



16 October, 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 is intended 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 2nd 15-day comment package ("2nd 15 day package") released on October 1st almost certainly represents the conclusion of an extensive process of policy development and stakeholder engagement that began almost two years ago. 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. This process has sought to address persistently low credit prices that present a significant obstacle to California's efforts to achieve carbon neutrality by 2045. On the whole, the package of amendments that will be presented to the Board in November is likely to provide some support towards this end, and provide a transient period of market balance, however the fundamental challenges facing the market will remain and additional reforms will be necessary to secure the LCFS for long-term stability.

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.

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



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Impact of 2nd 15 day Package on Credit/Deficit Balance and LCFS Credit Price

The changes proposed in the 2nd 15 day package are, for the most part, unlikely to have significant impacts on LCFS credit supply and demand as compared to changes proposed earlier. The relaxation of the 20% per-company cap on crop-based feedstock would be expected to slightly reduce credit generation by allowing greater fractions of crop-based (and therefore, higher-CI fuels) to be credited under the LCFS, while changes to HRI provisions may result in slightly more credits being generated from these pathways.

We note that the total effect of all proposed amendments, including the original proposal and both 15 day packages is unlikely to address the large oversupply of LCFS credits relative to deficits, and therefore are unlikely to result in significant increases in LCFS credit prices. We have submitted modeling results with previous comments, as well as a report detailing the methodology of the Fuel Portfolio Scenario Model (FPSM) used to conduct this analysis.² As a result, if the amendments proposed to date are adopted without any further change, and absent significant upheaval in U.S. biofuel markets, we would expect the LCFS credit price trends observed over the last two years to persist indefinitely. The credit prices these imply, predominantly in the \$50-75 range, have been identified by a wide range of stakeholders as inadequate to support the investments required for California to meet its long-term GHG reduction goals in the transportation sector.

Changes to Auto-Acceleration Mechanism Triggering Criteria

Proposed changes shift the timing of the determination of whether the proposed auto-acceleration mechanism (AAM) is triggered and when such a decision would be announced. Previously, this determination would occur only once each calendar year in May, the 2nd 15 day package proposes shifting this to a quarterly determination, with announcements in February, May, August, and November. CARB Staff have indicated that the purpose of this change is to allow greater advance notice of an AAM triggering event. Given the potential for the AAM to impose significant benchmark increases, providing advance notice could limit the risk of market volatility, or obligated parties finding themselves short of compliance credit.

We note that in discussions with LCFS stakeholders, researchers and analysts, there is substantial uncertainty regarding the function and limits of this provision. Several parties read the proposed language in such a way that would allow the AAM to be triggered more frequently, or more than twice before 2030. We reached out to Staff by email for clarification and were informed that CARB's interpretation of this section is that it does not allow the AAM to be

² See: [Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking](#), [UCD Feb 20 2024 LCFS Comment](#), [UCD Comments on April 10 LCFS workshop](#), and [UCD August 27 2024 Comment on 15 day amendment package](#)



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triggered more frequently, and particularly not three times prior to 2030. We appreciate Staff's quick response and willingness to provide clarification on this matter.

While Staff were quite clear that the intent of this provision is to offer additional advance notice prior to AAM triggering events, the language in the 2nd 15 day package does not effectively convey this intent, in two key ways. First: there may be circumstances where quarterly determination of AAM triggering could actually reduce advance notice of target increases. For example, if the Executive Officer determines at the February and May determination dates that the conditions have not been met to trigger the AAM, but subsequent data change this determination such that an AAM triggering event is announced at the November determination date, the proposed amendments suggest that the target would increase the following January, which means obligated parties would be subject to the higher target with only 6 weeks of advance notice. While this sequence of events would require a specific, and unusual combination of market factors, it is not implausible that these factors could occur.

Second, the language in the 2nd 15 day package can be reasonably read in such a way as to allow a third triggering event prior to 2030, if the following sequence of events were to occur.

May, 2027 - The Executive Officer determines and announces that the AAM has been triggered, based on data from 2026.

January, 2028 - The 2029 target is adopted, one year ahead of schedule, because the AAM has been triggered once..

August 2028 - The Executive officer announces a second AAM triggering event, based on data from 2027 and 2028.

January, 2029 - The 2031 target is adopted, two years ahead of schedule, because the AAM has been triggered twice.

November, 2029 - The Executive Officer announces a third AAM triggering event, based on data from 2028 and 2029

January, 2030 - The 2033 target is adopted, three years ahead of schedule because the AAM has been triggered three times.

In this scenario, which aligns with a reasonable reading of the language in the 2nd 15 day package (an interpretation many LCFS stakeholders arrived at independently), the AAM could be triggered three times in the 2020's, leading to a 43.5% CI reduction target in 2030. The last of these three triggering events would have been announced only 6 weeks before the target was officially implemented in January. In addition to not aligning with Staff's expressed intent, this outcome would create the risk of credit shortfall and significant gas price impacts to consumers. In our presentation at the May 23, 2023 LCFS workshop on auto-acceleration mechanisms, we discussed the possibility of



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overcorrection by AAM triggering events.³ This risk is especially present in the early 2030's when the CI target increases by 4.5% per year, but light-duty EV sales shares may still be significantly below 100%.

The proposed language from the 2nd 15 day package may need to be clarified to better reflect the intent of the proposal. Specifying that the target cannot be accelerated two calendar years in a row could accomplish this, as would a requirement that target increases would not take effect until an adequate amount of time had passed (such as two or three quarters) to allow obligated parties the opportunity to update their compliance plans to reflect the higher target.

Limits on Crop-Based Feedstock Content

The 2nd 15 day package proposes adding sunflower oil to the list of crop-based oils subject to the company-level 20% cap on the use of such oils as biomass-based diesel feedstock, and makes changes to the criteria used to determine whether a company is eligible for an exemption from this provision until 2028.

The addition of sunflower oil aligns with the primary intent of this provision, which is to clearly signal the intent to limit the amount of crop-based feedstock that can be credited under California's LCFS. While sunflower oil is not a major source of biomass-based diesel feedstock at this time, it is a significant contributor to global vegetable oil supplies and there are no known technical reasons why it could not expand its footprint in the biofuel space, in which case the use of sunflower oil could have offered a loophole around the intent of this provision. Adding sunflower to the list of crop-based fuels would therefore close this potential loophole.

The change in exemption criteria would be expected to significantly expand the number of companies eligible to exceed the 20% cap through 2028. There is no clear indication, in published research or recent market data, as to why such an expansion would be required at this time. As we discussed in our August 27th comment letter, this company-level cap on crop-based feedstock is unlikely to present a significant obstacle to the continued growth of biomass-based diesel (BBD) in California, because there are ample sources of waste and residue feedstock available to U.S. BBD producers to allow continued BBD consumption growth in California while shuffling crop-based feedstocks to other jurisdictions.⁴ As we observed in our previous comment, the proposed 20% limit is likely to function primarily as a signal of California's intent to de-emphasize the role of crop-based biofuel feedstocks over time, but because feedstock shuffling offers a low-cost route to compliance, this would provide minimal

³ https://ww2.arb.ca.gov/sites/default/files/2023-05/UCDavis_052323.pdf

⁴ [UCD August 27 2024 Comment on 15 day amendment package](#)



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protection against ILUC or other sustainability risk. Extending additional exemptions from the 20% cap, as the proposed changes in the 2nd 15 day package would do, further limits the potential benefits from this provision, without providing a strong rationale for doing so.

Additionally, the provisions regarding the 20% cap on crop-based feedstocks specifies that volumes of fuel in excess of the cap be assigned a CI score equal to the relevant LCFS benchmark for the most comparable fossil fuel in that year. While this will not allow such fuels to generate credits, they would still have a significant cost advantage over fossil fuels that would generate LCFS deficits. In years where the LCFS target is significantly lower than the baseline fossil fuel carbon intensity, this can imply a quite significant per-gallon cost advantage for these fuels, even without generating credits. If the benchmark is lower than the pathway CI score for the fuels in question, this could even lead to crop-based fuels in excess of the 20% per-company cap being assessed at a lower CI score (meaning more credits per gallon) than the fuels that do not exceed the cap. This creates a perverse incentive for companies to emphasize crop-based fuels in their offerings to California, and undermines the intent of the 20% per-company cap. Assigning fuels in excess of the cap the CI score of the most comparable fossil fuel would eliminate this perverse incentive and better reflect the intent of the LCFS as well as this specific provision.

Classification of Corn Stover as a Specified-Source Feedstock

The 2nd 15 day package proposes adding corn stover to the list of specified source feedstocks that must supply chain of custody documentation, but are not required to complete a feedstock sustainability certification. Specified source feedstocks are generally those based on wastes and residues, for which there is limited alternative use and are not thought to entail a significant upstream source of GHG emissions. Corn stover, however, has some non-fuel uses and removing stover from fields to use it as a feedstock can have significant GHG impacts. As such, corn stover does not share enough characteristics with actual waste and residue feedstocks to justify inclusion on this specified-source feedstock list.

Corn stover is generally classified as an agricultural residue under most applicable classification systems, however this does not necessarily mean it is free from emissions impacts that should be considered under the LCFS. Corn stover may be used as an animal feed or bedding material, in which case shifting to become biofuel feedstock would cause additional feed or bedding material to be procured to back-fill what is lost. More importantly, however, corn stover is customarily left on most corn fields after the grain is harvested, where it is subsequently re-incorporated into the soil, either via tillage, or in the case of no-till fields, by compaction and other natural processes. The solid carbon embodied in corn stover helps maintain soil organic carbon (SOC) stocks, which would otherwise decline over time as SOC is decomposed by soil microbes. Removing stover to use for biofuel feedstock reduces the rate of SOC accumulation, and can result in long-term reductions in total SOC levels in corn fields. While studies have



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demonstrated that small amounts of stover can be removed without significantly impacting SOC levels, the amount of stover that can be removed varies widely from field to field due to soil, climate, agronomic, and other factors. A meta-analysis of U.S. field trials in which varying amounts of stover were removed showed this variability, and also found that even relatively low rates of stover removal, <25% of total stover mass, can lead to significant declines in SOC in some fields.⁵

Given that the LCFS is intended to reduce GHG emissions over the full life cycle of a fuel, this loss needs to be carefully considered during the pathway certification process, higher rates of SOC loss due to stover removal can significantly increase carbon intensity of cellulosic biofuels, or even render the resulting fuel more carbon intensive than the petroleum it displaces.⁶ SOC impacts of stover removal must be evaluated on a case-by-case basis, accounting for local conditions. Effective sustainability certification, especially when backed by soil carbon measurements, could mitigate this risk. The categorical exemption of corn stover from the proposed certification requirements means that CI certification of stover-based pathways may lack the necessary evidence to effectively evaluate GHG impacts from its use, thereby undermining the LCFS' ability to achieve long-term life cycle GHG reduction.

Biomethane Pathway Recertification

The 2nd 15 day package proposed changes to § 95488.9 (f) (3) that would limit the number of recertifications specified RNG projects that use dairy or swine manure as feedstock can be credited for, and also that project that break ground in 2030 or later shall only receive avoided methane credits for the duration of their current pathway certification at the time. We note that the language in § 95488.9 (f) (3) (A) is articulated as a maximum limit on the number of recertifications, not a requirement that each pathway be offered recertifications up to that limit.

The life cycle analysis underpinning LCFS credit quantification requires certain analytical assumptions or parameter determinations to be made, either explicitly or implicitly. Additionality is one of the most important and complex of these. Best practices throughout scientific literature on LCA, especially when it is utilized as part of regulatory or incentive programs such as the LCFS, emphasize the need to ensure that actions or production being credited are additional to what otherwise would have happened in the absence of the regulatory or incentive. In the LCFS context, this means that only actions that would not otherwise have occurred without the LCFS

⁵ C. W. Murphy, "Modeling the Environmental Impacts of Cellulosic Biofuel Production in Life Cycle and Spatial Frameworks by," Ph.D. Dissertation, University of California, Davis (2013). Chapter 4 <https://www.proquest.com/dissertations-theses/modeling-environmental-impacts-cellulosic-biofuel/docview/1525046145/se-2?accountid=14505>

⁶ C. W. Murphy, A. Kendall, Life cycle analysis of biochemical cellulosic ethanol under multiple scenarios. *GCB Bioenergy* 7, 1019–1033 (2015). <http://doi.wiley.com/10.1111/gcbb.12204>



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should be considered for CI determination and subsequent crediting. The LCFS has established a clear and transparent standard that actions required by law or regulation should not be credited or used to reduce the CI of certified fuel pathways because they are non-additional. This is to say, one cannot receive LCFS credit for actions taken to comply with applicable laws. Allowing previously certified pathways to remain valid through their expiration, even if they include credits or consideration of actions rendered non-additional by new law or code adopted after their certification deviates from both sound science and precedents repeatedly established under the LCFS. In some cases, this deviation is justified if necessary to maintain market confidence in the validity of LCFS incentives as a guide for investment.

The proposed changes to § 95488.9 (f) (3) (B) however, create a categorical exemption for projects that break ground in 2029 or before, allowing them to be recertified with avoided methane credits, even if such credits would be clearly non-additional at the time of recertification. This exemption breaks with well-accepted principles of life cycle analysis as well as past precedent under the LCFS. There can be a valid rationale to extend avoided methane crediting beyond what a typical interpretation of additivity would suggest, e.g. if the capital cost of a digester has not been fully repaid by the end of a crediting period. This exemption may be more common in early digester projects - which may be more expensive than later ones due to their reliance on less mature technology and supply chains. The proposed provision, however, essentially assumes that this is the case without requiring project operators to provide evidence. The proposed language in the 2nd 15 day period does not attempt to ascertain whether such exemptions are necessary, cost-effective, nor how long the crediting of non-additional emissions benefits must continue to repay the project's capital, and instead allows recertification of additional 10-year crediting periods for all pre-2030 digester projects.

Accurate assessment of GHG impacts, underpinned by a clear and accurate assessment of additivity is essential for the success of the LCFS. Crediting non-additional emissions benefits increases costs borne by gasoline and diesel consumers without providing commensurate emissions benefits. If and when the LCFS breaks from common and well-supported practices around additivity assessment, these exceptions should be as narrow as possible, to preserve the LCFS' basis in sound science. Limiting the duration of recertification with avoided methane credits to better match the actual needs of specified projects would better align the LCFS with the consensus in the life cycle assessment literature.

Sustainability Certification

We note several changes to the proposals around feedstock sustainability certification in § 95488.9 (g), and observe that while these changes generally improve the core functionality of the proposed certification requirements, none address the core issues of sustainability and ILUC



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risk that we have raised in multiple previous comment letters.⁷ Taking into consideration all proposed changes across both the original draft text and both 15 day packages, the LCFS is still inadequately mitigating the significant ILUC risks entailed by the use of biofuels at large volumes. This means that GHG benefits from these fuels as estimated using their pathway certified CI scores likely overestimate actual emissions impacts, and significant sustainability risks remain unaddressed by this rulemaking.

Clarification of Definitions and Intent

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

Definitions

Recovered Organics - The 2nd 15 day package proposes adding language to the definition of “Recovered Organics” to specify that these can come from anaerobic digestion or compost facilities. There are certainly opportunities to recover organic materials for beneficial utilization from streams that enter, leave, or circulate within anaerobic digestion facilities or compost facilities, however we note that the term “recovered organics” is typically used in ways that align with the original definition: where organic material is recovered from a mixed waste stream, in which some fractions are inorganic or otherwise unusable. Given that anaerobic digestion and compost facilities would, in most operational examples, be dealing with streams made up solely of organic material, this new definition may expand the concept of “recovered organics” outside of its customary use, which could lead to unexpected and/or unwanted interactions with other organic waste policies. We were unable to find instances of the term “recovered organics” being used elsewhere in the 2nd 15 day package, though our search did not exhaustively cover all of the supporting documents. Given that the term “recovered organics” seems to be sparingly used, if at all, it is difficult to ascertain the rationale behind this change or the impacts it might have, and we suggest CARB Staff provide additional clarification prior to adopting this change.

Clarifications of Intent

§ 95488 (i)(2) - This proposed change modifies language about the use of book-and-claim accounting to track RNG used as a transportation fuel, an input to the production of specified fuels, or to produce electricity for EV charging. The change to § 95488 (i)(2) states

⁷ Notably: [UCD Feb 20 2024 LCFS Comment](#) and [UCD August 27 2024 Comment on 15 day amendment package](#)



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“Indirect accounting may be used for RNG used as a transportation fuel, to produce electricity using a fuel cell for EV charging, or to produce hydrogen for transportation purposes” (underlined text indicates the additions in the 2nd 15 day package).

The word choice in this clause is unclear, one reading of it would imply that book-and-claim accounting can only be used when RNG is being used to generate electricity using a fuel cell for EV charging or to produce hydrogen, i.e. excluding its use in CNG or LNG fueled vehicles. A following sub-part, § 95488 (i)(2)(A) states

“RNG injected into the common carrier pipeline in North America (and thus comingled with fossil natural gas) can be reported as dispensed as bio-CNG, bio-LNG, or bio-L-CNG, or to produce electricity using a fuel cell for EV charging, or as an input to hydrogen production, without regards to physical traceability.” (underlined text indicates the additions in the 2nd 15 day package).

This section (as well as § 95488 (i)(2)(B), which has language similar to § 95488 (i)(2)(A) makes it clear that use of RNG in CNG or LNG fueled vehicles would also allow for book-and-claim accounting. Based on prior statements by CARB staff, this reading appears to match the intent of these provisions. Simply adding the word “or” immediately before “to produce hydrogen” in § 95488 (i)(2) would match the wording in § 95488 (i)(2)(A) and remove any ambiguity from this section.

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

From the start of this rulemaking process, 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, and the challenges this presents to California’s long-term climate goals, this focus on corrective measures is understandable.

The limited scope, however, meant ignoring many critical and complex structural topics that, when fully explored, might offer avenues to improve the efficiency, resilience, and effectiveness of the LCFS. 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 fossil fuels rapidly exit California’s fuel supply, expanding the LCFS to cover air, water, and rail fuels, integrating vehicle or transportation-system effects into fuel CI assessment, differentiation between so-called “bridge” fuels and those with the capacity to achieve carbon



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neutrality, etc. As discussed in our many comments on this rulemaking, 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.

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 California's climate policy portfolio. The LCFS has in the past conducted major rulemakings following the release of the Scoping Plan; if 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.

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

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. 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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