

May 10, 2024

The Honorable Liane M. Randolph
Chair
California Air Resources Board
(Comment submitted electronically)

RE: Infinium Operations, LLC’s Recommendations to Enable California to Harness the Profound Decarbonization Potential of eFuels

Dear Chair Randolph,

Infinium Operations, LLC (“Infinium”) is pleased to submit supplemental comments regarding the California Air Resources Board’s (“CARB”) proposed amendments to the Low Carbon Fuel Standard (“LCFS”). During the 45-day comment period, Infinium respectfully requested that CARB revisit its proposed regulation (the “Proposed Regulation”) pertaining to the sourcing of low carbon intensity power (“Low-CI Power”) as applied to power-to-liquid fuels (“PtL Fuels”) which are also known as “eFuels.” Since the filing of our prior comment, new federal policy regarding Low-CI Power has changed the policy landscape favorably for eFuels. We are therefore updating our comments regarding the optimal LCFS regulatory structure to complement this federal policy. This comment highlights the benefits of aligning the LCFS with section 40B of the Inflation Reduction Act (“IRA”) to standardize Low-CI Power sourcing rules, improve economics for eFuels and enable full commercialization of this vital fuel technology.

Our 45-day comment discussed the critical importance of eFuels to decarbonizing hard to abate sectors including legacy gasoline vehicles, and long-haul aviation. We appreciate that many other stakeholders emphasized the special role of eFuels and that CARB recognizes the vital importance of eFuels. We therefore only briefly revisit this topic with additional support and reference our 45-day comment letter for its analysis and authority.¹

Our prior comment also respectfully requested that CARB enhance the LCFS program by:

1. Establishing a book-and-claim accounting system for hydrogen pipelines that is applicable outside California.
2. Establishing a book-and-claim accounting system for carbon dioxide pipelines that is applicable outside California.
3. Revising the proposed Alternative Fuel definition to account for drop-in eFuel alternatives for gasoline and diesel fuel.

We would like to reiterate the importance of these issues but do not think it necessary to update or restate any of these issues through this Comment. We therefore simply encourage review of our 45-day comment letter on these issues.²

¹ See “Proposed Low Carbon Fuel Standard Amendments, Public Comments Received,” Comment #353, Comment of Infinium RE: Electrofuels, at www.arb.ca.gov/lists/com-attach/7032-lcfs2024-VD1TO1UyUWsHb1O9.pdf at p. 2-5 (hereafter “Infinium 45-day Comment”).

² *Id.* at p. 7-8.

The Critical Issue for eFuels is Access to Low Carbon Intensity Power

As further examined in this comment, the critical issue we raise is that the Proposed Regulation precludes the recognition of greenhouse gas (“GHG”) emission reductions that are achieved by sourcing Low-CI Power delivered over the grid to produce eFuels. By effectively limiting eFuel production facilities to sourcing grid power that includes fossil-based power, the Proposed Regulation precipitously increases the CI of eFuels. Because eFuels effectively convert electricity into drop-in liquid fuels, blocked access to Low-CI Power prevents LCFS credit generation. Exclusion from LCFS revenue opportunities freezes rather than catalyzes the growth of the eFuel industry and the expansion of new sources of renewable power.

The core objective of the LCFS program is the decarbonization of transportation fuels in California. LCFS credit generation opportunities are based on CI reductions achieved as compared to annual CI benchmark standards for diesel, gasoline and fossil jet fuel. Utilizing conventional gasoline as the reference fuel, Table 1 of the current LCFS regulation establishes a CI benchmark standard of 85.77 gCO₂e/MJ for 2025. In order to generate LCFS credits, fuels used as a substitute for gasoline must be certified with a CI score of less than 85.77 gCO₂e/MJ. Market participants that supply gasoline fuel into the California transportation market with a CI score in excess of 85.77 gCO₂e/MJ in 2025 generate deficits that trigger a corresponding obligation to purchase and retire LCFS credits on annual basis.

In the 45-day rulemaking package, CARB proposed to retain the existing LCFS structure for Low-CI power for electric vehicle usage as currently exists in section 95488.8(i)(1)(A)-(B). CARB proposed, however, to restrict the use of book-and-claim accounting for hydrogen to hydrogen used directly as a transportation fuel and to exclude eligibility to hydrogen used to produce a transportation fuel as reflected in proposed section 95488.8(i)(1). This proposed elimination of book-and-claim accounting for hydrogen used to produce a transportation fuel is uniquely damaging to eFuels producers. It is through the production of electrolytic hydrogen that eFuel producers convert electric energy into molecular energy that after further processing and synthesis is converted into drop-in liquid fuels that replace fossil gasoline, diesel and jet fuel. Upon the effective date of an LCFS regulation that effectively provides that electrolytic hydrogen can only be produced from grid mix electricity, eFuel producers are transformed from LCFS credit generators to LCFS deficit generators.

The following estimated CI values for eFuels were determined by internal life cycle analysis (LCA) undertaken by Infinium personnel based on non-proprietary information on eFuels. The CI estimates were made on a wells-to-wheels basis with input values from the upcoming CA-GREET4.0 model. Using these parameters, the forecasted CI score of sustainable aviation eFuel (“eSAF”) produced at an eFuel facility sited in California and utilizing California average grid mix power would exceed 180 gCO₂e/MJ. To the extent that the same eFuel facility could instead utilize book-and-claim accounting to source zero CI power under the current LCFS regulatory structure established by section 95488.8(i)(1)(A)-(B) for both its electrolytic hydrogen production and for all of its electricity use, the eSAF produced at the eFuel facility would achieve a CI score of less than 3 gCO₂e/MJ.

Thus, it is not hyperbolic to assert that the Proposed Regulation represents an existential threat to the establishment of eFuel production facilities that would serve the California market. Pursuant to Table 3 of the existing regulation, “LCFS Carbon Intensity Benchmarks for 2019 for Fuels Used as a Substitute for Conventional Jet Fuel,” an eFuel production facility providing eSAF to the California market would be delivering a fuel that exceeds the 2025 benchmark standard by over 93 gCO₂e/MJ. In contrast, an eFuel production facility that is authorized by the LCFS regulation to source all of its power via a book-

and-claim accounting system that is comparable to the current system for electrolytic hydrogen production would be supplying an eSAF to be uplifted in California with a CI score of 3, a lower CI score than currently exists for any alternative jet fuel in the pathways table.

Infinium

Infinium’s mission is to decarbonize the transportation sector through the production of eFuels, an ultra-low carbon fuel alternative to petroleum derived transportation fuels. Infinium eFuels are drop-in replacements for use in planes, ships and motor vehicles without the need for costly infrastructure changes. Infinium’s proprietary technology utilizes carbon dioxide (CO₂) that would otherwise be emitted, renewable power, and water as feedstocks to produce transportation fuels (e.g. eSAF, eDiesel and eNaphtha), with substantial reductions in lifecycle GHG carbon emissions as compared to fossil-based alternatives. Infinium is financially and strategically supported by its investors, including affiliates of Amazon, NextEra Energy, Mitsubishi Heavy Industries, SK Ventures, and AP Ventures. These world leading companies are interested in both reducing their carbon footprints and innovating solutions to current environmental issues. Infinium operates the first commercial drop-in eFuel facility in the world at its plant in Corpus Christi, Texas. Infinium announced a second commercial eFuel facility in West Texas call Project Roadrunner, which will focus primarily on the production of eSAF to decarbonize air traffic.

Low-CI Power Sourcing is Essential to the Success of eFuels And eFuels are Essential to Successful Decarbonization

This past November, The International Council on Clean Transportation (“ICCT”) published a white paper assessing the feasibility of meeting the targets in the Biden Administration’s SAF Grand Challenge based on “resource availability, production costs, technology readiness level, and policy support.”³ ICCT’s white paper emphasized the importance of eSAF in meeting the 2050 SAF Grand Challenge goal of 35 billion gallons and stated as follows:

Though the technology remains in the demonstration phase, e-fuels have gained significant interest in Europe and other markets due to their ‘drop-in’ advantages and theoretically unlimited supply.(...) These e-fuels are estimated to be costlier than most biomass-derived SAFs in the near-future, but their costs could rapidly come down as electrolyzer technology matures and the cost of renewable electricity declines (Zhou et al., 2022).⁴

Consistent with ICCT’s recognition of the importance of eFuels in the above-referenced white paper entitled Meeting the SAF Grand Challenge, ICCT’s 45-day comment letter to the LCFS rulemaking contained the following comment and recommendation regarding eFuels:

However, we note that as written, the current guidance will restrict the use of e-fuels made from low-CI electricity, as these are not included in the current language. Thus the proposal would effectively restrict low-CI electricity from being eligible for attribution unless it was supplied via a direct electricity connection. However, it is likely that as with most green hydrogen production, grid-connected projects will have greater economic competitiveness due to a higher capacity

³ O’Malley, J., Pavlenko, N., & Kim, Y.H. (2023). Meeting the SAF Grand Challenge: Current and Future Measures to Increase U.S. Sustainable Aviation Fuel Production Capacity. International Council on Clean Transportation. Available at <https://theicct.org/wp-content/uploads/2023/11/ID-37-%E2%80%93SAF-Grand-Challenge-white-paper-letter-40036-v3.pdf>.

⁴ Id.

factor.⁵ Therefore, to provide more flexibility for e-fuel pathways based on converting green hydrogen into other fuels, we recommend that CARB treat these pathways' use of low-CI electricity consistent with green hydrogen and direct air capture. This will still maintain crucial safeguards on project vintage, deliverability and double-counting, while providing necessary flexibility for these projects to use renewable electricity supplied via the grid.⁶

As noted by ICCT, eFuels are costlier than most biomass derived SAF currently and in the near future. However, there is an opportunity to reduce the cost of eFuels as electrolyzer technology matures and the cost of renewable electricity further declines. Success in driving down the cost of both wind and solar power has been an enormous success story that has been led in the US by California policy and optimal LCFS policy design can unlock these Low-CI power sources for hydrogen, SAF and eFuels. This aligns with California's 2022 Scoping Plan's ambitious goals to expand supply and demand for hydrogen while driving down prices. The LCFS is CARB's most powerful and proven tool to introduce and scale these types of Low-CI fuel technologies.

**New Federal Policy Unlocking Low-CI Power for SAF Producers
Through Existing LCFS Regulatory Mechanisms
Should be Integrated into the LCFS for Both SAF and eFuels**

The new federal policy referenced earlier in this Comment is focused not solely on eFuels used in the aviation sector but more broadly on all types of SAF that meets the federal CI standard established by section 40B. Infinium plans to primarily produce SAF at its production facilities but also plans to produce other fuels and feedstocks such as eDiesel as an on-road fuel that meets conventional diesel specifications and eNaphtha that can be utilized as a blendstock to produce gasoline that meets conventional gasoline specifications. Because Infinium intends to produce both SAF and Low CI on-road fuels and due to the uniquely beneficial attributes of eFuels discussed previously in this letter and in our 45-day comment letter, Infinium recommends that CARB authorize indirect accounting for SAF and all eFuels. In addition, because eFuels are drop-in fuels that comply with conventional petroleum-based ASTM specifications, Infinium recommends that CARB adopt an LCFS definition of eFuels to precisely distinguish eFuels from fossil fuels for LCFS regulatory purposes.

The following overview of the newly-established federal Low-CI power sourcing structure for SAF is provided to serve as the policy basis for CARB to implement a similar LCFS regulatory structure applicable not just to SAF but also to hydrogen, direct air capture and eFuels. Under section 40B of the 2022 Inflation Reduction Act ("IRA"), a federal tax credit of \$1.25-\$1.75 per gallon was established for sustainable aviation fuel that attained a carbon intensity reduction of at least 50% (the "SAF Tax Credit") as determined by either: "(1) the most recent Carbon Offsetting and Reduction Scheme for International Aviation ("CORSIA") which has been adopted by the International Civil Aviation Organization with the agreement of the United States, or "(2) any similar methodology which satisfies the criteria under section 211(o)(1)(H) of the Clean Air Act (...)" Section 40B further provides for an additional \$0.01 credit for each additional percent CI reduction above 50%, up to a maximum \$1.75/gallon credit.⁷

⁵ See "Proposed Low Carbon Fuel Standard Amendments, Public Comments Received," Comment #222, ICCT Comments on LCFS Amendments, at www.arb.ca.gov/lists/com-attach/7032-lcfs2024-VD1TO1UyUWsHb1Q9.pdf at p. 22, internal footnote 65 in ICCT comments to <https://theicct.org/publication/fuels-us-eu-cost-ekerosene-mar22/>

⁶ *Id.* at p. 22.

⁷ Inflation Reduction Act, at Sec. 40B. Sustainable Aviation Fuel Credit.

The section 40B SAF Tax Credit provides a strong financial signal to enable fulfillment of California’s ambitious goals for SAF expansion and displacement of fossil jet fuel. Governor Newsom has targeted 20% clean fuels adoption in the aviation sector.⁸ The Legislature has estimated a need for at least 1.5 billion gallons of SAF blending by 2030.⁹ Moreover, in order to fulfill California’s goal of achieving carbon neutrality by 2045, the 2022 CARB Scoping Plan states that 80% of all aviation fuel demand will need to come from SAF by 2045.¹⁰ While California has not yet implemented distinct targets for eFuels, Infinium anticipates that the State may follow the European Union’s and United Kingdom’s lead in adopting such targets in the future for the reasons indicated above by ICCT- “*their ‘drop-in’ advantages and theoretically unlimited supply.*”¹¹ Thus, like hydrogen, SAF and direct air capture, there are sound policy reasons to provide eFuels access to Low-CI Power through proven LCFS indirect accounting methods coupled with a new additionality component that is a refinement to the 3-year rule in the Proposed Regulation.

For California to realize the full potential value of the SAF Tax Credit to fuel SAF and eFuel expansion, it is essential to align the LCA methodology of the LCFS with the LCA methodology established by the U.S. DOE that adheres to Clean Air Act 211(o)(1)(H) criteria as required by the IRA. On April 30, 2024, the U.S. Department of the Treasury and Internal Revenue Service (“Treasury”) released guidance on the SAF Tax Credit (“SAF Credit Guidance”) that was developed in close partnership with the U.S. Environmental Protection Agency (“EPA”), Department of Agriculture (“USDA”) and DOE. As part of the guidance, the agencies comprising the SAF Interagency Working Group jointly announced the 40BSAF-GREET 2024 model (“40BSAF-GREET”).¹²

The SAF Credit Guidance developed by Treasury, EPA, USDA and DOE demonstrates tremendous respect and recognition from the SAF Interagency Working Group to CARB and the State of California for CARB’s groundbreaking work in developing the LCA methodology and regulatory structure of the LCFS program. This recognition is demonstrated by the fact that substantial components of the SAF Credit Guidance are fundamentally informed by the LCFS and that various components of CARB’s LCFS program structure are incorporated into the SAF Credit Guidance, 40BSAF-GREET and the 40BSAF-GREET Guidelines by direct reference to LCFS regulatory provisions.

In the last major LCFS rulemaking, CARB recognized the vital importance of enabling Low-CI power sourcing to electrify transportation and established a policy structure that enabled two categories of LCFS credit generators to choose Low-CI electricity over grid mix power. Specifically, CARB authorized the

⁸ See California Office of the Governor, Governor’s Letter to Chair Randolph. July 22, 2022. <https://www.gov.ca.gov/wp-content/uploads/2022/07/07.22.2022-Governors-Letter-to-CARB.pdf?emrc=1054d6>

⁹ See AB1322 (Rivas) available at https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=202120220AB1322. AB 1322 was passed by the California assembly in 2022 and later vetoed by Governor Newsom, who, in his veto letter, supported the legislature’s intent with the bill and ordered CARB to develop a “plan to reduce greenhouse gas emissions through the production and use of sustainable aviation fuels by July 1, 2024”. Governor Newsom’s veto letter available at <https://www.gov.ca.gov/wp-content/uploads/2022/09/AB-1322-VETO.pdf?emrc=7598b6>

¹⁰ See CARB, 2022 Scoping Plan for Achieving Carbon Neutrality. December 2022. https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf. Page 73. The Scoping Plan scenario envisions 20% of aviation fuel demand met by electricity (batteries) or hydrogen (fuel cells) in 2045, with sustainable aviation fuel meeting the remaining 80%.

¹¹ See Infinium 45-day Comment for detailed information regarding the EU RefuelEU Aviation Program, at p. 4-5.

¹² U.S. Department of the Treasury, “Biden-Harris Administration Partners Announce Updated GREET Model to Measure Lifecycle Emissions from Sustainable Aviation Fuels,” April 30, 2024, at <https://home.treasury.gov/news/press-releases/jy2307>; U.S. Department of Energy, “Guidelines to Determine Lifecycle Greenhouse Gas Emissions of Sustainable Aviation Fuel Production Pathways using 40BSAF-GREET 2024” (April 2024), at https://www.energy.gov/sites/default/files/2024-04/40bsaf-greet_user-manual.pdf, hereafter the “SAF-GREET Guidelines.”

sourcing of Low-CI power for electric vehicle usage and electrolytic hydrogen production via the use of Renewable Energy Certificates (“RECs”).¹³

By establishing an LCA methodology within the LCFS regulation for SAF and eFuels that is consistent with the 40B LCA methodology, CARB will facilitate greater development of these vitally important new fuels for the hard to abate aviation sector as well as for legacy internal combustion engines. Through this regulatory strategy, CARB will also achieve upstream emission reductions and stimulate expansion of Low-CI power generation capacity, storage and transmission.

Due to the importance of Low-CI Electricity to the production of eFuels, and the importance of eFuels to meeting both California’s 2045 carbon neutrality goal and California’s specific goals to displace fossil jet fuel with SAF, we respectfully recommend that CARB modify the proposed LCFS amendments such that eFuel production facilities are authorized to procure Low-CI power for electrolytic hydrogen production and their other energy needs via book-and-claim accounting. Our specific regulatory proposal is included as **Exhibit A** and is effectively a hybrid proposal that includes necessary components from the existing LCFS regulation section 95488.8(i), the proposed LCFS regulation section 95488.8(i), and the DOE’s section 40B guidelines.

Thank you for the opportunity to provide comments. Should you have any questions or would like additional information, please feel free to contact me at dzaziski@InfiniumCo.com.

With kind regards,



David Zaziski, Ph.D.
Vice President, Policy & Government Affairs

¹³ 17 Cal Code Reg. Sec. 95488.8(i)(1)

Exhibit A

This Exhibit shows recommended changes to the existing LCFS regulation in underline and ~~strike-out~~.

Section 95481. Definitions and Acronyms.

- (a) *Definitions.* For the purposes of sections 95480 through 95503, the definitions in Health and Safety Code sections 39010 through 39060 shall apply, except as otherwise specified in this section or sections 95482 through 95503:

(...)

(xx) “eFuel” means a fuel that is produced from captured carbon dioxide and hydrogen.

(...)

Section 95488.8.

(...)

(i) *Indirect Accounting for Renewable or Low-CI Electricity and Biomethane.*

- (1) *Book-and-Claim Accounting for Renewable or Low-CI Electricity Supplied as a Transportation Fuel or Used to Produce Hydrogen.* Reporting entities may use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel or for hydrogen production through electrolysis for transportation purposes (including hydrogen that is used in the production of a transportation fuel), provided the conditions set forth below are met:

(A) Reporting entities may report low-CI electricity used as a transportation fuel or as an input to hydrogen production delivered through the grid without regard to physical traceability if it meets all requirements of this subarticle. The low CI electricity source must have a commercial operation date that is no earlier than thirty-six months before the date when the hydrogen production facility starts production of transportation fuel. The low-CI electricity must be supplied to the grid within a California Balancing Authority (or local balancing authority for hydrogen produced outside of California) or alternatively, meet the requirements of California Public Utilities Code section 399.16, subdivision (b)(1). Such book-and-claim accounting for low-CI electricity may span only three quarters. If a low-CI electricity quantity (and all associated environmental attributes, including a beneficial CI) is supplied to the grid in the first calendar quarter, the quantity claimed for LCFS reporting must be matched to grid electricity used as a transportation fuel or for hydrogen production no later than the end of the third calendar quarter. After that period is over, any unmatched low-CI electricity quantities expire for the purpose of LCFS reporting.

- A. Low-CI electricity can be indirectly supplied through a green tariff program (including the Green Tariff Shared Renewables program described in California Public Utilities Code Section 2831-2833) or other contractual electricity supply relationship that meets the

following requirements:

1. Electricity is generated by, or supplied under contract to, the pathway applicant for all environmental attributes of the claimed electricity. In order to substantiate low-CI electricity claims, the applicant must make contracts available to the Executive Officer, upon request, to demonstrate that the electricity meets the requirements of this subarticle. Generation invoices or metering records are required to substantiate the quantity of low-CI electricity produced from the renewable assets. Monthly invoices must be unredacted copies of originals showing electricity sourced (in kWh) and contracted price;
2. All electricity procured by any LSE for the purpose of claiming a lower CI must be in addition to that required for compliance with the California Renewables Portfolio Standard (described in California Public Utilities Code sections 399.11-399.32) or, for hydrogen produced outside of California, in addition to local renewable portfolio requirements;
3. Renewable energy certificates or other environmental attributes associated with the electricity, if any, 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). Retirement of renewable energy credits for the purpose of demonstrating Green Tariff Shared Renewables procurement to the California Public Utilities Commission does not constitute a double claim.

(2) *Book-and-Claim Accounting for Pipeline-Injected Biomethane Used as a Transportation Fuel or to Produce Hydrogen. (...)*

(...)

(3) *Book-and-Claim Accounting for Renewable or Low-CI Electricity Used to make Alternative Jet Fuel or eFuels. Reporting entities may use indirect accounting mechanisms for low-CI electricity supplied for Alternative Jet Fuel or eFuel production, provided the conditions set forth below are met:*

(A) Reporting entities may report low-CI electricity supplied for Alternative Jet Fuel or eFuel production delivered through the grid without regard to physical traceability if it meets all requirements of this subarticle. The low CI electricity source must have a commercial operation date that is no earlier than thirty-six months before the Alternative Jet Fuel or eFuel production facility starts production of transportation fuel. The low-CI electricity must be supplied to the grid within a California Balancing Authority (or local balancing authority for Alternative Jet Fuel or eFuel produced outside of California) or alternatively, meet the requirements of California Public Utilities Code section 399.16, subdivision (b)(1). Such book-and-claim accounting for low-CI electricity may span only three quarters. If a low-CI electricity quantity (and all associated environmental attributes, including a beneficial CI) is supplied to the grid in the first calendar quarter, the quantity claimed for LCFS reporting must be matched to grid electricity for Alternative Jet Fuel or eFuel production no later than the end of the third calendar quarter. After that period is over, any unmatched low-CI electricity quantities expire for the purpose of LCFS reporting;

(B) All electricity procured by any LSE for the purpose of claiming a lower CI must be in addition to that required for compliance with the California Renewables Portfolio Standard (described in California Public Utilities Code sections 399.11-399.32) or, for Alternative Jet Fuel or eFuel produced outside of California, in addition to local renewable portfolio requirements;

(C) Renewable energy certificates or other environmental attributes associated with the electricity, if any, 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).