

To: California Air Resources Board
From: Jeremy Martin
Date: May 10, 2024
Subject: Comments on the April 10th LCFS Workshop

The Union of Concerned Scientists (UCS) is a long-standing supporter of the Low Carbon Fuel Standard (LCFS) and has been actively involved in its implementation for more than 15 years. We urge the California Air Resources Board (CARB) to modernize the LCFS to ensure it equitably meets the needs of Californians and supports the attainment of air quality standards. Beyond California's borders, the LCFS is an important policy model for other states and the federal government, which could help address the many deficiencies of the Renewable Fuel Standard. But to meet these needs the LCFS must be modernized, to rebalance credit markets, provide reliable support for non-combustion pathways, strengthen safeguards against deforestation and the diversion of food to fuel use and phase out counterproductive methane digester subsidies that are contributing to dairy and meat industry consolidation. We have already submitted [extensive comments](#) on the December proposal and presented on the need to cap the use of crop based biofuels at the March 15th meeting of the AB32 Environmental Justice Advisory Committee Meeting ([slides](#) and [video](#)).

The comments below respond specifically to new information made available in advance of and during the April 10th LCFS workshop. These comments focus on insights gleaned from the release of the input and output files for the CATS model. This data allows for a more complete understanding of the staff proposal and to evaluate alternatives in a more quantitative manner. Our new analysis of the CATS model demonstrates that without a cap, there is a substantial risk that continued expansion of vegetable oil-based renewable diesel will destabilize LCFS credit prices, undermine support for transportation electrification including the Advanced Clean Fleets rule, harm the global poor and accelerate tropical deforestation.

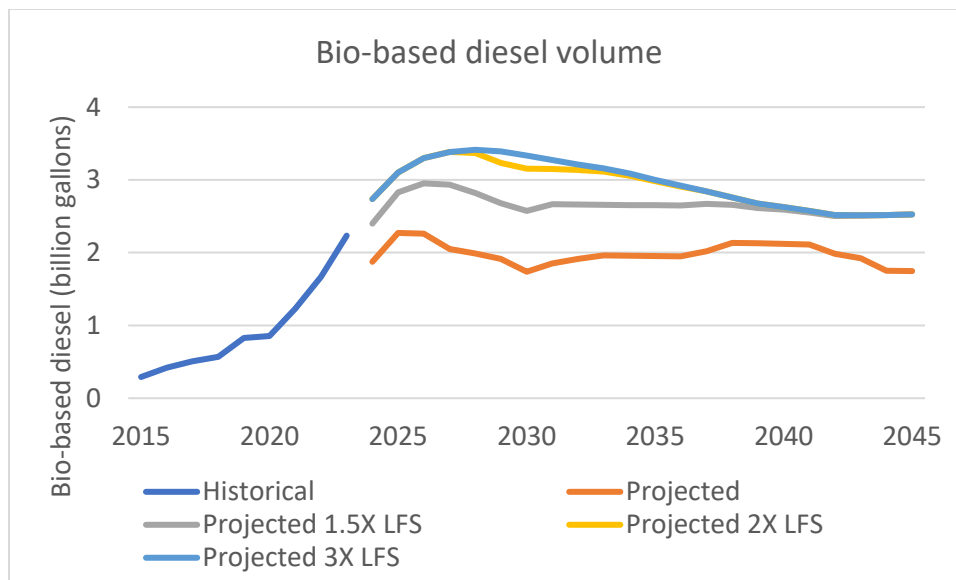
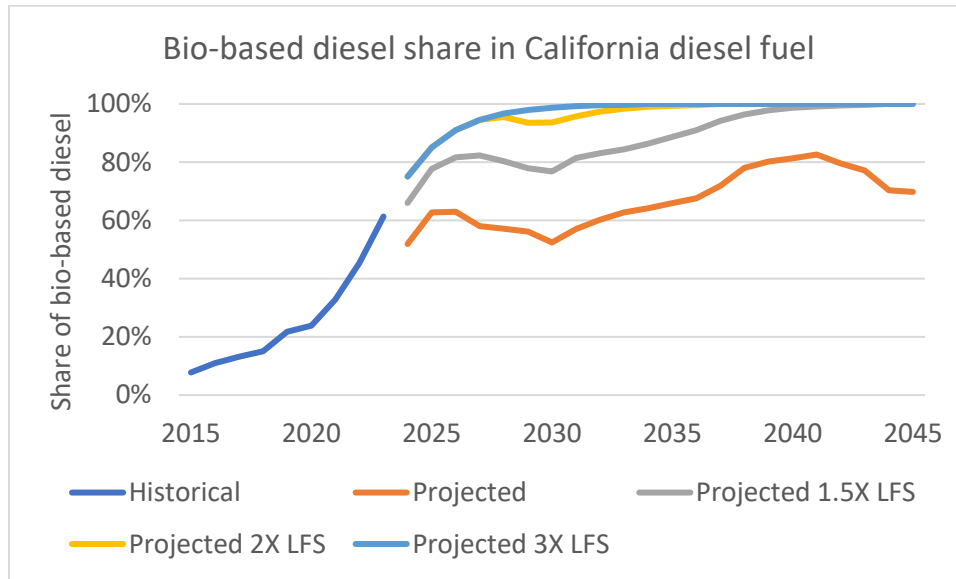
The CATS model projects bio-based diesel market stability in contrast to observed behavior and analysis from other experts.

The CATS modeling on which the ISOR and SRIA are based projects that biobased diesel volume has reached its peak and will not exceed current production levels going forward. This is inconsistent with analysis from several well qualified outside experts¹. Both groups conclude that the CATS model is substantially underestimating renewable diesel growth, and the Bushnell group specifically finds that renewable diesel growth will continue until the California diesel pool is effectively saturated, which is likely to happen in 2028.

To understand the implications of rapidly saturating the diesel pool, I adjusted the feedstock supply curves in the CATS model input files to produce renewable diesel consumption projections more consistent with this analysis and the recent historical record. Figure 1A and 1B compare historical bio-

¹ James Bushnell, Gabriel Lade, Aaron Smith, Julie Witcover, and Wuzheqian Xiao "[Forecasting Credit Supply Demand Balance for the Low-Carbon Fuel Standard Program](#)" (August 2023) | WP-340 | [Blog Post](#) and Colin Murphy and Jin Wook Ro, "[Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking](#)" (February 2024). Reference: UCD-ITS-RR-24-12

based diesel trends with projections from the revised 15-day scenario presented at the April workshop and compares the same scenario with increased lipid feedstock supply (LFS). In contrast to the staff projection, increasing LFS by 50 percent (1.5X), 100 percent (2X) and 200 percent (3X) lead the bio-based diesel share of the diesel pool to keep rising, reaching 100 percent in 2043, 2036 and 2032 respectively. Moreover, the peak in bio-based diesel volume consumed in California rises to a level 30, 49 and 50 percent higher than the staff analysis.



Allowing California’s renewable diesel boom to continue until consumption exceeds 3 billion gallons of bio-based diesel will harm the global poor and accelerate tropical deforestation by diverting soybean oil from food to fuel and leaving palm oil to replace soybean oil in food markets. A continued expansion of renewable diesel will also destabilize LCFS credit markets, lowering credit prices and reducing support for transportation electrification and other more scalable alternative fuels. Relying on the auto-acceleration mechanism to correct the credit glut will lead to unstable credit price, with a period of very

low credit prices followed by a sharp spike in compliance costs. Capping the use of lipid-based fuels at a level consistent with the ISOR projection will more effectively stabilize LCFS credit markets.

Continuing California's renewable diesel boom will harm the global poor and accelerate tropical deforestation

As explained in detail in previous comments from UCS and other experts², California's renewable diesel boom has major implications for global vegetable oil markets, which affect access to food and cultivation of soybeans, oil palm and other oilseed crops, which are among the most significant drivers of tropical deforestation. Consumption of vegetable oil and other lipid feedstock to produce bio-based diesel for consumption in California doubled three times since 2015, starting at 1 million metric tons (MMT) in 2015 it exceeded 2 MMT in 2018, 4 MMT 2021 and 8 MMT in 2023. This rapid growth has outstripped secondary fats and oils, leading to increasing use of vegetable oil, especially soybean oil, which grew from 0.6 MMT in 2021, to 1.0 MMT to 1.6 MMT in 2023. Without a cap, lipid consumption for California bio-based diesel could grow by another 50% or 4 MMT, exceeding 12 MMT. California renewable diesel producers are already looking to global markets to secure feedstock, and experts agree that soybean oil is the most widely available vegetable oil that is eligible for US bio-based diesel production available in global markets. But with only 12 MMT of soybean oil traded in global markets in 2022, it's clear that increasing California demand for vegetable oil by up to 4 MMT will have a profound effect on vegetable oil markets, putting renewable diesel production for California in direct competition with global food markets.

The workshop presentation on crop sustainability began with a strong statement of purpose "Biofuel production must not come at the expense of deforestation or food production." Unfortunately, the discussion that followed did not live up to that commitment, and staff continue to refuse to consider the most direct and effective guardrail to address deforestation or food production, which is to limit the quantity of feedstock used to make fuel as a sustainable level with a lipid-based fuel cap. California renewable diesel consumption has already contributed to the global food crisis in 2022 by consuming almost 1 MMT of soybean oil during a historic spike in vegetable oil prices. Since it takes years to make changes to the LCFS, it would be irresponsible to wait until the next food crisis to act.

With renewable diesel producers diverting a growing share of soybean oil from food markets to fuel production, consumers around the world will shift to palm oil. Tracking or certification of the feedstock directly used to produce fuel for California will not address the harms caused by increased palm oil production required to replace the diverted soybean oil in food markets.

A continued renewable diesel boom will destabilize the LCFS credit market

Because staff ignore the risk of a continuing boom in renewable diesel, the staff analysis projects stability in bio-based diesel, which in turn supports stable LCFS credit prices. The updated (15 day) CATS analysis of the staff proposal projects credit prices between 2025 and 2035 averaging \$144 (± 41) per metric ton of CO₂ equivalent emissions below the standard and a 60 percent share of bio-based diesel (BBD) in California's diesel pool. However, if the renewable diesel expansion continues and reached a 95% share of BBD, consistent with expert analysis cited above, credit prices between 2025 and 2035 will collapse to \$52 (± 30)/MT. This is not a healthy state for the LCFS credit market and will undermine LCFS support for transportation electrification.

² Scientists and economists letter calling for a cap on the use of vegetable oil-based biofuels in the LCFS. <https://www.arb.ca.gov/lists/com-attach/6959-lcfs2024-BXYAZQZuUmQGbgF1.pdf>

Relying on the auto-acceleration mechanism to correct the credit glut will leave the policy with low credit prices until 2030, and then create a large swing in credit prices. The CATS model (run with 2X lipid feedstock availability) projects that credit prices would jump from an average of \$86/MT between 2025 and 2029 to the credit price ceiling of \$221/MT and remain at the ceiling through 2040. As described below, a lipid cap would lead to a more stable LCFS credit market than relying on the AAM.

Staff should evaluate at least one scenario in which diesel consumption is rapidly replaced by 100 percent bio-based diesel (by 2028) and evaluate the implications for global vegetable oil markets and LCFS credit markets.

The future trajectory of California’s renewable diesel market is quite uncertain, subject to many factors, only a few of which are captured in the CATS model, and many outside the control of California regulators. It is not realistic to expect any model to accurately predict the future. However, for the purpose of evaluating the proposed LCFS amendments, it is extremely important to consider the very plausible scenarios that renewable diesel boom continues until the diesel market is saturated with bio-based diesel.

In 2023, California renewable diesel consumption grew 42 percent, and bio-based diesel consumption accounted for 49 percent of LFS credits generation. In the staff analysis, renewable diesel consumption stabilizes below the current peak and by 2028 it has fallen 15 percent. By contrast, external analysis predicts renewable diesel consumption could rise 50 percent by 2028 versus its 2023 level. Whether renewable diesel consumption falls 15 percent or rises 50 percent in the next 4 years will have a profound impact on the credit balance of the LCFS program, and both scenarios should be evaluated explicitly in the rulemaking process.

Staff should evaluate the how LCFS program will perform using double the feedstock availability at each price, that is cells AH1:AP3 in the feedstock tab of the input table should be as follows.

600	800	1000	1200	1400	1600	1800	2000	2200
933904	697481	697481	697481	697481	697481	697481	697481	
5518591	409348	409348	409348	409348	409348	409348	409348	inf

To be clear, I have not conducted an alternative assessment of feedstock supply. The table above was developed by working backward from the analysis of Bushnell, et al. The feedstock supply curve is one of several factors that dictate how much renewable diesel the model projects will be consumed. Other factors include conversion costs, exogenous subsidies and strategic decisions of fuel producers and distributors that are not captured the in CATS model. Other combinations of CATS inputs could be adjusted to achieve a similar result. However, I do not believe these factors influence the CATS output outside of the determination of how much RD will be supplied at a given LCFS credit price. What is important is to understand the policy implications of the possibility that the Bushnell et al. analysis is correct and bio-based diesel saturates the California market in 2028. Evaluating the higher available feedstock supply is a straightforward means to evaluate this risk.

Staff should evaluate lipid-based fuel caps in addition to a bio-based diesel phaseout

In the ISOR, the staff proposed and rejected Alternative 1, which phased out rather than capped renewable diesel. This alternative was not responsive to the input from UCS and ICCT calling for a cap³

³ Jane O’Malley, Nikita Pavlenko, Stephanie Searle, and Jeremy Martin. [Setting a lipids fuel cap under the California Low Carbon Fuel Standard](#) (August 2022).

and we reiterate our request that staff evaluate the impact of capping bio-based diesel. The staff justification for rejecting Alternative 1 has focused heavily on the large increases in fossil diesel consumption required in the event of an RD phaseout. But a cap would not lead to any increase in the use of fossil diesel. A cap set at a level consistent with current consumption would reduce the risk that a continuation of the renewable diesel boom destabilizes food markets and LCFS credit markets.

Staff should evaluate a cap on lipid-based fuels to understand the effect on LCFS markets. In my analysis I evaluated a cap on renewable diesel (RD) at 1.6 billion and 2 billion gallons (BG). Since the CATS input file effectively fixed biodiesel consumption at 280 million gallons, the net effect of the 1.6 BG or 2 BG RD caps I imposed are to cap bio-based diesel (BBD) consumption at 1.9 or 2.3 BG. The 1.6 BG RD cap is consistent with CARB's projections for the 15 day proposal, while the 2.0 BG RD cap is consistent with capping the program at 2023 production levels.

A caps at the level projected in the ISOR will stabilize credit prices and avoid harmful unintended consequences

Implementing a cap in the CATS model at 1.6 BG of renewable diesel (1.9 BG of bio-based diesel including biodiesel) resulted in average blend rate of 56 percent bio-based diesel and credit prices between 2025 and 2035 averaging \$156 (± 51)/MT. Rerunning the CATS model with a 100 percent increase in lipid feedstocks (LFS) has very little impact on the share of bio-based diesel, which increased to just 5 percent, and keeps credit prices at \$162 (± 57). Stable credit prices will support transportation electrification and innovation in new fuel pathways while avoiding the harmful impact of excessive bio-based diesel consumption on global vegetable oil markets and deforestation.

Responses to CARB discussion on feedstock April LCFS Workshop:

In the absence of a cap, substantial increases in virgin oil fuel use in California will occur over long-term

In the workshop presentation, staff says "Based on current and future understanding of market conditions, it is uncertain if substantial increases in virgin oil fuel use in California will occur over long-term." If California's bio-based diesel consumption remains at current levels, the differentiated support for fuels made from secondary fats and oils provides a clear incentive to secure feedstocks that enjoy preferential treatment. This is clearly happening now with the remarkably fast increase in imports of used cooking oil, especially from Asia. The scaleup has been so dramatic as to raise considerable skepticism about whether the feedstock is legitimate, and CARB should certainly move forward with detailed traceability, verification and/or enforcement of waste feedstocks to avoid fraud.

However, despite the long-standing incentives to encourage the use of secondary fats and oils, the use of soybean oil as a feedstock has increased steadily. The most recent quarterly data shows that California consumption of virgin oil-based fuels increased more than 50 percent in 2023 over 2022, reaching 1.5 MMT of feedstock. Market analysts across the spectrum agree that supplies of secondary fats and oils are effectively tapped out, and substantial increases in production will inevitably draw from soybean and other first use vegetable oils. This is partly why the large increases in imports of UCO create suspicions of fraud.

In the absence of a volume-based cap, the renewable diesel boom is likely to continue. Saturating the California diesel market would imply 4.5 billion gallons of bio-based diesel with feedstock requirements for reaching 12 million metric tons by 2028, a 50% increase over current usage. It is exceedingly unlikely

that there is an adequate supply of legitimate secondary fats and oils to meet this level of supply, so it is almost inevitable that this supply will be met with soybean oil (or fraudulent UCO).

Increasing demand for vegetable oil and other lipids by up to 4 MMT of feedstock will certainly have a major impact on global vegetable oil markets. Total global trade in all sources of vegetable oil is about 80 MMT, of which more than half is palm oil. Increasing California's consumption from 8 to 12 MMT of lipids would have a substantial impact on global oil prices. There are many other factors that influence oil vegetable prices, but California has become a significant factor.

As explained in my earlier comments, the limited rate of growth in global market for soybean meal means that large increases in the use of soybean oil for fuel will be primarily backfilled with palm oil. However, because the palm oil will substitute for soybean oil diverted from food markets, prohibiting the use of palm oil for fuel production will have no meaning impact on avoiding deforestation associated with expanded palm production.

LCFS support for virgin oil feedstocks does not “phase out naturally”

Page 40 of the staff presentation is titled “Credit Generation for Virgin Oil Feedstocks Naturally Phases Out” and on the graph is a note explaining that “virgin oils become deficit generating in 2033 under ISOR proposal, or 2030 if AAM triggered twice.” While this is technically true, it is deeply misleading. The compliance value of renewable diesel for an obligated party is not just the credits generated, but the deficits avoided by replacing fossil diesel with a lower CI fuel. The difference between the carbon intensity of renewable diesel and fossil diesel does not change as the standard is reduced, so the compliance value remains the same, even as the credits change.

To illustrate, in 2024, with a CI standard of 88 g/MJ, a CI for fossil diesel (ULSD) of 100 g/MJ and a CI for Soybean oil renewable diesel (Soy RD) of 60 g/MJ, the compliance value of replacing ULSD with Soy RD is 40 g/MJ, 28 g/MJ from credits and 12 g/MJ from avoided deficits. When the CI of the standard falls to 60 g/MJ, the compliance value remains unchanged at 40 g/MJ. There is no credit generation, but the avoided deficits increase to 40 g/MJ. Even if the CI standard is zero, it would still be worth 40 g/MJ to use Soy RD in place of ULSD to reduce the number of deficits per gallon of diesel fuel sold. For this reason, declining credit generation would not “naturally phase out” the risk of unsustainable levels of vegetable oil-based fuel consumption.

Increasing LUC for certain fuel/feedstock combinations may be warranted but is not sufficient to address market wide impacts of expanded lipid based fuel consumption in California.

In the workshop slides, CARB staff mentioned that they are evaluating the option of increasing LUC for certain fuel/feedstock combinations. This is a reasonable idea for feedstocks sourced in areas with supply chains more directly linked to damaging land use change. However, because soybean and soybean oil are fungible commodities traded on global markets, this disincentive will have little meaningful impact on reducing deforestation. The total level of lipid-based fuel consumption is the primary driver of deforestation, and a cap is the most straightforward way to address this problem.

Given existing combustion engines persist, what liquid fuel options exist to meet demand and support GHG and air quality needs?

The Durbin et al. studies on diesel engines makes clear that the air quality benefits of renewable diesel are primarily observed when it is used in off-road equipment and the declining fleet of older on-road diesel engines, and no statistically significant benefits are seen in the new technology diesel engines that consume the vast majority of the diesel fuel. If CARB analysis find that fuel switching to renewable

diesel is an important and cost-effective strategy to improve air quality, it should develop incentives or mandates to encourage or require the use of this fuel in vehicles and regions where the health benefits are most significant. Under the proposed amendments, the decision on where and whether to sell renewable diesel is left entirely at the discretion of the fuel retailers, and the vast majority of the fuel will presumably be used in vehicles where it offers no meaningful air quality benefits.

From a climate perspective, the disproportionate focus on lipid-based fuels is counter-productive. Many climate analyses find that bio-based fuels can help meet climate targets but few if any of these analysis focus on lipids as a significant feedstock because they are expensive, their yields per acre are low, supply of low CI lipid feedstocks is inelastic, and soybean and palm oil are major drivers of deforestation. Capping the use of lipid-based biofuels at a reasonable level will encourage fuel producers to focus on commercializing other more scalable feedstocks. The absence of a cap discourages investment in these more scalable feedstocks, because in the short term it is easier for an existing oil refinery to outbid food consumers in global vegetable oil markets than to make long term investments. Capping this pathway will provide a signal to investors that long term investments in biomass-based fuel pathways will not have to compete against an unrestricted volume of lipid-based fuels.

Should E15 be considered to help reduce retail gasoline costs?

Please provide more information so that I can comment on this question in detail. How widely does CARB anticipate E15 would be available? Is it plausible or likely that E15 could quickly become the predominant gasoline blend in California? What would the impact be on total ethanol consumption?

My general view is that is that gradually increasing the ethanol blending rate at a speed that is offset by decreased gasoline consumption so that total ethanol consumption is flat or gradually declines is not a concern, since there would not any additional cropland required to supply that fuel. I would be concerned if total corn used a feedstock for fuel consumed in California grew rapidly, as has been recently observed for vegetable oil used to produce bio-based diesel. The land use impact is dictated by the total feedstock consumed for all fuel, including E10, E15, E85 and any corn ethanol made into jet fuel. The scaleup of these fuels, especially ethanol to jet fuel, is hard to predict and depends on many factors outside the control of the LCFS.

As a safeguard, CARB should clarify that total corn consumption for all fuels used in California will not be allowed to exceed the level used in 2023, roughly 0.5 billion bushels of corn. Under current expectations, this level seems unlikely to be exceeded, even with some growth in the use of E15 or ethanol made into jet, since E10 blending will be falling with gasoline consumption. By clarifying this expectation now, California can proactively avoid a future land use problem and provide investors a clearer expectation about the scale of the opportunity for new fuels based on corn and encourage investment in pathways based on underutilized feedstocks.

Additional Questions

Slide 25 in the workshop presentation shows that the number of legacy engines in the on-road fleet will decline dramatically over time, and slides 25 and 26 show and that there are no statistically significant air quality benefits to using RD in NTDEs. Please clarify what PM and NOx emissions benefits if any were attributed to the use of renewable diesel in NTDEs in the air quality analysis. I was not able to find this information in the air quality workbook.