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Sample LCFS Credit Price Outlook 2023 Baseline Edition

PREPARED FOR

BY
STILLWATER ASSOCIATES LLC

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EXECUTIVE SUMMARY

In this report, Stillwater offers a forward-looking view of California Low Carbon Fuel Standard (LCFS) credit balances and prices through 2035. The key factors contributing to differences between the outcomes found in this 2023 baseline outlook and our 2022 annual cycle of outlooks are:

1. Stillwater's anticipation that the California Air Resources Board (CARB) will accelerate the 2030 CI reduction schedule from 20% to 30% and extend the schedule out to 2035 with a reduction of 45%,
2. The adoption of an auto-acceleration mechanism (AAM) as proposed by AJW in CARB's May 2023 workshop,
3. Accelerated penetration of electric vehicles (EVs) into the future in line with recent historic adoption rates.

In Section One, we offer an overview of California's LCFS program. The LCFS and similar low carbon fuel (LCF) programs aim to reduce emissions of greenhouse gasses (GHGs) by reducing the average carbon intensity (CI) of transportation fuels that are used in a particular jurisdiction. Under the LCFS, each fuel is assigned a CI by source which accounts for feedstock, manufacturing, transport, and use of the fuel. The difference between a particular fuel's CI and the annual benchmark (the regulatory target CI) establishes the number of credits or deficits the fuel will generate. California's current CI reduction schedule steps down linearly from a 10% reduction in 2022 to a 20% reduction by 2030, but CARB has begun the process to update and extend the schedule to greater reductions beyond 2030 and, potentially, prior to 2030 as well.

To understand the likely forward trajectory of LCFS credit prices, it is important to understand the levers that have influenced LCFS credit prices historically. As such, in Section Two we cover how political, legal, regulatory, and market forces have affected LCFS credit prices since the program's inception and how this landscape may shift going forward.

In Section Three, we describe our approach to analyzing LCFS credit and deficit balances and credit prices. Stillwater's outlook for LCFS credit prices is based on our deep historic knowledge of the LCFS program, our assessment of potential program amendments, our analysis of the demand for fossil gasoline and diesel, our assessment of the supply of low-CI fuels in California, and our outlook on the CI of each fuel pool.

In Sections Four and Five, we offer fuel-by-fuel supply, demand, and CI outlooks for each of the deficit-generating

(Section Four) and credit-generating (Section Five) fuels covered under the LCFS program. These form the basis for our credit balance outlook through 2035.

Supply of all low-carbon fuels is ultimately limited by the availability of suitable feedstocks, and the most critical feedstock availability issue concerns fats, oils, and greases (collectively, FOG or lipids) utilized for nearly all existing commercial production of BD, RD, alternative jet fuel (AJF), renewable gasoline blendstock (RG), and renewable propane (RP). Accordingly, Section Six offers Stillwater's exclusive lipid feedstock outlook.

To help the reader interpret the modeling results, in Section Seven we look at how the different fuel volumes combine to create an overall picture of the gasoline pool and the diesel pool. Examining each of these pools separately enables us to understand how the market is adjusting to the requirements for complying with the LCFS overall.

Finally, in Section Eight we offer our LCFS credit bank and price outlooks through 2035. Importantly, CARB is expected to increase the stringency of the LCFS as it develops amendments responding to the 2022 Scoping Plan for Achieving Carbon Neutrality (the 2022 Scoping Plan). However, these amendments have not been announced as of this writing. For this report, Stillwater has modeled the future trajectory of the LCFS to match the amended program CARB has telegraphed via public workshops and meetings.

Figure ES-1 illustrates Stillwater’s three scenarios that define the possibilities for LCFS credit prices given the supply, demand, and regulatory factors discussed herein and the statutory credit price cap that limits the LCFS price (the top line in the figure below). Key factors driving the shape of these curves include:

1. Our assumptions for LCFS program amendments currently being developed by CARB. These are described in Section 3 of this report.
2. The annual outlook for sources of the low-CI fuels needed to meet the anticipated demand for credits – if supply of low-CI fuels, especially RD, outstrips growth in deficit-generation, this would tend to drive credit prices lower.
3. The forecast rate of growth in the population of EVs in California – a growing EV population lowers deficit generation from CARBOB and increases credit generation from low-CI electricity thus tending to drive credit prices lower.
4. The outlook for commodity prices (such as crude oil and soybean oil) which influence the relative costs of production of petroleum and low-CI fuels – credit prices tend to increase when the price spread between renewable feedstocks and crude oil increases.

The line labeled “Base Case” represents Stillwater’s outlook for the annual average LCFS credit price during each year through 2035. This price curve is estimated based on analysis

of key factors which have explained prior year price levels as well as emerging new trends and Stillwater’s outlook for program amendments expected to be proposed by CARB in the next few months. This outlook becomes increasingly less certain into future years as compliance options and strategies evolve. In the short term, these underlying trends can be masked by exogenous events (such as economic recessions), news items, and rumors concerning future changes to the regulations.

Stillwater derived the price curve labeled “Low Gasoline (High EV) Case” in the figure (and referred to as the “Low Case” throughout this report) through the same approach as the Base Case with lower credit prices reflecting the different assumptions of this case (discussed in detail in the body of this report). In the Low Case, we set an assumed floor price of based on market behavior between September 2022 and February 2023 to reflect a price level below which production of some low-carbon fuel options ceases to be economic. We do not believe that this floor price represents sustainable market conditions. The acceleration of the reduction schedule we have assumed represents the action we expect CARB will take to support prices in the near term.

The price curve labeled “High Gasoline (Low EV) Case” in the figure (and referred to as the “High Case” throughout this report) depicts a scenario with a lower-than-expected rate of growth in the EV population; this case requires steady increases in other low-CI fuels, such as RD and RNG, throughout the outlook period.

Figure ES-1. LCFS Credit Price Scenarios

Redacted

Table ES-1, below, displays Stillwater’s Base Case LCFS credit price scenario, expressed in dollars per metric ton (MT).

Table ES-1. Base Case LCFS credit price outlook through 2035 (\$/MT)

Year	Base Case LCFS Credit Price Scenario
<i>2018 actual</i>	Redacted
<i>2019 actual</i>	
<i>2020 actual</i>	
<i>2021 actual</i>	
<i>2022 actual</i>	
2023	
2024	
2025	
2026	
2027	
2028	
2029	
2030	
2031	
2032	
2033	
2034	
2035	

*Price Cap

*Note: Stillwater’s LCFS Credit Price Outlook projects the amount and environmental characteristics of each fuel that contributes to the supply or demand of LCFS credits. We estimate several key factors based on this outlook to determine the forecasted price. As with all forecasts, the input assumptions, including potential regulatory changes, commodity prices, and the economic environment may shift over time, resulting in deviations from the forecast. For the purposes of this outlook, we assume no additional LCF programs are added in this timeframe beyond the current programs in California, Oregon, Washington, and British Columbia, and the Canadian program scheduled to take effect July 2023. Our price assessment is clearer in the short-term and is very dependent on CARB’s actions and the impact of additional LCF programs in the long term. **For clients with specific concerns over the sensitivity of our outlook to specific variables, we can evaluate additional cases for an added fee.***

FOOTNOTES

1. Carbon intensity (CI) is defined as the emissions of carbon dioxide and equivalents per unit of fuel energy over its full lifecycle; this includes emissions associated with production of feedstocks, transport to the fuel production facility, the production of the fuel, transport of the fuel to market, and tailpipe emissions associated with its end use. Emissions of carbon dioxide from biogenic sources are excluded from this calculation. CI is expressed in units of grams of CO2 equivalent emissions per megajoule of fuel, gCO2e/MJ or, more simply, g/MJ.
2. Stillwater’s outlook for program amendments is discussed in Section 3 of this report.