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27 August, 2024

State of California, Air Resources Board Industrial Strategies Division, Transportation Fuels Branch California Air Resources Board 1001 I St. Sacramento CA, 95814

Re: Comments on Proposed Amendments to the Low Carbon Fuel Standard

Dear LCFS Team:

Thank you for the opportunity to comment on the current rulemaking to amend the Low Carbon Fuel Standard (LCFS). The University of California, Davis Institute of Transportation Studies (ITS-Davis) has been engaged in research, policy analysis, and technical assistance relating to the LCFS since it was first developed, over 15 years ago. Since then, the LCFS has become a critical part of California's climate policy portfolio and a model that has been adopted in many other jurisdictions around the world. Following the strategic vision laid out in the 2022 Scoping Plan, the LCFS would continue to support profound changes in California's transportation and energy systems in order to meet the statutory goals of a 40% reduction in greenhouse gas (GHG) below 1990 levels by 2030, and carbon neutrality by 2045.¹

The LCFS has successfully guided the evolution of California's transportation fuels for almost 15 years, supporting the deployment of low-carbon biofuels, electric vehicles, and other advanced technologies. During that time, ITS-Davis has been the preeminent academic research institution in the world on issues related to the LCFS, and has published an extensive set of peer-reviewed publications, technical reports and reviews of related topics. We appreciate the opportunity to continue our collaboration on this important subject.

We commend Staff for facilitating a robust series of workshops over the last two years, and for their willingness to engage with stakeholders on this complex issue. These comments are presented in the spirit of ITS- Davis's mission to bring science into the policy process. Neither UC Davis nor ITS-Davis seek a specific policy outcome; these comments are offered to help California meet its climate, environmental, and equity goals. We group our comments into thematic categories to allow proposed changes to be evaluated in context with related material.

¹ SB 32 (Pavley, Chapter 249, Statutes of 2016), AB 1279 (Muratsuchi, Chapter 337, Statutes of 2022)

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Impact of Proposed Amendments on LCFS Credit and Deficit Generation

The package of amendments and related analysis released by CARB on August 12 (hereafter referred to as the 15 Day Package) presented several changes from the amendments proposed in January 2024, several of the proposed changes follow discussions that occurred the April 10th workshop. The scope of the present rulemaking has, from the start, been limited to a narrow set of topics; predominantly (though not exclusively) those which can help address the sharp decline in LCFS credit prices over the last 3 years. We agree with the consensus interpretation that the low credit prices that have dominated the market over the last two years will make it significantly more difficult for advanced low-carbon fuel production and distribution capacity to deploy at large scale in California's market. While some lower-carbon alternative fuel technologies, e.g. crop-based biofuels, renewable natural gas, electrification of light-duty vehicles, are cost-competitive under current market conditions, several technologies that have been identified as critical to attaining California's long term GHG reduction targets, e.g. medium-duty (MD) and heavy-duty (HD) vehicle electrification, hydrogen, cellulosic biofuels, e-fuels, and carbon capture and sequestration (CCS) generally lack a pathway to large-scale, cost-effective deployment without significantly more policy support than they currently receive. For many of these technologies, the LCFS is the most appropriate policy mechanism to provide such support, in that it is already well-established, and creates a strong link between the GHG benefits from a particular fuel and the amount of incentive that fuel receives. Our research generally aligns with the sentiment that has been consistently expressed by stakeholders leading up to, and during, this rulemaking: many technologies that will likely be critical to California's progress towards carbon neutrality will struggle to deploy if current LCFS credit prices persist. It is particularly important to support commercial-scale deployment of novel, higher-cost technologies like these in the near term, to allow these technologies the time and opportunity to mature, develop robust supply chains that create economies of scale, and position themselves for large-scale, cost-effective deployment in the 2030's, creating an efficient pathway to long-term deep decarbonization.²

Many of the changes proposed in the previous LCFS amendments, as well as the 15 day package are clearly aimed at supporting a higher LCFS credit price. We have written extensively about the status of the LCFS, and the market dynamics that influence LCFS credit pricing and developed the Fuel Portfolio Scenario Model (FPSM), a scenario analysis tool based on a design first published by CARB, that we use to evaluate LCFS credit supply and demand trends across various technological, market, and policy scenarios.³ This work, which aligns with similar

²See: Brown, et al. (2021) <u>Driving California's Transportation Emissions to Zero</u>

³ Initial report: Ro, J., Murphy, C. W, & Wang, Q. (2023). Fuel Portfolio Scenario Modeling (FPSM) of 2030 and 2035 Low CarbonFuel Standard Targets in California. *UC Office of the President: University of California Institute of Transportation Studies*. http://dx.doi.org/10.7922/G2S46Q8C Retrieved from https://escholarship.org/uc/item/6f2284rg

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analyses published by other researchers, indicates that a variety of factors initiated the credit price decline, but the rapid growth of renewable diesel production (RD) capacity in the U.S. is primarily responsible for its depth and persistence. Renewable diesel is effectively setting the marginal cost of compliance with the LCFS, and the stabilization of LCFS credit prices in the \$50-70 range over the last 18 months offers guidance about the level of LCFS support required for RD to enter the California market. While there have been reports of declining profit margins for RD producers, and some delays announced for RD capacity expansion, the broad trend in this space still points to growth, with a recent NREL report projecting U.S. hydrotreated (RD and hydroprocessed sustainable aviation fuel) capacity to roughly double by 2030, to around 9.6 billion gallons/year.⁴ California's own capacity to produce these fuels appears poised to continue growing as well, with the expectation that projects to convert the Phillips 66 and Marathon refineries in the Bay Area from petroleum to renewable diesel and hydrotreated alternative jet fuel, will be operational at or near nameplate capacity by the end of the year.⁵ The capacity these projects provide indicate continued availability of additional RD and/or SAF to the California market, even if the national growth trend slows, or even modestly reverses.

These trends provide important context for any discussion of LCFS market dynamics or credit prices. Because RD is setting the marginal compliance cost for the LCFS, and ample capacity exists within the U.S. to allow California's growth trend to continue, it is likely that the present LCFS credit price conditions will also hold for the foreseeable future, unless a significant shift in the LCFS policy structure bring the supply and demand for LCFS credits closer to a balanced state. The amendments proposed in the 15 day package, while providing valuable support to several technologies that are important to California's sustainable transportation goals, are not likely to bring the supply and demand close enough to a balanced state to support a higher LCFS credit price. As such, if the proposed package of amendments were adopted without change, we would expect to see LCFS credit prices approximately maintain their current level, predominantly within the \$50-\$70 range for the foreseeable future.

²⁰²⁴ update: Murphy, C., & Ro, J. (2024). Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking. *UC Davis: Policy Institute for Energy, Environment, and the Economy*. http://dx.doi.org/10.7922/G25719BV <u>https://escholarship.org/uc/item/5wf035p8</u>

⁴ <u>Rosales Calderon, O., Tao, L., Abdullah, Z., Talmadge, M., Milbrandt, A., Smolinski, S., ... & Payne, C.</u> (2024). Sustainable Aviation Fuel State-of-Industry Report: Hydroprocessed Esters and Fatty Acids Pathway (No. NREL/TP-5100-87803). National Renewable Energy Laboratory (NREL), Golden, CO (United States).

⁵ Alternative jet fuels, especially hydrotreated esters and fatty acids (the most common form of alternative jet fuel on the market today) are often referred to as "sustainable aviation fuel" or SAF. The actual GHG footprint or sustainability profile of any form of SAF depends on factors specific to its feedstock and production process. Not all examples of so-called "SAF" are truly sustainable or lower-carbon than the petroleum fuel they displace. We adopt the SAF naming convention to align with common usage, but note this caveat in doing so.

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This prediction is informed by updated FPSM modeling of the changes described in the 15 day package. Apart from the 9% step-down and the changes to e-forklift crediting, the proposals in the 15 day package that directly impact credit balance are more likely to exacerbate the oversupply of LCFS credits than reduce it. The new light- and medium-duty (LMD) infrastructure capacity credits, and expanded credit generation for electrified fixed-guideway transit would be expected to increase credit generation, while the removal of provisions that create a deficit obligation for jet fuel used for intrastate travel would likely reduce deficit generation in the near term. While the impact of each change is relatively small, typically on the order of a few percent of total credit generation, the combined effect pushes the market farther into credit oversupply.

This result aligns with earlier modeling we presented in our letter following the April 10th workshop, where Staff discussed the possibility of 5%, 7% and 9% step-down levels. At that time, we indicated that even the 9% step-down would not bring the market back into balance, and would still likely lead to multiple Auto-Acceleration Mechanism triggering events.⁶ Below, we present results from updated FPSM modeling of the impact of proposed changes in the 15 day package, including the 9% step down. The methods used to generate these results are described in Murphy & Ro (2024), with the following exceptions:

- Electrified Fixed-Guideway transit credits are multiplied by 2.2 from their previous assumption starting in 2025, to approximate the changes in crediting methodology. This is a smaller increase than that reported in the CATS modeling released in conjunction with the 15 day package.⁷
- Total HRI and FCI credit generation from pathways described in the 15 day package assumed to peak at 2% and 1.5% of prior year deficits, respectively, in 2031 before gradually declining, along with legacy light-duty HRI and FCI credits combined peaking at 0.8% of prior-year deficits in 2026, before declining. Existing LD HRI and FCI pathways have not approached the cap on credits that they could earn, however based on public feedback and conversations with stakeholders, there are credible reasons to believe the new HD HRI and FCI provisions may be more heavily utilized. Our assumption yields significantly less total credit from HRI and FCI pathways than the CATS model runs discussed earlier, suggesting that this is a reasonably conservative estimate.
- E-forklift electricity consumption stays at 2023 levels indefinitely, due to the proposed switch to measured charging data rather than estimates.
- Intrastate jet fuel no longer generates deficits. The effect of this is relatively small, since previous FPSM runs assumed that the deficit obligation would lead to enough SAF to fully satisfy intrastate flight demands entering the CA market by 2030. Without this deficit obligation, we assume about half as much SAF enters the market, but since FPSM
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https://ww2.arb.ca.gov/system/files/webform/public_comments/11621/UC%20Davis%20Comments%20on %20April%2010%20Workshop.pdf

⁷<u>https://ww2.arb.ca.gov/sites/default/files/2024-08/15Day_Proposed_9step_30_final_posted_0.xlsx</u>

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assumes that the lowest-CI feedstocks are preferred by all biomass-based diesel and SAF producers, the lost volume comes from crop-based fuels and therefore has a comparatively small impact on net credit generation over the coming decade.

Soy and canola pathways for SAF and biomass-based diesel capped at 500 and 400 million gasoline gallon equivalents (GGE) respectively, to approximate the 20% limit on credits from such fuels for any given producer, while still reflecting anticipated growth in the total volumes of biomass based diesel and SAF. This approach was selected because at the time of writing FPSM lacks the capacity to implement a percentage based limit on specified feedstocks. These limits imply post-2028 blend rates up to 25% for soy plus canola in the late 2020's and early 2030's, before falling back below allowable levels. This exceedance, however, would reduce aggregate credit generation compared to a strict 20% blend limit and so represents a conservative estimate of its effects. These limits imply that biomass-based diesel, and to a lesser extent electricity and RNG, will fully displace petroleum diesel from California's market by 2029; annual growth in biomass based diesel consumption is limited to no more than the observed 2022-2023 growth rate.

The graphs below summarize the projected impacts of the 15 day package on credit balances and aggregate bank volume. The top graph reports the annual LCFS credit balance (credits minus deficits), while the bottom graph reports the aggregate bank. Note that on the credit balance graph, the blue and red lines (representing the 15 day package of amendments, and the 15 day package with only a 5% step-down, respectively) overlap after 2030, with only the blue line visible. The graphs below also present projections based on the original January amendments for comparison. Auto-Acceleration Mechanism (AAM) triggering events were manually added by reviewing deficit and bank levels to determine if they met the AAM triggering criteria specified in the proposed rule text, then manually advancing subsequent compliance schedules by one year if they did.

The FPSM results presented here show that unrestricted growth of renewable diesel will likely lead to continued accumulation of banked credits through the early 2030's. The 9% step-down reduces, but does not eliminate annual credit surpluses in 2025 and 2026, but robust growth returns thereafter. AAM triggering events are predicted in 2027 and 2029, the first two opportunities, leading to higher program targets in 2028 and 2030, with a third AAM triggering event possibly occurring in 2031 or 2032.⁸ The 9% step down does result in a smaller aggregate bank of credits in 2030 compared to a 5% step-down, however this merely reduces the bank from 101 million credits (almost 2.5 times annual deficits) to 82 million (just under 2 times annual deficits). We note that adopting a cap on lipid based fuels at 2 billion GGE, approximately 2022

⁸ The third and final AAM triggering event meets AAM triggering conditions by a margin smaller than the uncertainty in model estimates. We interpret this as a borderline or possible-but-uncertain trigger, though it should be noted that these borderline triggering conditions persist for several years, meaning it is likely that the AAM would eventually be triggered.

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levels, but holding all other parameters from the 15 day package the same would be projected to yield a market which would not trigger the AAM until 2031 and for which a single AAM triggering event would likely be all that is required to keep the market in a long-term balance, with conditions far more conducive to rising LCFS credit prices.



We are happy to provide more comprehensive output files, or run additional scenarios upon request.

Ultimately, FPSM modeling indicates that the amendments described in the 15 day package are unlikely to support significant increases in LCFS credit price. The bank-reducing effect of the 9% step down is partially offset by increased electrified transit, and infrastructure capacity credits,

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as well as the reduction in near-term deficits from intrastate jet fuel. As a result, even with the 9% step down, FPSM modeling projects AAM triggering events at the first two opportunities, leading to a 39% target in 2030. A third triggering event in the early 2030's was also predicted, though with less certainty. Even with the relatively low LCFS credit prices that would be expected under such an outcome, gas price impacts to consumers may be significant, due to the higher target level, with approximately 20 to 40 cents per gallon maximum theoretical gas cost impact expected in 2030, and 30 to 60 cents per gallon expected by 2033.⁹ Adopting a volumetric cap on lipid-based fuels would allow California to remain on track to meet its long-term GHG reduction goals with lower LCFS program targets through the 2030's, thereby reducing the risk of unwanted gas price impacts.

Sustainability and ILUC Risk Mitigation Provisions

Changes to Feedstock Sustainability Certification

The 15 day package proposes several changes to provisions related to feedstock sustainability and ILUC risk mitigation. § 95488.9 sets forth, among other things, requirements for biomass feedstock to pass sustainability certification. The sustainability certification requirements described in this section, especially those in § 95488.9 (g) generally align with well-accepted practices in this space and would be expected to help ensure that any feedstock used to produce fuels consumed in California would not present an unacceptable risk of direct sustainability impacts. The change in § 95488.9 (g) (1) (A) to subject all biomass feedstocks, not just crop- or forestry-based ones, to sustainability certification requirements is especially important, given the risk of crop oils being mislabeled as wastes or residues to increase the value of fuels produced from them in GHG-indexed incentive programs like the LCFS. Aligning LCFS sustainability certification requirements and certification body approvals with those used in Europe and elsewhere helps create a stable, predictable landscape for fuel producers as well as increasing the number of approved certification bodies that may be available to fuel producers.

While the sustainability protocols presented in § 95488.9 and elsewhere, particularly the sustainability certification requirements, offer a significant degree of protection against direct environmental or human harms, they are incapable of effectively addressing indirect or

⁹ The lower price estimates assume \$50 LCFS credit prices, upper estimates assume \$100 LCFS credits. It is important to note that these estimates reflect the maximum theoretical cost impacts from the LCFS, effectively assuming obligated parties comply solely by buying LCFS credits at prevailing market prices. Obligated parties have multiple options to reduce their deficit generation or obtain credits at below-market rates, e.g. self-producing lower-carbon fuels for blending, long-term offtake agreements, joint ventures, etc.. These theoretical costs therefore represent the maximum possible impact, with real-world impacts expected to be lower. In reality, retail gasoline prices are set by gasoline producers, distributors and retailers, based on a variety of factors; LCFS compliance costs are a small part of the total cost profile.

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market-mediated effects, especially indirect land use change (ILUC).¹⁰ § 95488.9 (g) (1) (A) specifically requires that biomass feedstocks must be sourced from land that was cleared or cultivated prior to January 1, 2008 and has been in continuous management or fallow since then. While this provision effectively mitigates the risk that fuels will be made from feedstocks grown on recently converted land, thereby controlling for *direct* land use change risk, that same provision requires that certified feedstocks be a source of *indirect* land use change risk. Any land that was in continuous management or cultivation since 2008 will have produced a product that was sold or used to satisfy some form of demand: this is the reason for a grower to invest the time and resources entailed in management. Limiting feedstock certification to biomass sourced from historically cultivated land means it necessarily must be redirected from a previous use to biofuels. This redirected production is, by definition, the event that initiates the causal chain of events that results in ILUC. This illustrates the reason why feedstock sustainability guidelines cannot effectively mitigate ILUC risk: Eliminating direct land use change risk through feedstock sustainability guidelines requires avoiding feedstocks grown on cropland that was recently converted to cultivation. Eliminating ILUC risk through feedstock sustainability guidelines requires avoiding feedstocks grown on cropland that was historically cultivated. No land can simultaneously satisfy both conditions.

Phase-out of New RD Pathways

Proposed changes to § 95488 (d) would authorize the Executive Officer to not accept new pathway applications for biomass-based diesel if California meets specified targets for Class 3-8 (MD and HD) ZEVs. This sends a clear and helpful message to alternative fuel producers and prospective producers that biomass-based diesel's role in California's transportation system is intended to decline over time. This aligns with findings from the *Driving to Zero* report, as well as our FPSM modeling studies, that the expected transition to MD and HD ZEVs will dramatically reduce the consumption of biomass based diesel in the 2030's and 2040's. Previous FPSM studies project less than 1.5 billion gallons of liquid diesel consumption in 2040 and only around 650 million gallons in 2045. To some extent, the declining annual CI targets that are the foundation of the LCFS serve the same purpose; because few if any liquid fuels for combustion engines can meet anticipated CI targets in the late 2030's and early 2040's, there is strong pressure to switch to fuels more capable of achieving deep decarbonization.

Even with this anticipated behavior, however, the clear and explicit message sent by this proposed change serves as a helpful reinforcement of California's commitment to deep decarbonization. While the long-term signal to markets is expected to be beneficial, we anticipate that this provision will have very little tangible impact on the size or composition of California's liquid diesel pool. The provisions do not take effect until 2031 at the earliest, and

¹⁰ We have written at length about ILUC risk in previous comment letters, including those submitted on <u>May 9th</u> and <u>February 20th</u> and refer Staff to those for a deeper discussion of ILUC issues.

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while new pathways may not be accepted, existing pathways are unaffected and may not expire until the late 2030's.

There may be unintended negative consequences from the proposed structure of § 95488 that could be mitigated by some small changes, to better allow the intent of this provision to be carried through. Ceasing the acceptance of new pathways may prevent or disincentivize producers from making efficiency-improving upgrades that would normally require pathway recertification. Allowing existing pathways to be recertified to recognize the value of efficiency improvements or CI reductions without extending the duration of their certification could help prevent this unwanted outcome. Similarly, there may be forms of biomass-based diesel that achieve very low CI scores with excellent sustainability characteristics and minimal ILUC risk, e.g that made from algae or cellulosic biomass. While we anticipate a small and rapidly declining pool of liquid diesel demand in the 2040's, several hundred million gallons of such demand are likely to remain in 2045 and beyond. If a biomass-based diesel substitute with very low CI scores were to emerge after 2030, it may be advisable to allow that fuel access to the incentives offered by the LCFS to support deployment at commercial scale. Such an exemption may be within the scope of Executive Officer authority, since the language of § 95488 is permissive rather than mandatory: "Beginning January 1, 2031, the Executive Officer may choose not to accept new fuel pathway applications...." (emphasis added). The clarity and transparency of this provision may be enhanced by specifying the conditions under which the Executive Officer would choose to accept new pathways, e.g. if the pathways achieved a CI score 75% below the fossil diesel benchmark, including appropriate ILUC adjustment and without the need for CCS, book-and-claim delivery of renewable energy, or indirect carbon credits like avoided methane credits.

Limits on Soybean and Canola Feedstock Content

The 15 day package proposes adding § 95482 (i), which specifies any biomass based diesel made from soy or canola feedstock in excess of twenty percent of a company's total quantity delivered to California will be credited as if it had a CI equal to the CI benchmark for that year, or the fuels assessed CI score, whichever is greater. Similar to § 95488 (d) (discussed above), this sends a clear and helpful signal to fuel markets and prospective producers that California has a clear commitment to deep decarbonization. Also similar to § 95488 (d), the effect of this provision may duplicate the expected impact of the LCFS's core design. The declining CI targets naturally mean that crop-based fuels (which are typically more carbon intensive over their life cycle than comparable waste- or residue-based ones) will cease generating LCFS credits earlier than most other options. As a result, we would typically expect crop-based fuels to make up a shrinking share of total fuels credited under the LCFS over time. Having the allowable fraction of crop-based fuels decline over time would further strengthen the message that this provision sends.

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While the proposed § 95482 (i) will send a clear and helpful message to fuel markets, it is unlikely that it will provide any significant protection against ILUC risk. The figure below shows the mix of feedstocks used for biomass-based diesel production in the U.S.¹¹ In 2022, roughly half of total biomass based diesel production used waste and residue feedstock, since then there has been significant growth in the amount of waste and residue oils imported from other countries. This suggests that ample waste and residue capacity exists for producers to comply with this 20% limitation by shuffling their production across the multiple markets that exist for such fuels in North America. California's biomass-based diesel demand can be satisfied by a portfolio of fuels that complies with the new requirements in § 95482 (i), which the remaining crop-based feedstocks can be sent to other jurisdictions, especially Canada, where rapidly expanding demand for compliance credits under the Clean Fuels Program, coupled with that program's complete lack of ILUC risk mitigation lead to it being a highly receptive market for crop-based feedstocks. In this event, the aggregate demand for biomass-based diesel feedstocks in North America will remain unchanged, even while California nominally complies with § 95482 (i). Since ILUC is caused by aggregate demand for agricultural commodities, this would lead to the same amount of ILUC risk as would have occurred had § 95482 (i) not been adopted.

¹¹ Source:

https://farmdocdaily.illinois.edu/2024/04/fame-biodiesel-renewable-diesel-and-biomass-based-diesel-feed stock-trends-over-2011-2023.html

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Ultimately, § 95482 (i) will only provide a significant degree of tangible, near-term protection against ILUC or other sustainability risks if other jurisdictions in North America adopt similar provisions. Given the potential size of the Canadian market for alternative fuels in the coming decade, coupled with its lack of any meaningful ILUC risk mitigation, it is possible that their program alone could absorb enough crop-based biofuel to make company-level compliance with § 95482 (i) purely via feedstock shuffling feasible. As such, while the market signal provided by § 95482 (i) is beneficial, this provision should not be relied upon to provide any measure of ILUC or sustainability risk mitigation until more jurisdictions have adopted equivalent policies and the anticipated effects have been confirmed by modeling.

Authority for the Executive Officer to Replace Values in Table 6

The 15 day package proposes changes to § 95488.3 (d), specifically adding a sub-part authorizing the Executive Officer to substitute new, more conservative values for existing entries in Table 6 of the regulation, if the existing entries are not "conservatively representative" of a particular region/feedstock/fuel combination. The impacts of this provision depend largely on how CARB chooses to interpret the term "conservatively representative" and what evidentiary

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standard may be required for the Executive Officer to arrive at the conclusion that such a replacement is warranted. If this authority is utilized in a timely and vigorous manner, this provision could provide very strong protection against ILUC risk. As we have discussed in previous comment letters, while there has been a marked lack of investment in ILUC research and modeling over the last decade, multiple studies have indicated that the ILUC adjustment values currently in Table 6 significantly underestimate actual ILUC impact.¹² This impression is reinforced by the results of an inter-model comparison exercise the EPA conducted for ILUC models in 2023, which found a range of ILUC impacts for soybean oil based biodiesel that ranged from 11 to over 300 gCO_{2e}/MJ.¹³ While the estimate of U.S. soybean oil represented in Table 6 is within that range, it is clearly at the low end of it. The asymmetric risk dynamics involved with ILUC estimation.¹⁴ As such, it may be reasonable to conclude that Table 6's value for soybean oil is not a conservatively representative estimate of ILUC risk at present.

While we focus on soybean oil for the purpose of the above discussion, it is quite possible that other values in Table 6 may not be conservatively representative of actual ILUC risk at present, however the short timeframe of this comment letter did not allow for sufficient analysis to arrive at an informed conclusion for other feedstock/region/fuel combinations. We are happy to work with CARB or other stakeholders to evaluate these in the future.

Ultimately, the proposal to allow the Executive Officer the authority to substitute values in Table 6 with more conservative ones aligns with the imperative to ground the LCFS on current science on critical issues like ILUC. The data, methods, and modeled scenarios that underpin the existing Table 6 values, while state-of-the-art at the time they were created, are outdated now and inadequately protective against ILUC risk. The values in Table 6 have not been updated since their adoption, despite the completion of multiple LCFS rulemakings; this suggests that additional authority to update these values outside of the rulemaking process may be necessary to keep the LCFS aligned with the best science. The degree to which this authority actually reduces ILUC risk depends on the timeliness and vigor with which this authority is exercised. The rapid growth of biomass-based diesel has created massive new demand for lipid

<u>https://www.arb.ca.gov/lispub/comm/iframe_bccomdisp.php?listname=lcfs2024&comment_num=7063&vir</u> <u>t_num=380</u>

¹² E.g. Malins, *et al.* (2020) <u>https://www.sciencedirect.com/science/article/abs/pii/S0959652620307630</u> and Berry, *et al.* (2024)

<u>https://www.arb.ca.gov/lists/com-attach/6987-lcfs2024-AXVUPQNgUWsDa1AP.pdf</u>. In addition, the lead investigator on the project that established the values currently in Table 6 submitted a comment on a previous public docket supporting the need to reevaluate and likely increase the values in Table 6. O'Hare (2024) *Low Carbon Fuel Standards Amendments.*

¹³ EPA (2023) *Model Comparison Exercise Technical Document* <u>https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1017P9B.pdf</u>

¹⁴ Murphy (2023) Making Policy In the Absence of Certainty: Risk-Aware Consideration of Indirect Land Use Change Estimates for Biofuels **2**223-08-07 | UC Davis Policy Institute - Making Policy in the Ab...

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feedstocks. Given that there is no evidence of a decline in lipid consumption in non-biofuel sectors, this demand must necessarily be met by increased lipid production, the only feasible route for which under current technology is increased production of vegetable oils. It is inconceivable that increased vegetable oil production sufficient to satisfy billions of gallons of new biofuel demand does not entail some conversion of land into new cultivation (though clearly, not all new demand is being met by expanding cultivated areas). This means that the land use change impacts California seeks to avoid are happening now. A recent California State Auditor's report concluded that state biofuel purchases are contributing to tropical deforestation globally; there is no reason to believe that the biofuels purchased by the state would have such an impact while biofuels purchased by private individuals or corporations would not.¹⁵ The proposal to allow substitution of more conservative values for existing ones in Table 6 offers one of exceedingly few ways California can mitigate its ILUC-driven GHG emissions in the near term: by adopting more risk-aware and effectively protective ILUC values at the earliest possible opportunity.

CATS Model Results

Updated results of CATS modeling were released simultaneously with the 15 day package. The results from the CATS model include some changes in direction for existing credit generators currently experiencing substantial growth – notably renewable diesel and dairy biogas. These results deserve some interpretation, as they stand at odds with recent modeling in FPSM as reported in Murphy & Ro (2024) and by Bushnell et al. (2023)¹⁶ that suggests considerable growth in renewable diesel likely to the point of liquid diesel saturation. There are also several cases where CATS model results are highly volatile year to year, such as the CI scores of electricity used for EV charging in some scenarios; this kind of discontinuity is not uncommon in optimization models even though it reflects behavior that is highly unlikely to be observed in reality, due to the prevalence of long-term contracts in fuel supply, and other sources of market inertia.

The methodological choices underpinning any model must be considered as critical context when evaluating model output; for example, the model shows a zero credit price for some periods in scenarios that lack the AAM, despite that a credit price of zero has never been observed in the LCFS and would indicate a profoundly dysfunctional market. While models like CATS and FPSM can provide valuable guidance during policy design, the strengths and weaknesses of their design must be taken into account as policymakers decide how much weight to ascribe to any given output. We provided a more extensive discussion of the methodological choices in CATS in our May 9th letter and urge CARB and LCFS stakeholders to

¹⁵ California State Auditor (2024) *Tropical Forest Risk Commodities* <u>https://www.auditor.ca.gov/reports/2023-129/</u>

¹⁶ For the latter, see <u>https://haas.berkeley.edu/wp-content/uploads/WP340.pdf</u>

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carefully consider consider the methodological limitations and inherent biases of CATS and other models (including FPSM) as they look to modeled outputs for guidance during policy design. We note that the decline in 2024 RD consumption compared to 2023 that previous CATS model runs predicted appears highly unlikely, given the continued growth of RD observed in Q1 LCFS data that were recently released.¹⁷ This error in prediction of behavior less than a year in advance is, as we discussed previously, a predictable artifact of the CATS model design. Optimization models like CATS typically provide their best predictive ability when they are evaluating markets that are in a normal functional state, operating in the middle of the range of the supply curves they draw from. The LCFS market at present is profoundly oversupplied with credits, operating at the fringes, or even completely outside of the range of conditions under which CATS is best equipped to evaluate. As such, caution is warranted when using CATS outputs as the basis for policy analysis or evaluation.

Changes to Infrastructure Capacity Crediting Provisions

The 15 day package proposes several changes to amendments related to infrastructure capacity crediting provisions, notably the separation of stations serving MD and HD vehicles into separate categories, with stations serving light duty (LD) and MD vehicles grouped into a combined LMD category. Both FCI and HRI categories are subject to a limit on aggregate credit generation, set at 2.5% of prior quarter deficits. The provisions appear to be structured to give the HD FCI and HRI pathways priority over the LMD ones for access to the pool of available HRI and FCI credits; this aligns with multiple statements of intent to prioritize policy support for HD ZEV deployment to allow California to meet its climate and air quality goals.

The implementation of this prioritization, however, appears to create a loophole through which significantly more credits to be issued via HRI and FCI pathways that the stated 2.5% limit would allow. § 95486.3 (a) (3) (A) (1) (which applies to LMD HRI pathways, though similar language exists in § 95486.3 (b) (3) (A) (1) for LMD FCI pathways) states "If estimated potential HRI credits from all approved HRI and LMD-HRI stations exceed 2.5 percent of prior quarter deficits, the Executive Officer will not approve additional HRI pathways, and will not accept additional LMD-HRI applications until estimated potential HRI credits are less than 2.5 percent of deficits". The intent of these sections is clear: that total HRI and FCI potential credit generation should not exceed the 2.5 percent of prior quarter deficits limit.

Language in the HD HRI and FCI sections, however, establishes a slightly different test. § 95486.4 (a) (3) (A) (1) states (and equivalent language in § 95486.4 (b) (3) (A) (1) mirrors) "If If estimated potential HD-HRI credits from all approved stations exceed 2.5 percent of deficits in the most recent quarter for which data is available, the Executive Officer will not approve additional HRI pathways for HD-HRI stations and will not accept additional applications until

¹⁷ <u>https://ww2.arb.ca.gov/sites/default/files/2024-08/quarterlysummary_Q12024.xlsx</u>

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estimated potential HRI credits for approved HD-HRI stations are less than 2.5 percent of deficits." The critical difference between the provisions in the LMD pathways and their HD equivalents is that the HD pathways only test to see whether estimated potential credits from all approved HD stations exceed 2.5 percent of prior quarter deficits, whereas the LMD stations test to see whether the sum total of LMD and HD stations exceed the 2.5 percent threshold.

This structure seems intended to prioritize HD stations access to the allowable pool of credits in the event that the 2.5% limit is approached or reached. However, the specific structure proposed creates a loophole that could allow this 2.5% ceiling to be broken. If, for example, in a given quarter LMD-HRI stations generate estimated potential credits equal to 1% of prior quarter deficits and HD-HRI stations generate estimated potential credits equal to 1.6% of prior quarter deficits, the Executive Officer would not approve additional LMD-HRI pathways, but would continue to approve HD-HRI pathways until they reached the 2.5% limit. If approvals of HD-HRI pathways in that quarter added additional potential credit generation equal to 0.9% of prior quarter deficits, the actual potential credit generation from HRI pathways in that quarter would be equal to 3.5% of prior quarter deficits, 2.5% from HD-HRI pathways and an additional 1% from the existing LMD-HRI pathways. This exceedance could result in significantly more credits than anticipated or nominally permitted being issued to HRI pathways in contradiction to the intent of these provisions and further exacerbating the oversupply of credits discussed earlier in this letter.

Clarification of Definitions and Intent

This section presents comparatively smaller issues with definitions and other proposed changes from the 15 day package.

Definitions

Feedstock First Gathering Point - The 15 day package proposes changes to this definition that focus it exclusively on entities that receive, aggregate, store or treat "biomass directly from farms, plantations, or forests…" This definition implies that the definition of a first gathering point is limited only to systems using purpose-grown biomass (from farms or plantations) or collected from forests, which may themselves be managed for a purpose. This seems to exclude the possibility of a first gathering point for waste or residue biomass that did not come from a forest, such as grassland, wetland, or municipal supplies. We question whether this was the intent of this definition, and if a more expansive definition would better suit the purpose.

Forest Biomass Waste - The 15 day package creates a definition meant to describe forest biomass removed for the purpose of wildfire fuel reduction or forest health enhancement, that could not be salvaged for lumber or other wood products. The intent of this definition is clear and appropriate. Staff may want to consider a reference to the California Forest Practice Manual

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or relevant natural resources code that describe forest biomass waste, to better align the LCFS with existing policy.

Public LMD-FCI Charging Site and Public LMD-HRI Station - The definition of these stations indicates that chargers or stations must not be reservable during public hours. The intent of this definition is clear and in concept, appropriate. It may be useful, however, to allow very limited exemptions from the ban on reserving chargers or stations. If a driver in a vehicle is near a station and in need of recharging or refueling, allowing them to reserve a slot while they are en route (e.g. less than an hour away) may allow for more efficient planning and allocation of charging or refueling capacity in heavily-trafficked areas. Care must be taken to ensure that automated, speculative, or consecutive reservations do not expand this exemption beyond its limited intent.

Renewable Gasoline - The definition is unclear whether captured carbon that is subsequently used to produce gasoline, such as by Fischer-Tropsch synthesis powered by renewable electricity, qualifies as "renewable" for this purpose. Clarifying whether captured CO_2 qualifies and if any restrictions exist for specified sources (e.g. captured CO_2 from a fossil fuel powerplant) would help ensure that the implementation of related provisions match the intent of this definition.

Other Issues Relating to Clarity and Intent of Proposed Changes

§ 95486.2 (b) (4) (F) - Proposed changes to this provision would require a station that receives FCI credits to dispense electricity in each quarter that it receives such credits. This requirement aligns with the intent of the HRI and FCI provisions, to support the deployment of critical refueling and fast charging infrastructure in advance of vehicle deployment. Requiring some actual dispensing of electricity ensures that a station must actually contribute to refueling of ZEVs in California to receive infrastructure credits. We suggest Staff consider adding a significance threshold to this requirement, to ensure that a single charging event, or isolated handful of them, cannot by themselves maintain eligibility for infrastructure capacity credits. This protects against the possibility that a fast charger operator would utilize their own charger once a quarter solely for the purpose of maintaining eligibility for FCI credits.

Attachment 2, Credit Quantification Equations for HRI and FCI Pathways - In our reading of this attachment, we note several areas where the subscripts on variables in credit quantification equations appear to be inconsistently used. For example, § 95486.3 (a) (3) (B) presents the following equation to quantify potential LMD-HRI credits:

 $Credits_{LMD-HRI}^{Potential} = Credits_{LMD-H}^{Prior\,qtr} \times \frac{Cap_{LMD-HRI}^{Approved}}{Cap_{LMD-HRI}^{Operational}}$

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However the description of variables below lists $Credits_{LMD-HRI}^{Prior qtr}$ rather than $Credits_{LMD-H}^{Prior qtr}$. It is unclear which variable name is intended here. Careful reading and cross-referencing generally allows the intent of these provisions to be ascertained, but we suggest Staff carefully review these equations for consistency to prevent misinterpretation by stakeholders moving forward.

Attachment 2, Provisions regarding limitations on number of credits generated by HRI and FCI pathways -Wwe observe inconsistent use of "deficits" and "prior quarter deficits" in these sections, and while the intent seems clear and discernable as written, aligning the language in these sections could reduce the possibility of future misinterpretation.

Unresolved Issues Point to Need for Additional Rulemaking in the Near Term

From the start of the workshop and engagement process that led up to this rulemaking, Staff were clear that the scope would be strictly limited in order to allow timely and efficient adoption of changes that could stabilize the LCFS credit market and help strengthen the LCFS credit price. The workshops, engagement opportunities, and discussion materials circulated since then have reflected this agenda. Given the significant decline in LCFS credit prices, this focus on corrective measures is understandable.

The limited scope, however, meant that many critical and complex structural topics that, when fully explored, might offer avenues to improve the efficiency, resilience, and effectiveness of the LCFS as decarbonization proceeds were excluded from this rulemaking. These include, but are not limited to, consideration of updated EERs, updating how the regulation addresses ILUC impacts, addressing appropriate crediting from fossil fuel displacement in a transitioning fleet, treatment of interactions or potential double-counting with other climate programs, harmonizing LCFS protocols with other jurisdictions that have similar programs in place or coming online, preparing for radical LCFS credit market shifts anticipated in the 2030's as program revenues begin declining due to reduced gasoline consumption, expanding the LCFS to cover air, water, and rail fuels, and integrating vehicle or transportation-system effects into fuel CI assessment, differentiation between so-called "bridge" fuels and those with the capacity to achieve carbon neutrality, etc. As discussed in earlier sections of this comment, several of these issues have demonstrated actual or potential capacity to negatively affect the LCFS and/or progress toward California's climate, environmental, and equity goals within the next 5-10 years. The other issues deserve careful consideration and the opportunity for public discussions in a forum that includes stakeholders from a variety of perspectives and LCFS program staff.

It is especially important in the transportation fuel space to make policy changes as early as possible, in order to avoid a situation that requires precipitous action that may create stranded assets, excessive fuel price volatility, or erode policy certainty about the LCFS market. The LCFS has in the past conducted major rulemakings following the release of the Scoping Plan; if

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past patterns hold this would imply the next significant LCFS rulemaking in 2028. By that time, failure to address some of the issues listed above could lead to another destabilization of LCFS credit markets. While many of these issues are complex and will take significant time and resources to address, most are amenable to solutions that can be gradually implemented, to minimize disruption. Waiting until a crisis emerges increases the chance that precipitous, disruptive change will be required.

<u>CARB should commit to a follow-up LCFS rulemaking, without any limitations to its scope, at the earliest possible opportunity.</u>

Thank you again for the opportunity to provide comments on the proposed amendment package. We appreciate the discussion this process has fostered so far and look forward to continuing our dialog through the coming year. We attach to this submission copies of the three recent reports from our research group related to research and modeling the LCFS, they are also available at the links cited in this letter. If we can offer any additional assistance or clarify any of the material in this comment, please do not hesitate to reach out to Colin Murphy by email at cwmurphy@ucdavis.edu.

Signed,

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