June 10, 2020

James Duffy
Branch Chief, Transportation
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

RE: Recommended LCFS Workshop Issue- Enabling Low Carbon Intensity Power Sourcing by Fuel Production Facilities

(Comment submitted electronically to LCFSWorkshop@arb.ca.gov)

Dear Mr. Duffy,

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 Low Carbon Fuel Standard ("LCFS") Public Workshop to Discuss Potential Regulation Revisions for 2022 ("LCFS Revisions Workshop"). 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.

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, depending on site and location, Fulcrum may have no other option but to utilize substantial power from fossil-based electric grids and thereby release unnecessary CO_2 into the atmosphere during the production of low carbon fuels.

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 criteria pollutant reduction goals. This topic therefore warrants consideration in the LCFS Revisions Workshop.

Fulcrum's Next Generation Biofuel Processing Technology

Fulcrum is the parent company of Fulcrum Sierra BioFuels, LLC ("Sierra BioFuels"). Sierra BioFuels is constructing and will own and operate 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 is operational and is located near the Lockwood Regional Landfill in Storey County, Nevada. The biorefinery is located approximately 20 miles east of Reno in the Tahoe-Reno Industrial Center. The Sierra BioFuels Plant will transform post separated municipal solid waste ("Separated MSW") into very low carbon fuels including a distillate product that is anticipated to meet ARB's stringent future standard for low emission diesel fuel. The Feedstock Processing Facility will receive Separated MSW that would otherwise be landfilled. A sophisticated feedstock processing system will shred, screen, and sort 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 will 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. The biorefinery is expected to begin commissioning in the second half of 2020.

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 approximately 30 million gallons. Two Feedstock Processing Facilities will process MSW from the Greater Chicago area prior to conversion into low carbon fuels at the biorefinery. This project is in advanced development with construction anticipated to begin in 2021. Fulcrum plans to build an additional five or six 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. As a result, 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 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 $MMTCO_2e$.[1] 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.[2]

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.[3] In addition, the Executive Order provides that, "The California Air Resources Board shall work with relevant state agencies to

[1] 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.
[2] 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.
[3] Executive Order B-55-18, available at https://www.ca.gov/archive/gov39/wp-content/uploads/2018/09/9.10.18-Executive-Order.pdf

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 identifed 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.[4] The "Gasification with Fischer-Tropsch Synthesis to Liquid Fuels" section of the report references a single facility:

> *"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."*[5]

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.[6] 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.

---

[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).

[5] Id. at 53.

[6] Id. at 69.

California Policy Requires Substantial Reductions in Criteria Pollutants

In addition to GHG reductions, California has also established aggressive criteria pollutant reduction requirements. In its Mobile Source Strategy, ARB has proposed to establish standards for Low-Emission Diesel ("LED"), that would require that diesel fuel providers to sell steadily increasing volumes of LED until it comprises 50% of total state diesel sales by 2031. Based on current California Energy Commission ("CEC") estimates, this will require 1.6 billion of LED supply.[7] Based on LCFS data, there was a combined total of 311 million DGE of renewable diesel, biodiesel, BioCNG and BioLNG supplied in 2015, representing less than 20% of the 2030 target.[8]

Similarly, in the Revised 2016 State Strategy for the State Implementation Plan, CARB proposed the same target as the Mobile Source Strategy of 50% diesel market penetration by LED by 2031. Notably, only some portion of the current LCFS alternative diesel fuel supply would meet the LED standard referenced in the Proposed SIP of 30-60 g CO2e/MJ, less than one percent aromatics, and virtually no sulfur.[9]

CARB is at the early stages of an informal rulemaking process that is anticipated to lead to the adoption of a Low Emission Diesel Standard, as discussed in the Fuels Update Concept Paper.[10]

Recommended Revision to LCFS to Enable Low-CI Power Sourcing

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

[7] Air Resources Board, Mobile Source Strategy, May 2016, https://www.arb.ca.gov/planning/sip/2016sip/2016mobsrc.pdf (last viewed September 19, 2016) at p. 151, 153-155.

[8] Air Resources Board, LCFS Data Dashboard, Tab 2, Alternative Fuel Volumes and Credit Generation https://www.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm and accompanying spreadsheet (last viewed September 12, 2016).

[9] Air Resources Board, Proposed 2016 State Stratetgy for the State Implementation Plan, May 17, 2016, https://www.arb.ca.gov/planning/sip/2016sip/2016statesip.pdf (last viewed September 12, 2016) at 101-103.

[10] Air Resources Board, Fuels Update Concept Paper at https://ww2.arb.ca.gov/resources/documents/fuels-update-concept-paper

(1) and (2) below:

(1) Low-CI electricity must be supplied from generation equipment under the control of the pathway applicant or subject to a firm power purchase agreement (PPA) from generating equipment within the same balancing authority as the facility. 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 purchaser agreement, CARB would facilitate the achievement of California's GHG and criteria pollutant 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,

Bruno Miller
Managing Director, Fuels & Regulatory Affairs
Fulcrum BioEnergy, Inc.