpoint will have triple the production capacity of the Sierra BioFuels Plant, with an estimated annual output of over 30 million gallons. Two Feedstock Processing Facilities will divert 700,000 annual tons of MSW from the Greater Chicago area prior to conversion into low carbon fuels at the biorefinery. This project is in advanced development with operations targeted to start in 2025. Fulcrum plans to build an additional 12+ similar plants across the United States.

Current LCFS Requirements Pertaining to Low-CI Power

The controlling general rule regarding Low-CI Power for fuel pathways is found in §95488.8, titled "Fuel Pathway Application Requirements Applying to All Classifications." Section 95488.8(h) provides that a fuel pathway applicant cannot indirectly source Low CI power via PPA or other means. In order to effectively source Low CI power for LCFS fuel pathway purposes, the generation equipment must be: "directly connected through a dedicated line to a facility such that the generation and the load are both physically located on the customer side of the utility meter" per the requirement of §95488.8(h)(1)(B).

The full text of this provision relating to Low-CI Power is as follows:

> *(h) Renewable or Low-CI Process Energy. Unless expressly provided elsewhere in this subarticle, indirect accounting mechanisms for renewable or low-CI process energy, such as the use of renewable energy certificates, cannot be used to reduce CI. In order to qualify as a low-CI process energy source, energy from that source must be directly consumed in the production process as described in (1) and (2) below:*
>
> *(1) Low-CI electricity must be supplied from generation equipment under the control of the pathway applicant. Such electricity must be able to demonstrate:*
>
> *(A) Any renewable energy certificates or other environmental attributes associated with the energy are not produced, or are retired and not claimed under any other program with the exception of the federal RFS, and the market-based compliance mechanism set forth in title 17, California Code of Regulations Chapter 1, Subchapter 10, article 5 (commencing with section 95800).*
>
> *(B) The generation equipment is directly connected through a*

dedicated line to a facility such that the generation and the load are both physically located on the customer side of the utility meter. The generation source may be grid-tied, but a dedicated connection must exist between the source and load.

(C) The facility's load is sufficient to match the amount of low-CI electricity claimed using a monthly balancing period.

(…)

Lessons Learned through Fulcrum's Efforts to Source Low CI Power

Fulcrum is committed to using Low-CI power throughout its portfolio; however, current LCFS Low-CI Power sourcing requirements are challenging for even greenfield facilities to implement, and as a result are likely to result in sub-optimal outcomes than more flexible approaches.

The requirement for a dedicated connection behind the utility meter between the Low-CI power generation source and the biorefinery is particularly difficult. The impediment that is most difficult to overcome is securing a suitable site for Low-CI Power generation in the immediate vicinity of a suitable site for a biorefinery. Fulcrum biorefineries convert Separated MSW into fuels. In order to best source this waste stream, Fulcrum's preferred sites are near cities and populations that generate large volumes of trash. These areas are typically land constrained and lack the open spaces required for Low-CI Power (e.g., 200+ acres for a sufficient solar farm). Thus for Fulcrum, the LCFS behind the meter requirement consistently results in either the Low-CI Power generating facility or the biorefinery being sub-optimally located. In addition, imposing the requirement of co-developing a dedicated renewable power source on an advanced biorefinery dramatically increases capital cost and adds another element of risk to project development.

In addition to these substantial impediments, even in circumstances where a dedicated behind-the-meter connection is physically possible, utility regulations may preclude a biorefinery from having a behind-the-meter connection and being a retail utility customer at the same time. While not being connected to the grid is an option, this would require large amounts of storage infrastructure that would render the entire project uneconomical.

The alternative of building the Low-CI Power project at a distance from the biorefinery and then transmitting the Low-CI Power to the biorefinery is also fraught with difficulties. Unless there is pre-existing electric transmission infrastructure, building new transmission lines is prohibitively expensive and lengthy, assuming the right-of-way exists and permits can be obtained. Even in the rare case when transmission infrastructure exists, local electric power regulations may prevent the biorefinery from using transmission lines. For example, the biorefinery may have to purchase all other power in

the wholesale market which would require a wholesale power permit. These permits depend on factors outside of the control of the applicant, such as the availability of sufficient transmission capability and subject projects to uncertainty, costs, and lengthy delay.

California Policy Requires Decarbonization of the Transportation Sector

Pursuant to SB 32 and AB 197, California must reduce its GHG emissions 40% below 1990 levels by 2030 necessitating dramatic GHG reductions compared to current policies. Transportation emissions are the dominant GHG emissions source, constituting 41% of California's total GHG emissions of 424.1 $MMTCO_2e$.[6] Transportation GHG emissions have clearly emerged as the most difficult sector to decarbonize with transportation's rising from 35% of California's GHG emissions in 2015 to 41% in 2017.[7]

Pursuant to Governor Brown's Executive Order B-55-18, California has a statewide goal to achieve carbon neutrality as soon as possible, and no later than 2045, and to achieve and maintain net negative emissions thereafter in addition to statewide targets of reducing GHG emissions including SB 32 and AB 197.[8] In addition, the Executive Order provides that, "The California Air Resources Board shall work with relevant state agencies to ensure future Scoping Plans identify and recommend measures to achieve the carbon neutrality goal."

To identify negative emissions pathways that physically remove CO_2 from the atmosphere and that can enable California to meet its goal of achieving carbon neutrality by 2045, the Lawrence Livermore National Laboratory developed a recently published report entited, Getting to Neutral, Options for Negative Carbon Emissions in California ("Getting to Neutral Report"). Within the acknowledgments section of the Getting to Neutral Report, the technical information supplied by Jim Macias and Flyn van Ewijk of Fulcrum were recognized. The report identified the conversion of waste biomass to fuels, such as the conversion of Separated MSW to liquid fuels by Fulcrum, as one of the three primary pillars for California to reach 125 million tons of negative emissions annually. The Getting to Neutral Report estimates the total quantity of MSW available in California annually to be 13M bone dry tons, and determines there to be no incremental collection cost due to the existing waste collection system.[9] The "Gasification with Fischer-Tropsch Synthesis to Liquid Fuels" section of the report references a single facility:

[6] Air Resources Board, Public Workshop on the Transportation Sector to Inform Development of the 2030 Target Scoping Plan Update, September 14, 2016, https://www.arb.ca.gov/cc/scopingplan/meetings/091316/FINAL%20Scoping%20Plan%20Transport%20Workshop.pdf (last viewed September 19, 2016), at slide 11 and 14.
[7] Presentation of Executive Officer Richard Corey, slide entitled "Transportation Remains a Key Focus," presented at Argus Biofuels & Carbon Markets Summit, October 22, 2019, at slide 11.
[8] Executive Order B-55-18, available at https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf
[9] Getting to Neutral Report, at p. 29 (footnotes omitted).

> *"Within the state of California, this general type of biomass-to-liquid-fuels process has been developed by Fulcrum BioEnergy, based in Pleasanton. At their Sierra Biofuels plant, located in Storey County, NV, (estimated to begin operation in 2020), 175,000 tons per year of prepared feedstock (prepared from Municipal Solid Waste) will be gasified and then converted into a synthetic crude oil via Fischer-Tropsch synthesis. The gasification system is from ThermoChem Recovery International. Once fully operational, the plant will produce 11 million gallons of synthetic crude oil per year that will be processed by Marathon Petroleum into transportation fuel. The resultant liquid fuels will have a lifecycle emissions reduction of approximately 80% compared to their fossil counterparts."*[10]

The Getting to Neutral Report notes, however, that the cost of transporting CO2 combined with the limited availability of sequestration sites around the states are factors that limit the actual amount of negative emissions that can be achieved from biomass sources.[11] To address this concern, it is imperative that CARB facilitate the use of Low-CI Power by cutting edge biorefineries such as Fulcrum's in order to meet the state's carbon neutrality goals.

To further enable California to fulfill the goal of carbon neutrality by 2045 established by Governor Brown's Executive Order B-55-18, the California Legislature approved the Budget Act of 2019 (AB 74) that funded two studies, administered by the California Environmental Protection Agency, to: 1) identify strategies to reduce emissions from transportation energy use, and 2) identify strategies to manage the decline in fossil fuel production and associated emissions in parallel with reductions in demand. The study to reduce emissions from transportation use was conducted by the University of California Institute of Transportation Studies ("ITS") at four campuses, UC Davis, UC Berkeley, UC Irvine, and UCLA.

The resulting ITS report is entitled, "Driving California's Transportation Emissions to Zero."[12] While California leads the nation in electrifying transportation, the primary strategy developed in the report still recognized the reality that forcing all internal combustion engines off the road by 2045 is not feasible. As a result, the Driving California's Transportation Emissions to Zero report concluded that to achieve carbon neutrality it was necessary for California to make a complete transition by 2045 from petroleum-based gasoline to bio-based gasoline including ethanol blends as is illustrated in the following chart.

[10] Id. at 53.
[11] Id. at 69.
[12] Institute of Transportation Studies, "Driving California's Transportation Emissions to Zero," (April 2021), available at https://escholarship.org/uc/item/3np3p2t0

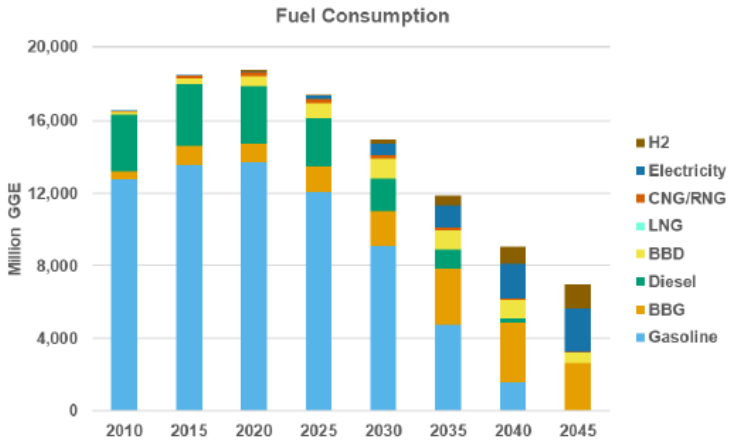

Figure EX-2. CO_2 emissions and fuel consumption projections in the LC1 scenario. The near-zero CO_2 emissions target is reached by 2045, with nearly all fossil fuels replaced by electricity, hydrogen, and biofuels at that date. (MMT, million metric tonnes; SAF, sustainable aviation fuel; H2, hydrogen; CNG/RNG, compressed natural gas/renewable natural gas; LNG, liquefied natural gas; BBD, bio-based diesel, including biodiesel and renewable diesel; BBG, bio-based gasoline, including ethanol blends and drop-in gasoline replacement fuels)

Driving California's Transportation Emissions to Zero

In order to enable the displacement of fossil fuels with bio-based gasoline and bio-based diesel fuel, it is essential that California facilitate the rapid expansion of next generation fuel facilities that utilize plentiful and Low-CI feedstocks, such as the Separated MSW feedstock that Fulcrum's facilities utilize.

<u>Recommended Revision to LCFS to Enable Low-CI Power Sourcing</u>

Fulcrum proposes the following modification of §95488.8(h) to enable Low-CI Power sourcing by low carbon fuel production facilities.

§ 95488.8. Fuel Pathway Application Requirements Applying to All Classifications.

(…)

(h) *Renewable or Low-CI Process Energy.* Unless expressly provided elsewhere in this subarticle, indirect accounting mechanisms for renewable or low-CI process energy, such as the use of renewable energy certificates, cannot be used to reduce CI. In order to qualify as a low-CI process energy source, energy from that source must be directly consumed in the production process as described in (1) and (2) below:

(1) Low-CI electricity must be supplied from generation equipment under the control of the pathway applicant <u>or subject to a firm power purchase agreement (PPA) from generating equipment within the same balancing authority as the facility</u>. Such electricity must be able to demonstrate:

(A) Any renewable energy certificates or other environmental attributes associated with the energy are not produced, or are retired and not claimed under any other program with the exception of the federal RFS, and the market-based compliance mechanism set forth in title 17, California Code of Regulations Chapter 1, Subchapter 10, article 5 (commencing with section 95800).

~~(B) The generation equipment is directly connected through a dedicated line to a facility such that the generation and the load are both physically located on the customer side of the utility meter. The generation source may be grid-tied, but a dedicated connection must exist between the source and load.~~

(B) The facility's load is sufficient to match the amount of low-CI electricity claimed using a monthly balancing period.

(…)

Conclusion

By implementing this proposed change to enable Low-CI Power sourcing by facilities via power purchase agreement, CARB would facilitate the achievement of California's GHG and petroleum reduction goals.

Thank you for your consideration of our input. We would welcome the opportunity to provide any further information that would be value to ARB on this subject.

Sincerely,

Benny Wong
Fulcrum BioEnergy, Inc.

Cc: Staff Air Pollution Specialist Jacob Englander
Industrial Strategies Division Chief Matthew Botill
Deputy Executive Officer Rajinder Sahota