TO: Chair Randolph and Members of the Board

FROM: Jane O'Malley and Nikita Pavlenko

RE: Public Meeting to Hear an Update on the Low Carbon Fuel Standard

DATE: September 28, 2023

The following comments on lipid-derived biofuels were submitted in an internal memo to CARB staff on August 28, 2023. The following comments on biomethane were submitted as written comments to the February 2023 LCFS workshop.

Comments on capping the contribution of lipid-derived biofuels

There is evidence that the California Low-Carbon Fuel Standard (LCFS) is leading to soy oil market distortions and these impacts are poised to get worse absent intervention in the current LCFS revision process. California Air Resources Board (CARB) staff have the opportunity to address this issue by establishing a volume or energy-based cap on lipid-based fuels in the LCFS. Our analysis draws the following three conclusions:

1. Over the last three years, the LCFS has greatly increased the consumption of virgin vegetable oils in California. Recent economic modeling of the LCFS suggests that absent intervention, the contribution of soy oil is projected to grow in response to continued incentives from the LCFS. We project that under business-as-usual, LCFS lipids volumes will grow to reach 2.4 billion gallons of diesel-equivalents later this decade.

2. The rapid increase of soy oil consumption is linked to various market distortions, particularly palm oil substitution as soy oil is diverted from food and oleochemical markets. Recent analyses suggest that palm substitution effects add considerable uncertainty to indirect land-use change emissions attributable to soy oil and may increase these emissions considerably.

3. An energy or volume cap on lipid-based biofuels could mitigate the impact of these market distortions and curb the rapid increase in soy demand from the biofuel sector. A cap would set a stable signal to producers and could be updated based on soy yield improvement or a proportional share of EPA's biomass-based diesel volume mandate under the federal Renewable Fuel Standard.

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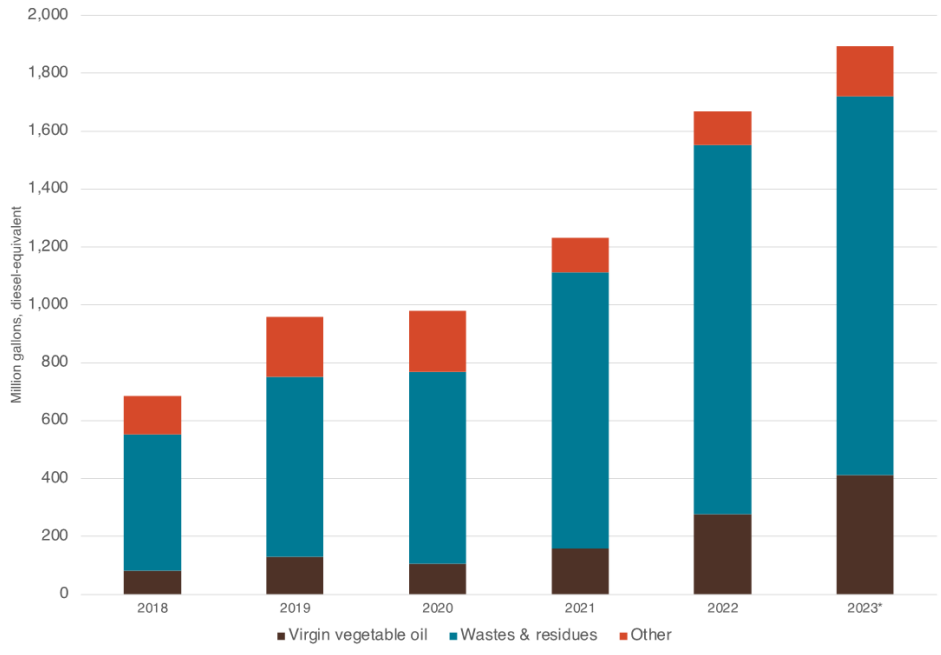
Current Trends and Projections for Biomass-Based Diesel Demand in California

Biomass-based diesel (BBD) comprised of biodiesel and hydrotreated waste and vegetable oils continues to make up a growing share of LCFS program compliance. The share of BBD credited under the program has grown from 1% of total volumes in 2011 to 46% of volumes in 2022.[1] In Q1 2023, BBD made up more than half of compliance volumes for the first time in program history,[2] a landmark celebrated by CARB but one that threatens adverse market and environmental impacts.

Limited availability of domestic waste oils places added reliance on virgin vegetable oils to meet growing market demand for BBD. This is bearing out in the last 2 years of LCFS data, as the growth of BBD from waste oils has begun to slow, whereas the consumption of virgin vegetable oils in California's fuel mix has grown rapidly, increasing by 75% in 2022. We illustrate this growth in million gallons of diesel gallon equivalent grouped by feedstock type in Figure 1. In the coming years, soybean oil is expected to serve as the dominant source of BBD growth in the U.S., consistent with historical trends.[3]



[1] https://ww2.arb.ca.gov/resources/documents/low-carbon-fuel-standard-reporting-tool-quarterly-summaries
[2] Ibid.
[3] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1017OW2.pdf

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Figure 1: Growth of biomass-based diesel consumption credited under the California LCFS, 2018-2023
**note: 2023 consumption is projected based on the first quarter of 2023*

An ICCT model run of the recently updated California Transportation Supply (CATS) model developed by CARB suggests that, absent intervention, the demand for BBD will continue to grow under a baseline, business-as-usual scenario, peaking at approximately 2.4 billion gallons in the next several years. This value exceeds the sustainable availability of vegetable and waste oil feedstocks to California, which we estimate to be 1.2 billion gallons in a previous report.[4] Figure 2 illustrates this projected future growth in red compared to the historical consumption starting in 2018, alongside a scenario wherein the consumption of lipids is capped at 2021 levels. Though BBD consumption in the baseline is projected to decline after 2030, this projection is strongly sensitive to 1) the rate of adoption of zero-emission heavy-duty vehicle technologies that would reduce diesel consumption, and 2) limited markets for drop-in aviation biofuels. If heavy-duty electrification is slow to mature, or if there is higher demand for aviation biofuels due to tax incentives or the obligation of the aviation sector under the LCFS, this could continue to place upward pressure on BBD demand.

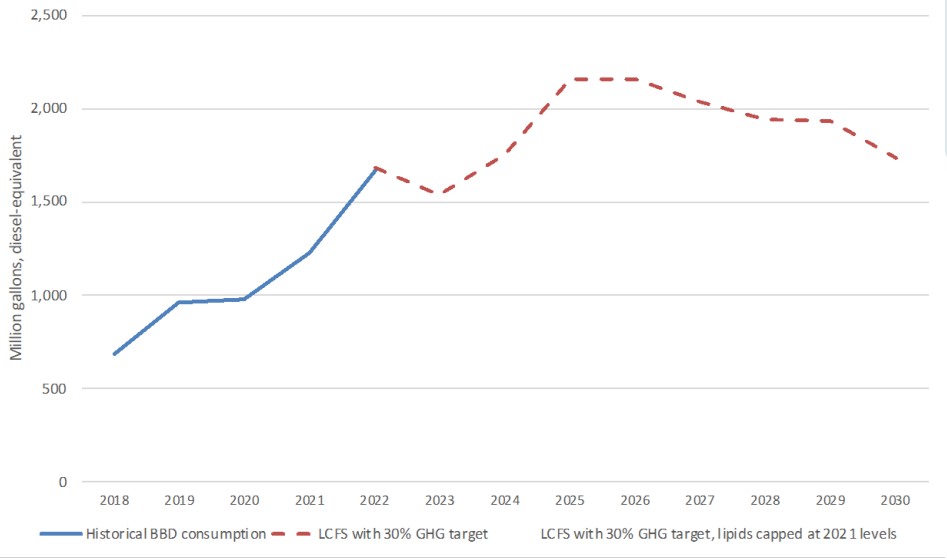

Figure 2: Historical and projected demand for biomass-based diesel in California, with and without an energy cap on lipid-based fuels, through 2030

[4] https://theicct.org/wp-content/uploads/2022/08/lipids-cap-ca-lcfs-aug22.pdf

Increased soybean oil biofuel production driven by the combination of Renewable Fuel Standard (RFS) volume obligations and state policy incentives in California could drive the three following outcomes, in order of likelihood: 1) diversion of soy biodiesel incentivized by the RFS from other states, 2) growth in domestic soybean crushing capacity, and 3) cropland expansion.

Soybean biodiesel diversion and LCFS interaction with the Renewable Fuel Standard

In the short-term, the easiest route to maximizing soy consumption within California would be to divert existing soy biodiesel consumption in other states, driven by the federal RFS, to California. As fatty acid methyl ester (FAME) biodiesel consumption is constrained by blending restrictions, this would necessitate converting that soy oil into drop-in, renewable diesel. Soy renewable diesel is slightly more emissions-intensive to produce than soy biodiesel, making this a counterproductive method of compliance. Increased demand for BBD in California would merely shuffle existing biodiesel consumption from other states under the RFS into California.

This trend can be observed in the U.S. Energy Information Administration's (EIA) state energy data system, which shows a steady decline in biodiesel consumption in states outside of California over the from 2016 to 2021, as the quantity of both renewable diesel and biodiesel consumption increases in California.[5] Though these diverted fuels would be credited as reducing emissions within the LCFS, the net impact of their diversion from other states' existing RFS-driven fuel consumption would be marginal if not negative.

CATS modeling suggests that, between 2022 and 2025, approximately 80% of RFS-mandated BBD growth will be consumed in California. This volume far exceeds the state's equitable share of the national fuel market, with California making up approximately 7% of national distillate fuel demand.[6] Left unchecked, California will deprive other jurisdictions from meeting their own fuel supply needs or climate targets assisted by BBD blending.

Beyond shuffling fuels internally, continued growth of BBD in California could risk overtaking the BBD volume mandates within the RFS. In its

[5] https://www.eia.gov/state/seds/seds-data-complete.php?sid=US ; "Energy Consumption Estimates for Selected Energy Sources in Physical Units, Selected Years, 1960-2021, United States"

[6] https://www.eia.gov/dnav/pet/pet_cons_821dst_dcu_nus_a.htm

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recent 2023-2025 volume rulemaking,[7] EPA raised the advanced fuels mandate to approximately 6 billion non-cellulosic gallons by 2025, equivalent to 3.35 billion gallons of BBD rising from 2.76 billion gallons in 2022.[8] EPA detailed its methodology for estimating higher volumes in a corresponding analysis based on projected growth in soybean production and crush capacity.[9] In setting the final volumes, the agency used a conservative estimate short of industry projections, noting the risks of setting higher volumes on market distortion and driving soy oil away from non-biofuel uses. If California's BBD growth in the next several years exceeds EPA's projected increase in the non-cellulosic advanced fuel mandate, it could lead to an acceleration in crush capacity expansion. It could also lead to California drivers shouldering an increasing burden of national-level RFS compliance with little to no climate benefit. Specifically, EPA has recognized that increased demand for soybean BBD puts pressure on global palm oil markets to "backfill" supply when soybean oil is diverted from existing uses.[10]

Comments on extending deliverability requirements to biomethane-derived hydrogen

Currently, the book-and-claim system used to credit biomethane produced and consumed in California does not align with the stringency of book-and-claim used for low-CI electricity. To better ensure that credited fuels are consumed in the transportation sector, we recommend that CARB impose deliverability requirements on biomethane beginning in 2024. We also recommend that these requirements be applied consistently to biomethane as a primary fuel and biomethane as a hydrogen intermediate. Due to the highly negative CI values assigned to some biomethane pathways, current practice allows for a relatively small amount of fuel injected into natural gas pipelines throughout the country to take the place of larger quantities of alternative fuels produced in-state, crowding out contributions from other fuel pathways with a more legitimate claim to displacing in-state fuel consumption. This practice likely dilutes the LCFS' impact on reducing overall petroleum consumption, disadvantages other states in meeting their own climate targets, and is currently widespread.[11] Based on state-level RNG

[7] https://www.govinfo.gov/content/pkg/FR-2023-07-12/pdf/2023-13462.pdf
[8] https://www.epa.gov/renewable-fuel-standard-program/final-volume-standards-2020-2021-and-2022
[9] https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P10155TQ.pdf
[10] https://cfpub.epa.gov/ncea/biofuels/recordisplay.cfm?deid=353055
[11] Daniel Mazzone, Julie Witcover, and Colin Murphy, "Multijurisdictional Status Review of Low Carbon Fuel Standards, 2010–2020 Q2: California, Oregon, and

production estimates and LCFS accounting data, approximately 70% of RNG credited under the LCFS is produced out of state.[12]

CARB's current deliverability proposal for biomethane is modeled off the California Energy Commission's Renewables Portfolio Standard (RPS) guidance on biomethane-derived electricity.[13] Under this guidance, biomethane injected into a common carrier pipeline must flow "from the point of injection to the point of receipt at least 50 percent of the time on an annual basis" (p. 9). Biomethane must also be injected within or interconnected to a pipeline system located within the Western Electricity Coordinating Council (WECC) region. We recommend that CARB strengthen this guidance by setting an in-state interconnection requirement beginning in 2024. As a weaker option, CARB could establish a deliverability requirement for biomethane to be produced and delivered within the WECC region. The California Energy Commission collects detailed data on the state pipeline network that could be used to verify this information at "citygate" gas interconnection points located throughout the state.[14]

Exempting hydrogen produced from biomethane from book-and-claim requirements established for CNG has the potential to undermine the benefits of implementing deliverability requirements altogether, for very little benefit. Though CARB has emphasized the need to support the growth of the hydrogen industry, the current system of biomethane hydrogen production simply involves purchasing environmental attributes for conventional gray hydrogen produced from natural gas, which is already a well-developed, commercialized technology. The additional subsidy value would not drive the value of green hydrogen, which is produced through an entirely different conversion process. This would likely shift investment from RNG toward bio-based hydrogen applications without addressing the underlying uncertainty around traceability. To provide an example of this risk, a California hydrogen producer has

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British Columbia" (UC Davis Institute of Transportation Studies, July 2021), https://escholarship.org/uc/item/080390x8.

[12] Database of Renewable Natural Gas (RNG) Projects: 2021 Update, Argonne National Laboratory, January 2022, https://www.anl.gov/es/reference/renewable-natural-gas-database.; CARB, "Low Carbon Fuel Standard Reporting Tool Quarterly Summaries."

[13] California Energy Commission, "RPS Eligibility Guidebook, Ninth Edition Revised," April 27, 2017.

[14] California Energy Commission, *California Natural Gas Pipelines*, accessed March 7, 2023, https://www.energy.ca.gov/sites/default/files/2020-10/Natural_Gas_Pipelines_ADA.pdf.

applied to produce hydrogen via fossil-based steam methane reforming while purchasing environmental attributes from a dairy farm injecting biomethane into the Wisconsin gas grid. This gas qualifies for a CI score below -250 gCO_2e/MJ,[15] but has been collecting methane on a digester since 2013—long before the application. Without book-and-claim requirements, it could be conceivable that the response to deliverability requirements for RNG would simply be to shift existing book-and-claim crediting to similar examples of gray hydrogen production, with little if any net benefit.

We recognize that the use of hydrogen as a transportation fuel and in other sectors will be critical to meet the 2022 Scoping Plan goals. However, exempting hydrogen producers from deliverability requirements and failing to update its baseline CI assumptions grants hydrogen fuel an unfair advantage and crowds out investment for other fuels with significant emissions reduction potential. At the federal level, domestic hydrogen production is expected to remain heavily subsidized from the Inflation Reduction Act. Under the legislation, hydrogen producers can receive up to $3 per kilogram in tax credits through 2032.

[15] ARB, 2021. "Staff Summary: FirstElement Fuel, Inc. Fuel Production Facility: Praxair SMR Facility Hydrogen Produced from Renewable Natural Gas" https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/comments/tier2/B0392_summary.pdf