Mission

The mission of this whitepaper is to better inform the California Air Resources Board (CARB), market participants, industry groups, and the general public by presenting a framework for the implementation of an Acceleration Mechanism within the Low Carbon Fuel Standard (LCFS).

Part 1: Overview

The LCFS program is overperforming as the program has already met the 2024 carbon intensity (CI) reduction target in Q2-2022, a full 2 years in advance. With the expected domestic Renewable Diesel buildout, further market share expansion of negative-CI Renewable Natural Gas (RNG), higher EV sales penetration, and slumping gasoline demand, net credit generation is projected to jump significantly over the next 2-3 years. Thus leading to over over 68 entities supporting a need for an Acceleration Mechanism in the most recent LCFS Workshop Comments including airlines (American, United), autos (Rivian, Tesla), renewable diesel producers (Neste, World Energy), negative CI RNG project developers, owners & operators (Amp Americas, DTE Vantage, CalBioenergy, Maas Energy Works), and utilities (LADWP, PG&E, SDG&E, SMUD, SoCal Edison)[1]. Major obligated parties such as Chevron[2] and Valero[3] did object to the idea of an Acceleration Mechanism based on price and stated the mechanism should encourage growth and innovation through a clearly defined, transparent, predictable process based on real data submitted to CARB. The following parts of this whitepaper aims to hit on those points by presententing a metric (part 2), Comp Curve (part 3), and the parameters for a triggering event of the Acceleration Mechanism along with an example walk through (part 4).

Part 2: Metric

The concept of a 4-quarter energy weighted CI delta presented by Carbon Acumen[4] and Net Negative Partners[5] should be used as the metric for the Acceleration Mechanism as it is the most transparent metric that currently exists. The 4-quarter energy weighted CI delta might sound a little confusing but it is quite simple. First the quarterly reduction will need to be calculated by dividing credits by deficits then multiplying by respective reduction target percentage as shown in equation 1 below. Take Q2-2022 for example with 6.74 million MT of credits, 5.39 million MT of deficits, and a 10% reduction target gets you to a 12.5% quarterly reduction.

$$Quarterly\ Reduction\ =\ (Credits/Deficits)\ *\ Reduction\ Target \qquad \textit{Equation 1}$$

To calculate the quarterly CI delta you subtract the reduction target from the quarterly reduction as calculated in equation 1. For Q2-2022 the quarterly delta would be 2.5%.

$$Quarterly\ Delta\ =\ Quarterly\ Reduction\ -\ Reduction\ Target \qquad \textit{Equation 2}$$

[1] CARB Nov 9, 2022 LCFS Workshop Comments
[2] Chevron Nov 9, 2022 LCFS Workshop Comments (pdf link)
[3] Valero Nov 9, 2022 LCFS Workshop Comments (pdf link)
[4] Carbon Acumen Nov 9, 2022 LCFS Workshop Comments (pdf link)
[5] Net Negative Partners Nov 9, 2022 LCFS Workshop Comments (pdf link)

For the final step you weight each quarterly CI delta based on the total energy used in that respective quarter relative to the prior three quarters. The table below shows an example of how the 4-quarter energy weighted CI delta would be calculated for Q2-2022, which is 1.53%. Meaning for quarters Q3-2021 through Q2-2022, the actual CI reduction outpaced compliance by 153 basis points or 1.53 percentage points.

Quarter	Credits (million MT)	Deficits (million MT)	Quarterly Target	Quarterly Reduction	Delta	Energy (MM MJ)
Q3-2021	5.53	5.17	8.75%	9.36%	0.61%	572,822
Q4-2021	5.61	4.69	8.75%	10.47%	1.72%	536,959
Q1-2022	5.84	5.15	10.00%	11.34%	1.34%	514,007
Q2-2022	6.74	5.39	10.00%	12.50%	2.50%	541,077
4-Quarter Energy Weighted CI Delta					**1.53%**	**2,164,865**

Note: CARB currently does not report total energy in the quarterly data, however they do report volumes for each quarter in gallons, gge or dge. The quarterly energy you see in the table above is the sum of multiplying each volume by its respective energy density. This method accounts for the energy-economy-ratio (EER) for each respective fuel.

Part 3: Comp Curve

The purpose of the Comp Curve is to have it ready to potentially accelerate the 2025-2030 reduction targets by taking into consideration four things: (1) 2024 step down, (2) new compliance curve slope, (3) significant data lag, and (4) avoid double counting CI reduction progress.

Please be patient with me in this section as I will lay out the need for a Comp Curve.

According to an analysis of the slides presented in the most recent LCFS workshop by OPIS, CARB is preparing for a step down in 2024[6]. What does a step down mean? The current 2030 target is 20% with many calling for a new 2030 reduction of around 30%. Instead of drawing a straight line from the 2023 reduction target of 11.25% to 30% in 2030, increasing compliance by 2.68% per year, CARB would 'step down' the compliance curve in 2024 at a steeper rate than the consistent reduction annual rate from 2025-2030. The reasoning for a step down is due to the current and expected near term over performance of the program causing the credit bank to swell to levels unsustainable to justify future financing of low carbon fuel infrastructure. The Comp Curve should take into account the 2024 step down and the new slope of compliance curve from 2025-2030.

[6] California's LCFS: Just How Much Stronger Will the New Targets Be? (OPIS; Nov 21, 2022)

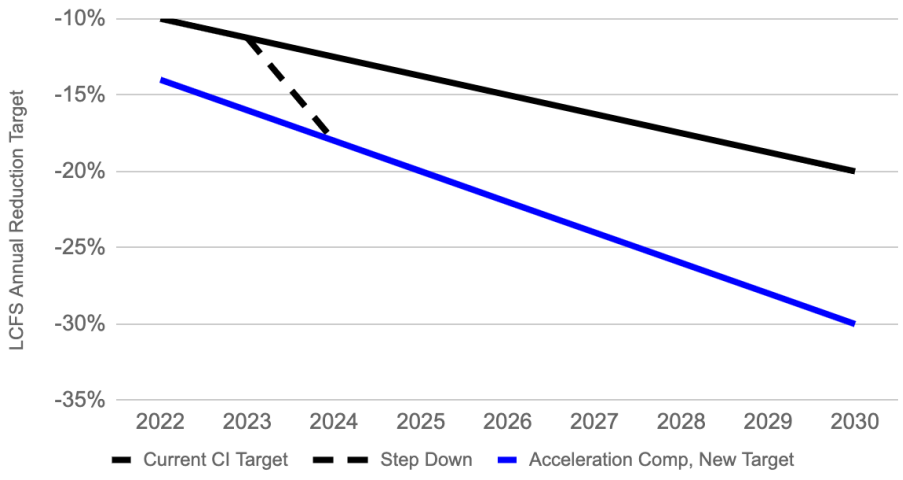
CARB releases LCFS data on a quarterly basis, however the timing of the release lags by a significant amount. For any reporting year only the first two quarters of that reporting year are reported in that calendar year with the remaining two quarters being reported in the following year. The Comp Curve and respective Acceleration Mechanism will need to take the significant data lag into consideration so that market participants have ample lead time to plan for the following year if the reduction target is going to accelerate.

Due to the anticipated 2024 step down and data lag, the CI delta will need to be calculated against a Comp Curve to avoid double counting CI reduction progress as opposed to being calculated against the reduction target as shown in equations 1 and 2. Therefore the quarterly reduction and delta should be calculated against the Comp Curve as shown in equations 3 and 4, respectively.

$$Quarterly\ Reduction\ =\ (Credits/Deficits)\ *\ Comp\ Curve\ Target \qquad \textit{Equation 3}$$

$$Quarterly\ Delta\ =\ Quarterly\ Reduction\ -\ Comp\ Curve\ Target \qquad \textit{Equation 4}$$

Assuming a 2024 step down to 18% and a 2030 reduction target of 30%, the graph below illustrates the current CI reduction targets (black line) versus the 2024 step down (dotted black line) and the Comp Curve (blue line). For years 2022 and 2023, the Comp Curve takes the same slope of the new compliance curve set forth by CARB in the upcoming rulemaking. The reasoning for the Comp Curve being different in 2022-2023 versus the reduction target curve is to not double count progress that has been accounted for in the 2024 step down along with having the same slope as the 2024-2030 slope. If the Acceleration Mechanism is never triggered, the Comp Curve is the same as the reduction target curve for 2024-2030.



If you are confused, please be patient. The Comp Curve will make more sense once you get through the next two sections.

Part 4: Trigger Event, Future Curve & Comp Curve Adjustments

As mentioned before, LCFS data for the last two quarters of the preceding year and the first two quarters of the current year are reported each year by CARB as summarized in the table below for the 2023 and 2024 calendar years.

Calendar Year	Quarter Data	Reporting Month
2023	Q3-2022	Jan-2023
	Q4-2022	Apr-2023
	Q1-2023	Jul-2023
	Q2-2023	Oct-2023
2024	Q3-2023	Jan-2024
	Q4-2023	Apr-2024
	Q1-2024	Jul-2024
	Q2-2024	Oct-2024

Given CARB updates Crude Oil CI[7] and electricity grid average CI[8] for the following year during Q4 of the current year, it is acceptable to use the same timing for the Acceleration Mechanism. Therefore the data used to calculate 4-quarter energy weighted CI delta should include Q3 and Q4 of the prior calendar year along with Q1 and Q2 of the current calendar year. For example if the Acceleration Mechanism was to trigger to accelerate the reduction targets for years 2025-2030, the data used in the 4-quarter weighted CI delta would be from quarters Q3-2023, Q4-2023, Q1-2024, and Q2-2024. By doing this, the market would have ample time to plan for 2025 as the last data used would be published at the end of October in 2024. Also since the 4-quarter energy weighted CI delta is a rolling metric, market participants should be fully aware of a potential acceleration for 2025-2030 reduction targets as early as July 2024.

CARB installed a triggering threshold for the Crude CI of 0.1 gCO2e/MJ. Meaning if the three year energy weighted CI average did not increase by more than 0.1 gCO2e/MJ, then the Crude CI did not change. CARB could do something similar with the Acceleration Mechanism by using a threshold of 0.5% or 1.0%. So if the 4-quarter energy weighted CI delta was not greater than the threshold it would not trigger in Q4 of the current year to accelerate the following years reduction targets. A triggering of the Acceleration Mechanism should not only adjust the future compliance curve but also the Comp Curve. An example of what a triggering event would like is provided below.

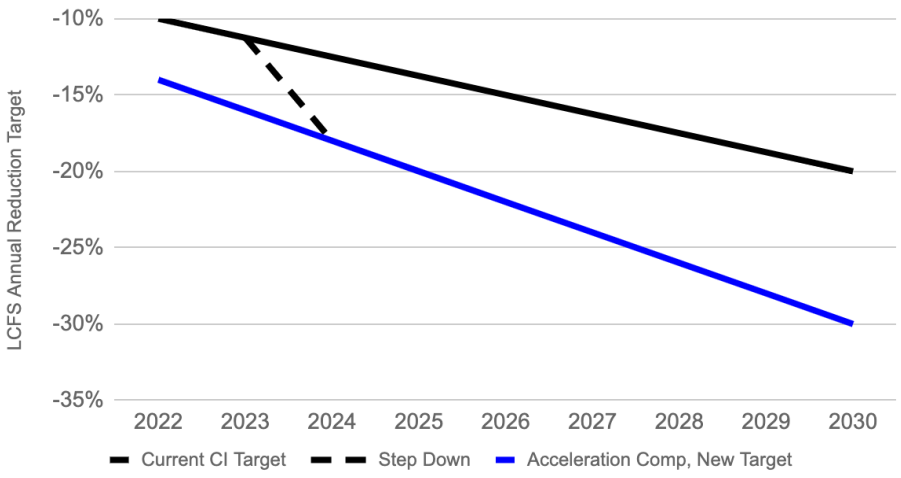
[7] LCFS Crude Oil Life Cycle Assessment
[8] 2023 CI Values for California Average Grid Electricity Used as a Transportation Fuel in California

Example

For this example it is assumed there is a 2024 step down to 18% along with a ratable annual increase of 2% per year to 30% reduction target by 2030. The table below outlines this example for the 2022-2030 reduction targets as well as the Comp Curve.

Compliance Year	Reduction Target	Comp Curve
2022	10%	14%
2023	11.25%	16%
2024	18%	18%
2025	20%	20%
2026	22%	22%
2027	24%	24%
2028	26%	26%
2029	28%	28%
2030	30%	30%

The graph below is a visual representation of the table above showing the current CI reduction curve, 2024 step down, the Comp Curve along with the new CI reduction curve.



The table below summarizes the quarterly data release timing along with the reduction target for each quarter and the respective Comp Curve to calculate the 4-quarter energy weighted CI delta in this scenario for years 2023-2026.

Release Year	Quarter Data	Reduction Target	Comp Curve
2023	Q3-2022	10%	14%
	Q4-2022	10%	14%
	Q1-2023	11.25%	16%
	Q2-2023	11.25%	16%
2024	Q3-2023	11.25%	16%
	Q4-2023	11.25%	16%
	Q1-2024	18%	18%
	Q2-2024	18%	18%
2025	Q3-2024	18%	18%
	Q4-2024	18%	18%
	Q1-2025	20%	20%
	Q2-2025	20%	20%
2026	Q3-2025	20%	20%
	Q4-2025	20%	20%
	Q1-2026	22%	22%
	Q2-2026	22%	22%

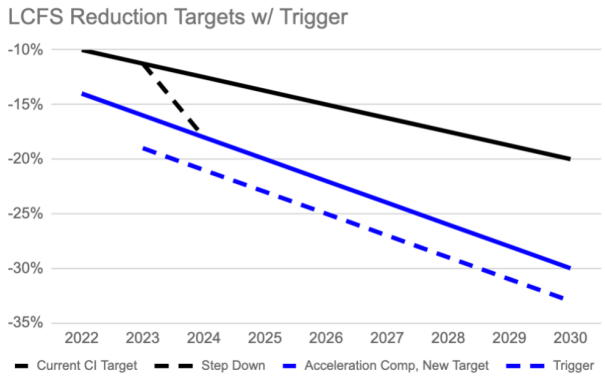
For this example let's assume for each quarter reported in 2024 (Q3-2023, Q4-2023, Q1-2024, Q2-2024) has a quarterly delta of 3%, therefore triggering the Acceleration Mechanism by adding an additional 3% for the 2025-2030 reduction targets. Lets also assume the 3% quarterly delta stays constant for Q3-2024 and Q4-2024 which is reported in 2025. By adjusting the Comp Curve with the initial 3% that was triggered at the end of 2024, the 3% additional reduction is now normalized to zero and not being double counted in 2025 when Q3-2024 and Q4-2024 are reported. If the Comp Curve did not adjust each time the Acceleration Mechanism triggered, then the reduction progress has the potential to be double counted and triggering another acceleration for compliance years 2026-2030. The table below reflects the 3% made to the reduction targets and the Comp Curve in red.

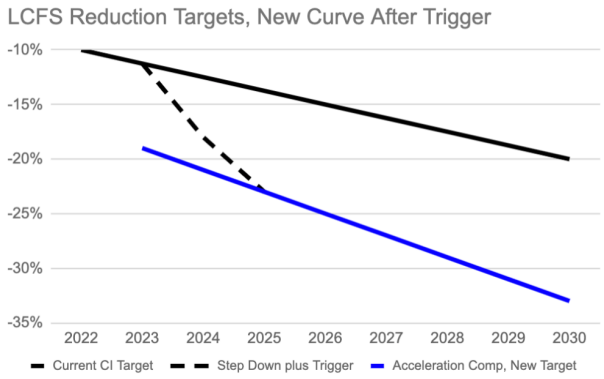
Release Year	Quarter Data	Reduction Target	Comp Curve
2023	Q3-2022	10%	14%
	Q4-2022	10%	14%
	Q1-2023	11.25%	16%
	Q2-2023	11.25%	16%
2024	Q3-2023	11.25%	16%
	Q4-2023	11.25%	**19%**
	Q1-2024	18%	**21%**
	Q2-2024	18%	**21%**
2025	Q3-2024	18%	**21%**
	Q4-2024	18%	**21%**
	Q1-2025	**23%**	**23%**
	Q2-2025	**23%**	**23%**
2026	Q3-2025	**23%**	**23%**
	Q4-2025	**23%**	**23%**
	Q1-2026	**25%**	**25%**
	Q2-2026	**25%**	**25%**

For a simpler view of what the 3% acceleration would mean for each compliance year as well as the Comp Curve. The Acceleration Mechanism, if triggered, adjusts future reduction annual targets while adjusting both the future Comp Curve and the preceding years as shown in red in the table below.

Compliance Year	Reduction Target	Comp Curve
2022	10%	14%
2023	11.25%	**19%**
2024	18%	**21%**
2025	**23%**	**23%**
2026	**25%**	**25%**
2027	**27%**	**27%**
2028	**29%**	**29%**
2029	**31%**	**31%**
2030	**33%**	**33%**

If you are a more visual person please see the graphs below using the same scenario of triggering a 3% acceleration in 2024. The graph on the left shows the triggering event of 3% by the blue dotted line while the graph on the right shows the trigger, adjusted Comp Curve and Compliance Curve.





Conclusion & Recommendations

In order to spur further investment into low carbon fuel infrastructure an Acceleration Mechanism needs to be adopted by CARB. A metric that is clearly defined, transparent, and based on real data submitted to CARB should be used for the Acceleration Mechanism such as the 4-quarter energy weighted CI delta calculated against a Comp Curve with clearly defined triggering events as presented in this whitepaper. If you have any questions or comments about the information provided above, please feel free to reach out to me at will@carbon-acumen.com.