



INFORMATIONAL HEARING

Select Committee on the Transportation Costs and Impact of the Low Carbon Fuel Standard

Wednesday, August 27, 2025
1pm – State Capitol, Room 444

BACKGROUND

LCFS Overview

The Low Carbon Fuel Standard (LCFS), established in 2011 and administered by the California Air Resources Board (CARB), is a regulatory program aimed at reducing greenhouse gas (GHG) emissions from transportation fuels. Enacted under the authority of Assembly Bill 32, California's landmark climate law, the LCFS seeks to decrease the lifecycle carbon intensity (CI) of fuels used in the state by encouraging the use of cleaner alternatives. The regulation was designed to be technology-neutral and performance-based, offering flexibility to fuel providers in how they comply.

The Basics

To comply with LCFS, fuel producers and importers must ensure that the average CI of the fuels they sell in California meets the annual benchmark set by CARB. The CI benchmark declines each year and is calibrated to achieve a 30 percent reduction in average fuel CI by 2030 relative to 2010 levels, with a long-term target of a 90 percent reduction by 2045¹. Each fuel's CI score represents the full lifecycle GHGs associated with producing, transporting, and consuming that fuel, expressed in grams of CO₂-equivalent per megajoule (gCO₂e/MJ)².

This performance-based approach allows regulated entities to select the most cost-effective or technologically appropriate strategies to reduce the CI of their fuel supply. Unlike prescriptive standards, the LCFS provides compliance flexibility, which has helped foster innovation in low-carbon fuels and infrastructure³. Fuel providers can achieve compliance by supplying lower-CI fuels, blending cleaner fuels with conventional ones, or purchasing credits from other market participants.

¹ California Air Resources Board. (2024). 2024 Amendments to the LCFS Regulation.
<https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024>

² California Air Resources Board. (2020). LCFS Basics.
<https://ww2.arb.ca.gov/sites/default/files/2020-09/basics-notes.pdf>

³ Mohanty, S., & McNamara, M. (2023, October 4). Understanding California's Low Carbon Fuel Standards regulation. RMI.
<https://rmi.org/understanding-californias-low-carbon-fuel-standards-regulation/>

The LCFS is also designed to be adaptive. CARB periodically revises the program to reflect advances in science, changes in the fuel market, and evolving state climate goals⁴. The CI benchmarks are updated in alignment with California's Scoping Plan, and CARB evaluates progress through rulemaking and stakeholder engagement. Additionally, the program includes mechanisms such as credit banking and carryback provisions that allow participants to manage compliance over multiple years, further enhancing market stability⁵.

CI Calculations and Fuel Pathways

CARB uses the CA-GREET model⁶—a modified version of the federal GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model⁷ developed by Argonne National Laboratory—to estimate the lifecycle CI of transportation fuels. This "well-to-wheels" approach evaluates emissions at each stage of a fuel's life, including feedstock cultivation or extraction, processing, transport, distribution, and end-use combustion. The CA-GREET model is central to the LCFS program because it enables consistent comparisons of CI values across fuel types, based on standardized assumptions and data inputs⁸.

CARB maintains a public database of approved fuel pathways, which are certified CI scores assigned to specific fuel types and production methods⁹. New producers can apply for custom pathways if they use novel or lower-emission processes not covered by existing certified pathways. This system is intended to enable innovation continuous improvements in production efficiency.

The CA-GREET has drawn criticism from environmental advocates, researchers, and even some industry groups¹⁰. One of the most debated issues in CA-GREET is its treatment of fuels with methane capture, particularly renewable natural gas (RNG) from dairy manure. Because methane is a potent greenhouse gas, CARB's model credits avoided emissions from capturing and reusing it, which can result in extremely favorable—sometimes even negative—CI scores. In some cases, dairy RNG is assigned scores below zero, implying that its use prevents more greenhouse gas emissions than it produces. Critics argue these assumptions may overstate the climate benefits of such fuels and risk incentivizing the expansion of industrial dairy operations to generate more methane-rich manure, rather than tackling emissions at the source. These credits may also distort the LCFS market by channeling support toward fuels with questionable long-term sustainability while undercutting cleaner alternatives like electricity and green hydrogen.

⁴ California Air Resources Board. (2022). 2022 Scoping Plan for Achieving Carbon Neutrality. <https://ww2.arb.ca.gov/our-work/programs/ab-32-climate-change-scoping-plan>

⁵ Ricardo Energy & Environment. (2021, September). California Low Carbon Fuel Standard: Rethinking decarbonisation incentives. Energy Systems Catapult. <https://esc-production-2021.s3.eu-west-2.amazonaws.com/2021/09/California-LCFS-Case-Study-FINAL.pdf>

⁶ California Air Resources Board. (2022). *CA-GREET3.0 Model User Guide*. <https://ww2.arb.ca.gov/resources/documents/ca-greet3-model>

⁷ Argonne National Laboratory. (2023). *GREET Model*. U.S. Department of Energy. <https://greet.es.anl.gov/>

⁸ California Air Resources Board. LCFS Life Cycle Analysis Models and Documentation. <https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation>

⁹ California Air Resources Board. (2023, September 14). Low Carbon Fuel Standard: Current fuel pathways. https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/current-pathways_all.xlsx

¹⁰ Malins, C., & Searle, S. (2019, September). *A critique of lifecycle emissions modeling in "The greenhouse gas benefits of corn ethanol—assessing recent evidence."* https://theicct.org/wp-content/uploads/2021/06/Critique_lifecycle_emissions_modeling_20190919.pdf

As a complement to the CA-GREET, CARB uses the Global Trade Analysis Project (GTAP) model to estimate indirect land use change (ILUC) emissions from crop-based biofuels¹¹. ILUC occurs when diverting crops for fuel increases global agricultural demand and leads to land conversion, such as deforestation, to replace food production. A wide range of independent academics has found that GTAP significantly underestimates ILUC emissions from liquid biofuels¹². This means that the model may be awarding emissions reductions that are not actually happening, with Californians ultimately paying for these miscalculations through higher fuel costs. Critics have therefore urged CARB to update its ILUC modeling to better reflect the real-world consequences of biofuel expansion.

Taken together, these concerns point to a larger issue: outdated or overly generous modeling assumptions can lead the LCFS to reward pathways that do not deliver the climate benefits Californians are paying for. For this reason, stakeholders across the spectrum have called for greater transparency in CA-GREET and GTAP assumptions, periodic review of how avoided and indirect emissions are calculated, and reforms to ensure that LCFS credits truly reflect real-world greenhouse gas reductions.

Credit/Deficit System

CARB uses a credit and deficit system to enforce LCFS. Fuels with CI values below CARB's annual benchmark generate credits, while fuels with CI values above the benchmark generate deficits. One LCFS credit is equal to one metric ton (1MT CO₂) of avoided GHG emissions. Covered entities—primarily refiners and importers of gasoline and diesel—must retire enough credits each year to offset the deficits generated by their fuel sales. To comply, they can either supply lower-CI fuels to earn credits or purchase credits from others.

Credits can be generated by producing or supplying lower-CI fuels such as renewable diesel, ethanol, hydrogen, or electricity. These credits can also be banked for future compliance or sold to other regulated entities in private bilateral transactions. Although there is no centralized trading exchange, CARB maintains a comprehensive credit account registry and verification system to track credit generation, transfers, and retirements. This centralized system ensures market transparency and regulatory compliance.

Credit prices are determined by supply and demand and can be volatile. Historically, credit prices have ranged from under \$20 to over \$200 per metric ton of CO₂e, with the price floor effectively set by the cost of low-CI fuel production and the ceiling influenced by CARB's credit clearance market mechanism¹³. This mechanism caps credit prices by allowing obligated parties to purchase credits at a maximum price if they are unable to secure enough through the open market, thus providing a safety valve against extreme price spikes.

A diverse range of entities participates in the credit market, including utilities that supply electricity for electric vehicles, EV charging infrastructure, biofuel producers, hydrogen suppliers, oil producers

¹¹ California Air Resources Board. (n.d.). *LCFS land use change assessment*. <https://ww2.arb.ca.gov/resources/documents/lcfs-land-use-change-assessment>

¹² Berry, S., Searchinger, T., & Yang, A. (2024, December). *Biofuels, deforestation, and the GTAP model*. <https://tobin.yale.edu/research/biofuels-deforestation-and-gtap-model-0>

¹³ California Air Resources Board. (2020). *LCFS Credit Clearance Market*. <https://ww2.arb.ca.gov/resources/documents/lcfs-credit-clearance-market>

using innovative crude extraction technologies, fleet operators that transition to electric cargo handling or delivery vehicles and others. This diversity reflects the LCFS's technology-neutral design and its role in incentivizing a broad array of decarbonization strategies across the transportation sector.

Credits Generated Out of State

A substantial share of LCFS credits originate from fuel production and emission reduction activities located outside of California. According to a 2020 analysis by Stillwater Associates, approximately 75 percent of all LCFS credits were generated by fuels imported from other states or countries. In 2019 alone, this equated to an estimated \$2.1 billion in credit value¹⁴.

The program's design allows for credit generation from fuels that are not physically produced within the state, provided they displace high-carbon fuels sold in California's transportation market. This includes renewable diesel, biodiesel, and ethanol produced in the Midwest, as well as electricity and RNG injected into interstate pipelines. One particularly controversial feature is the treatment of dairy-derived RNG from outside California. More than half of the LCFS credits tied to dairy methane capture have been awarded to projects based in other states, such as New York and Idaho¹⁵. These facilities inject biomethane into national gas pipelines and claim credits based on modeled displacement of fossil natural gas in California, even though the gas molecules do not physically reach the state.

CARB has indicated the LCFS program is designed to comply with the U.S. Constitution's Commerce Clause, which prohibits states from discriminating against or unduly burdening interstate commerce¹⁶. This design was informed in part by litigation—most notably *Rocky Mountain Farmers Union v. Corey*, in which out-of-state ethanol producers challenged the LCFS as discriminatory¹⁷. While the Ninth Circuit ultimately upheld CARB's program, the case underscored the risk of constitutional challenges if California restricted crediting to in-state facilities. To avoid running afoul of the Commerce Clause, CARB designed the LCFS to be "location neutral": credits are awarded based on the carbon intensity of the fuel and its use in California's market, not on where the fuel is produced. This framework allows fuels refined or captured outside the state—whether ethanol from the Midwest, renewable diesel from Singapore, or RNG from Idaho dairies—to generate credits as long as they displace petroleum fuels consumed in California.

Critics argue that this approach undermines the program's intent to stimulate local clean energy investment and may raise questions about environmental integrity. By issuing credits based on book-and-claim accounting methods rather than physical delivery, the LCFS can result in substantial financial rewards for out-of-state operations while offering limited direct air quality or economic benefits to Californians.

¹⁴ Stillwater Associates. (2020, October 20). West Coast LCFS credits generated by fuels produced out-of-state.

<https://stillwaterassociates.com/west-coast-lcfs-credits-generated-by-fuels-produced-out-of-state/>

¹⁵ Pierce, M. Hanna, and Aaron L. Strong. (2023). An Evaluation of New York State Livestock Carbon Offset Projects under California's Cap and Trade Program. <https://doi.org/10.1080/17583004.2023.2211946>.

¹⁶ Legal Information Institute. (n.d.). Commerce Clause. Cornell Law School. https://www.law.cornell.edu/wex/commerce_clause

¹⁷ United States Court of Appeals for the Ninth Circuit. (2019, January 18). *Rocky Mountain Farmers Union v. Corey*, No. 17-16881. https://climatecasechart.com/wp-content/uploads/case-documents/2019/20190118_docket-17-16881_opinion.pdf

These dynamics have sparked ongoing debate among policymakers, environmental justice advocates, and academic experts about how best to balance environmental performance, market efficiency, and geographic equity in LCFS crediting rules.

Price Impacts and Equity Considerations

Although LCFS compliance costs are partially passed on to consumers, research consistently finds that the impact on retail gasoline prices is modest. Most estimates suggest that the LCFS adds between 5 and 15 cents per gallon to the cost of gasoline, depending on credit prices and the share of low-carbon fuels in the supply mix¹⁸. These impacts are relatively small compared to other fuel price drivers such as global crude oil prices, refining costs, and state and federal excise taxes. For example, the price of crude oil alone can fluctuate by more than a dollar per gallon, often exerting a far larger influence on pump prices than environmental regulations¹⁹.

Nevertheless, LCFS credit market volatility and rising compliance costs have raised concerns about long-term economic impacts and the potential burden on consumers, particularly during periods of high-energy prices. To address this, CARB has implemented cost containment mechanisms, such as the Credit Clearance Market²⁰, to prevent extreme price spikes and ensure a more predictable compliance landscape.

At the same time, questions about additionality amplify these price concerns²¹. Because the LCFS does not require that credited activities be “additional” to business-as-usual, some credits are awarded for projects—such as biofuel production already mandated by the federal Renewable Fuel Standard—that would occur regardless of the program. This means California drivers are paying higher fuel costs to subsidize activities that do not generate new climate benefits. Critics argue that this undermines the program’s cost-effectiveness, as consumers bear the costs without receiving commensurate environmental gains.

There is growing policy interest in ensuring LCFS not only reduces greenhouse gas emissions but also delivers tangible, inclusive gains within California. While some California-based entities, such as investor-owned utilities, reinvest LCFS revenues into local clean transportation programs, including EV charger deployment and rebates for electric vehicle purchases, a substantial portion of LCFS credit value flows to out-of-state fuel suppliers²². This dynamic has raised concerns among stakeholders, who argue that Californians should receive a greater share of the program’s environmental and economic benefits.

¹⁸ California Energy Commission. (n.d.). Estimated gasoline price breakdown and margins. California Energy Commission. <https://www.energy.ca.gov/estimated-gasoline-price-breakdown-and-margins>

¹⁹ U.S. Government Accountability Office. (2005, May 2). Motor fuels: Understanding the factors that influence the retail price of gasoline. <https://www.gao.gov/assets/gao-05-525sp.pdf>

²⁰ California Air Resources Board. (2020). LCFS Credit Clearance Market. <https://ww2.arb.ca.gov/resources/documents/lcfs-credit-clearance-market>

²¹ **Martin, J.** (2024, February 15). *Something stinks: California must end manure biomethane accounting gimmicks in its Low Carbon Fuel Standard*. Union of Concerned Scientists. <https://blog.ucs.org/jeremy-martin/something-stinks-california-must-end-manure-biomethane-accounting-gimmicks-in-its-low-carbon-fuel-standard/>

²² Stillwater Associates. (2020, October 20). West Coast LCFS credits generated by fuels produced out-of-state. <https://stillwaterassociates.com/west-coast-lcfs-credits-generated-by-fuels-produced-out-of-state/>