

Proposal for Amendments to California LCFS Program

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Dr. Laskowski and CARB Staff,

California has proven to be a pioneer in the decarbonization of transportation. The LCFS program is leading the transformation of the largest carbon-emitting-sector of the state's economy, transportation; the policy has motivated billions in private capital towards a variety of sustainable fuels through a combination of good market design and good policy design. This policy has served as a framework that is being applied across the nation and across the world for other governments to direct the decarbonization of their own economies. California, as always, is the state upon a hill.

Pursuant to the recent series of Public Workshops held by CARB, this letter is intended to provide CARB staff with perspective built over years of active investment in the LCFS market. The objective of this letter is to suggest appropriately aggressive actions to strengthen the LCFS market and ensure that it achieves its goals aligned with California's Draft 2022 Scoping Plan.

The basis for the projections made in this report derive from extensive modeling of the LCFS market. This modeling incorporates publicly available data from sources including government agencies, interviews, and earnings calls, as well as proprietary data sets built through experience operating in the renewable fuels space. Inputs to this model have been aligned with those from the California Transportation Supply (CATS) model.

In addition to these inputs, supply of each fuel category reacts to economics over time; each category of fuel builds at a pace related to LCFS prices, RINs prices, blenders tax credits, commodity prices, feedstock prices, operating costs, etc. as appropriate. The speed of this supply response is based on the typical build cycles for projects producing each fuel. Consequently, high LCFS prices incentivize greater buildout over time than do low LCFS prices, a dynamic which is both obvious and often overlooked in fuel supply forecasts.

I look forward to working with CARB staff on making appropriate adjustments to the LCFS program and would welcome any questions on the above commentary.

Regards,

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CI Schedule Scenarios

Linear Scenarios

As seen in Figure 1, the level at which CARB sets the 2030 target will result in dramatically different outcomes for the credit bank. In more conservative scenarios, such as that where CARB sets a 25% CI reduction target for 2030 (Linear25, aligned with CARB's Alternative A), the credit bank continues to build, reaching nearly 100M credits banked by the end of 2030. Conversely, an aggressive approach of setting a 35% CI reduction target for 2030 (Linear35, aligned with CARB's Alternative C) depletes the bank over this period.

The key issue in each of these scenarios is that the credit bank expands rapidly over the coming years. As a result, credit prices would be expected to remain at current or lower levels, severely limiting the impact of the LCFS program on low-carbon fuel project development. Extending our view past 2030, it seems nearly impossible to reach the levels of decarbonization targeted by CARB by 2045 absent substantially more project development over the next 5 years than would be expected to occur in a low-price environment.

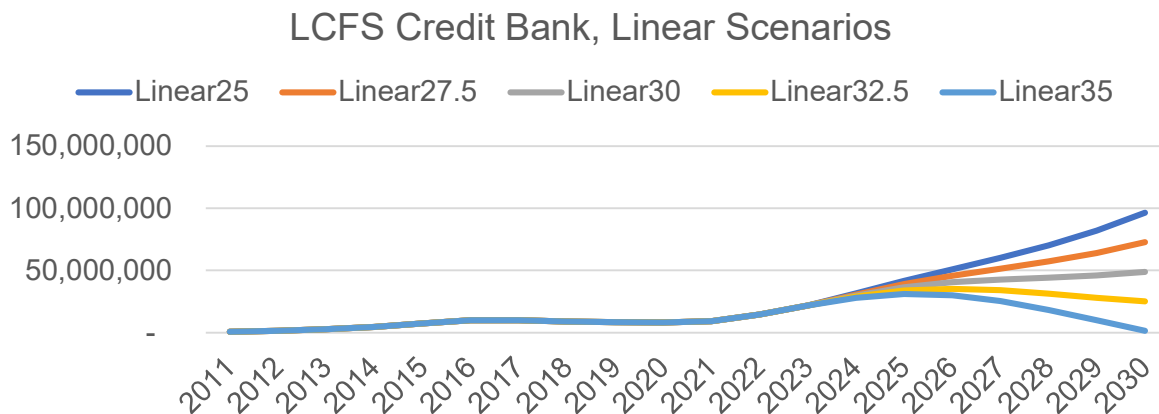


Figure 1: LCFS credit bank under linear CI schedule scenarios

Non-Linear Scenarios

Whereas all linear scenarios lead to meaningful increases in the credit bank over the next several years, non-linear CI schedules can avoid this problem. For each non-linear CI schedule evaluated, we will look at a one-time CI reduction target decrease in 2024, which is then followed by a linear path to the 2030 target.

Figure 2 and Figure 3 below showcase how the credit bank would be expected to proceed under different 2024 CI targets. The first number in the scenario names corresponds to the 2024 CI reduction target (e.g., NonLinear19,30); the second number is the 2030 CI reduction target (e.g., NonLinear19,30). Figure 2 shows scenarios with a 25% CI reduction target for 2030; this set of outcomes demonstrates that while a non-linearity is impactful on near-term market dynamics, it is not a substitute for an appropriately aggressive 2030 target as all scenarios lead to a rapidly expanding credit bank in the late 2020s. Meanwhile Figure 3's scenarios have a 30% CI reduction target in 2030 which show more stable credit bank values throughout the 2020s as the target is better aligned with the expected changes to California's fuel mix.

LCFS Credit Bank, Non-Linear Scenarios to 25%

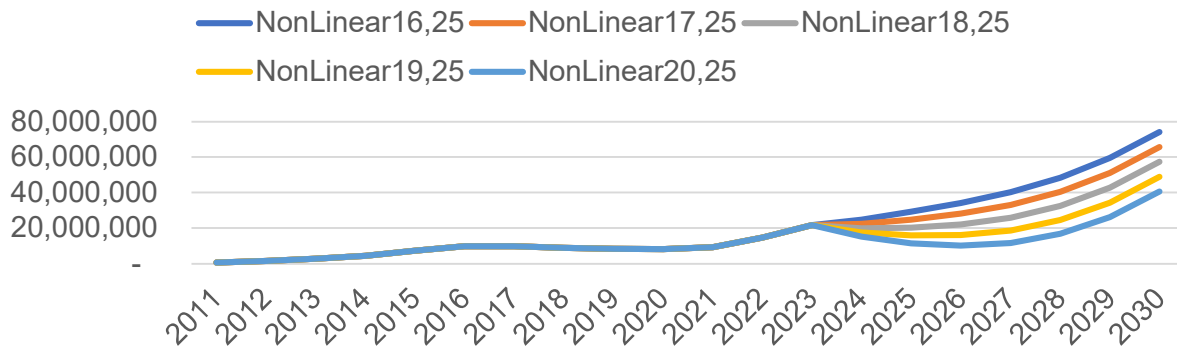


Figure 2: LCFS credit bank with a 2024 non-linearity targeting 25% CI reduction by 2030

LCFS Credit Bank, Non-Linear Scenarios to 30%

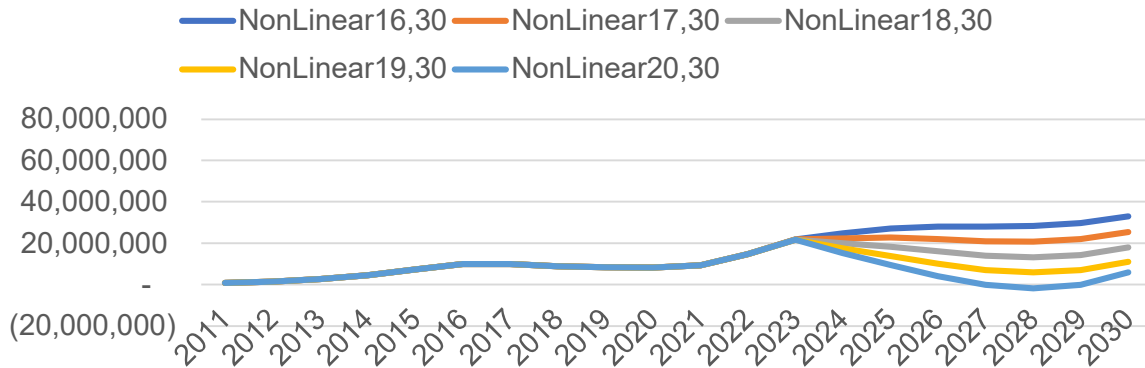


Figure 3: LCFS credit bank with a 2024 non-linearity targeting 30% CI reduction by 2030

Suggested CI Reduction Schedule

Given the credit bank trajectories, the most prudent course of action for CARB would be to set a non-linear path with a **19% CI reduction in 2024 and targeting a 30% CI reduction for 2030**. This schedule stimulates additional low-CI fuel capacity while paying dividends over the long-term with lower LCFS compliance costs. Further, this schedule would allow CARB ample flexibility in setting post-2030 targets to target greater levels of decarbonization in the transportation sector.

Ratchet Mechanism

While the above forecasts represent the best estimation of the market’s trajectory under various conditions, there is meaningful uncertainty to many of the inputs and the degree to which those inputs are determinative of credit supply/demand results. Given this, it is smart policy to enable the LCFS program to fluidly adjust to the realities of the market, an outcome which can best be accomplished through a “Ratchet Mechanism”. The concept would increase current and future

CI reduction targets as the market proves it can exceed the pace of decarbonization which had been previously assumed.

Benefits of the Ratchet Mechanism

A Ratchet Mechanism serves as a check against runaway conditions in the LCFS market and a hedge against how quickly regulators can intervene in the case of these conditions. While a Ratchet Mechanism would not be a replacement for a well-calibrated CI reduction schedule, it would limit the consequences of misestimating the appropriate future CI reduction target.

Because the concept would prevent runaway credit bank builds, there would be increased certainty to the value of credits. Investors would not be as worried that new investment will flood the market with credits, thereby removing the scenario in which the market oscillates from credit dearth to credit surplus. In this, investors will have more confidence allocating capital to LCFS credit generating projects, thereby enabling faster decarbonization of the transportation sector.

The Design

The functionality of a Ratchet Mechanism will be defined by (a) the triggering event for the provision, (b) the magnitude of the change to CI targets caused by the provision, and (c) how the CI schedule change will be implemented.

Trigger

The most effective way of defining the conditions in which the event is to go into effect is by using the rolling four-quarter average achieved CI reduction, weighting each quarter's achieved CI by the volume of fuel used in California in that quarter. This is defined mathematically for any quarter ("q") at a point in time ("t") in Equation 1 and Equation 2 with CIs defined in terms of percent reduction relative to the 2010 baseline and all energy terms converted to SI units.

$$\text{Equation 1: } CI_{q,Achieved} = CI_{q,Standard} * \sum Credits_{q,Achieved} / \sum Deficits_{q,Achieved}$$

$$\text{Equation 2: } CI_{q,Trigger} = \sum_{q=t-3}^{q=t} (CI_{q,Achieved} * E_q) / \sum_{q=t-3}^{q=t} (E_q)$$

Second, the threshold needs to be defined. For this, we average the next four quarters' CI standard with even weighting instead of volumetrically weighting them as the future fuel volumes cannot be known in real-time. This is defined in Equation 3.

$$\text{Equation 3: } CI_{Threshold} = \sum_{q=t+1}^{q=t+4} (CI_{q,Standard}) / 4$$

If this provision were currently active and were being evaluated for Q2 2022, we would evaluate the CI achieved in each Q3 2021 through Q2 2022, which would then be weighted by the volume of fuel used in each quarter respectively. The threshold would be the average of the CI reduction targeted in each Q3 2022 through Q2 2023. If the former exceeds the later, the provision would be activated. The calculations described above are shown in detail in the tables below. Because 10.891% is greater than 10.625%, the Ratchet Mechanism would be activated. As can be seen in Figure 4, the threshold would have been exceeded in Q2 2022 for the first time since 2016, and it is only exceeded previous to that due to the CI reduction freeze.

Quarter	CI Reduction Target (A)	Credits (B)	Deficits (C)	Achieved CI Reduction (A*B/C)	Energy Use
Q3 2021	8.75%	5,532,734 MT	5,165,372 MT	9.38%	574.26 PJ
Q4 2021	8.75%	5,606,738 MT	4,692,610 MT	10.46%	538.42 PJ
Q1 2022	10.00%	5,841,761 MT	5,150,491 MT	11.34%	515.51 PJ
Q2 2022	10.00%	6,741,371 MT	5,392,896 MT	12.50%	542.94 PJ
Wtd Average				10.891%	

Quarter	CI Reduction Target
Q3 2022	10.00%
Q4 2022	10.00%
Q1 2023	11.25%
Q2 2023	11.25%
Average	10.625%

CI Reductions vs. Ratchet Mechanism

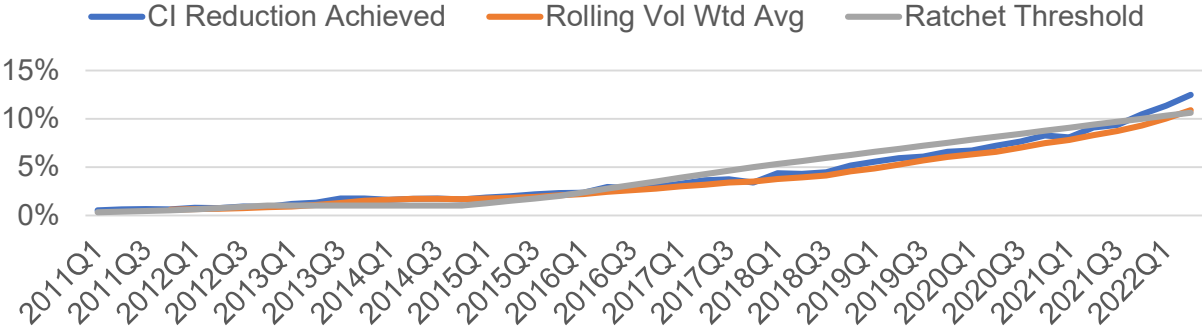


Figure 4: History of CI reductions achieved vs. the Ratchet Mechanism’s proposed threshold

Magnitude

Having established the threshold for activating the Ratchet Mechanism, the subsequent question is how substantially to shift the CI reduction schedule. To ensure the market continues to *increase* low-carbon fuel production, the magnitude of the change should be set such that the new CI reduction target should equal the realized CI reduction, as defined in Equation 4.

$$\text{Equation 4: } \text{Magnitude}_{q,Ratchet} = CI_{q,Trigger} - CI_{q,Standard}$$

$$\text{Equation 5: } CI_{q \geq t, New} = CI_{q \geq t, Old} + \text{Magnitude}_{q,Ratchet}$$

Using the numbers calculated for Q2 2022 above, the weighted average CI reduction over the previous four quarters is 10.89% compared to current CI reduction target of 10.00%; as a result

the magnitude of the shift would be $10.89\% - 10.00\% = 0.89\%$. All future CI reduction targets would likewise be increased by 0.89% with the updated CI reduction schedule as follows.

	2022	2023	2024	2025	2026	2027	2028	2029	2030
CI_{Old}	10.00%	11.25%	12.50%	13.75%	15.00%	16.25%	17.50%	18.75%	20.00%
$Magnitude_{q,Ratchet}$	0.89%	0.89%	0.89%	0.89%	0.89%	0.89%	0.89%	0.89%	0.89%
CI_{New}	10.89%	12.14%	13.39%	14.64%	15.89%	17.14%	18.39%	19.64%	20.89%

Implementation Timing

A key feature of the Ratchet Mechanism is to adjust the program’s ambitions in real-time to match the achievement of the LCFS program. Consider an adjustment made on the basis of the market’s performance from Q2 2026 through Q1 2027. The data set needed would be complete as of CARB publishing data for Q1 2027 on July 31, 2027. In the most aggressive implementation timeline, CARB could retroactively adjust the CI reduction target for all of 2027, adjusting credit account balances with new deficits and invalidating credits. Alternatively, CARB could choose to not adjust any CI targets until January 1, 2028, though this would allow for a major increase in the credit bank size during that delay. A moderated approach is to adjust the CI reduction target beginning in Q3 2027, when the data is published. This has the advantage of avoiding retroactive action on credit/deficit production and there is sufficient time for market participants to plan accordingly to the CI standard changes.

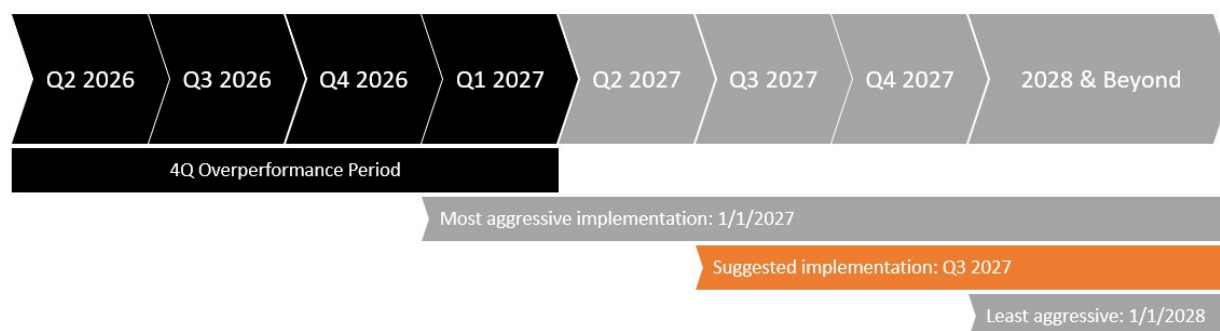


Figure 5: Possible implementation timelines for Ratchet Mechanism after being triggered

Proposed Ratchet Mechanism

In order to ensure the smooth and orderly operation of LCFS markets with increase the stability of credit pricing, **CARB should adopt a Ratchet Mechanism for the LCFS program**. This will accelerate the pace at which investors allocate capital to credit-producing projects and **speed the path to transportation decarbonization**. By setting clear rules ahead of time for such a provision, CARB can **remove regulatory friction** from the market and provide a stronger ecosystem for investors, developers, and operators.

Reform of Opt-In Entities Regulation

While the impact the LCFS program has made is clearly positive, the degree to which it has increased low-carbon fuel supply has been held back due to an inefficient market structure with regards to opt-in entities. This harms project developers and results in slower decarbonization than could otherwise be achieved.

Under Section 95483.1 of the LCFS regulation, corporate entities are only permitted to opt-in to the LCFS program insofar as they interact with the fuel supply chain, operate projects, or as a clearinghouse. This definition keeps market makers and liquidity providers out of the market, particularly those which are not permitted to own assets such as fuel producing projects under their operating mandates. As a result, the regulation prevents them from buying and selling credits.

The outcome of this has been the concentration of market power in the hands of a few large traders who have enjoyed a regulatorily-created competitive moat, collecting extreme spreads on trading as a result. Certain regulated parties, knowing that they are the only natural buyers of credits, regularly offer one-sided deals that stick nearly all market risk on the credit seller. For years, these trading desks have demanded terms such as upfront payment for the right to sell them credits and transacted prices with up to 50% discounts to the market price. In this, a huge amount of value of the LCFS market is being captured by the regulated entities.

These conditions are a direct consequence of the LCFS regulations disallowing competition from playing out as it does in other commodity markets, where buyers compete to offer the best terms to sellers. This dynamic has real consequences for the LCFS program and California's ambitions to decarbonize. To scale, the market needs to transition to more sophisticated means of transacting credits, largely through fixed-price contracts (similar to solar PPAs). Compared to the amount of capital available in the infrastructure debt markets, there is relatively little "risk-seeking" capital that is willing to underwrite projects that have uncertain cashflows, and that capital is insufficient to build the amount that is needed. Project debt markets will only be serious about funding LCFS projects if offtake contracts for credits reach the point of maturity that is commonplace in other commodity markets.

The benefits to the LCFS ecosystem of permitting a wider range of market makers would be immense. This would expand the variety, maturity, and sophistication of risk-sharing financial products available to project owners and operators, thereby enabling those projects to tap **new, large pockets of capital to fund project development**. This, in turn, would markedly **accelerate the pace at which projects will be developed**. The current system, though well-intended, helps keep the progress of the LCFS market at bay.

Biomethane Crediting

In the November 9, 2022 Public Workshop, Staff discussed the concept of phasing down biomethane, or renewable natural gas (RNG), as a credit generating fuel. This action would have meaningful implications contrary to the aims of the California Scoping Plan, increasing emissions both within and outside of California. Further, removing the technological neutrality stance that CARB has constructed would limit capital from supporting the program.

One aspect that CARB may be misinterpreting is how expensive it is to operate dairy manure-to-RNG projects. In the CATS model, Staff suggests that the conversion cost to produce one MMBtu of dairy RNG is \$11.40, the same as that for landfill RNG. This, however, is inaccurate; the actual cost of dairy RNG production is closer to \$25/MMBtu on the low end and up to \$40/MMBtu for higher cost operations. Staff may be projecting that RNG would shift from the transportation market to the utility market, where utilities have indicated willingness to procure RNG at \$10-15/MMBtu. Given the actual cost structure, this would result in operating losses and most dairy projects would be shuttered, resulting in large quantities of unabated methane

emissions. California could possibly take regulatory action regarding dairies within its own borders and mandate emission controls, but many dairies with LCFS-linked projects are located in states without meaningful climate regulations. As such, removing RNG from the LCFS program would serve to increase total emissions.

There would be additional indirect challenges as a result of CARB removing RNG from LCFS. Tech neutrality is effective because it gives investors reassurance that CARB will not “play favorites”; investors do not have to guess how CARB might think about a given fuel category at some future date (when CARB may be comprised of entirely different personnel). Staff would undermine confidence in the market if they were to remove RNG as a credit-generating fuel, and as a result investors would charge higher premiums on capital deployed into infrastructure – or, for many investors, abandon the market altogether. As a result, CARB would slow the pace of decarbonization when the focus should be on accelerating it by every means possible.

Additionally, CARB Staff has suggested removing RNG’s book-and-claim eligibility for RNG. Given that many dairy RNG projects would be shuttered if deprived of the LCFS incentive, project owners would have to pay pipeline owners to move molecules to California. With pipeline owners aware of this dynamic, they would charge high fees, redirecting LCFS dollars from project developers and investors into the hands of oil and gas asset owners. In addition to the financial cost, this would also be an inefficient and unnecessary use of energy and associated carbon emissions to move molecules.

In order to instill market participants with confidence, **CARB should maintain its policies with regard to biomethane**. CARB states that “LCFS is designed to encourage the use of cleaner low-carbon transportation fuels...and therefore, reduce GHG emissions”. Removing biomethane as a credit generating fuel is not aligned with these goals, puts California further away from achieving the LCFS program’s goals, and will make the challenge of achieving complete transportation decarbonization even greater.

Summary

The developments of the California transportation market over the past two years has resulted in the LCFS regulation’s CI reduction schedule being out of step with the achievements of the market. Based on extensive modeling of the LCFS market, the best path forward is likely to be one which brings the market back to equilibrium through a non-linear increase to the CI reduction target, paired with an appropriately aggressive target for 2030 (and beyond).

Beyond that, there are several steps CARB can take to accelerate decarbonization of the transportation system and promote the development of a well-functioning market under the LCFS policy. To ensure that the market continues to incentivize additional low- and zero-carbon fuel, CARB should adopt a Ratchet Mechanism to reward the market for CI reduction achievements beyond that which is required by the LCFS program. To enhance the rate at which capital can be deployed into the market, CARB should liberalize outdated rules on market participation. And to provide continued market confidence and demonstrate a commitment to tech neutrality, CARB should maintain its long-held policies regarding biomethane. Each of these will serve to enhance the LCFS market and promote decarbonization of the transportation sector as quickly as possible.