California Air Resources Board

Public Hearing to Consider Amendments to the Low Carbon Fuel Standard

Final Statement of Reasons for Rulemaking, Including Summary of Comments and Agency Response

Attachment 1.b - Table 1
45-Day Comments

Public Hearing Date: November 8, 2024
Agenda Item No.: 24-6-2

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Comment 377 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Christine
Last Name	Ball-Blakely
Email Address	cblakely@aldf.org
Affiliation	
Subject	LCJA et al. Comments on Proposed Amendments to LCFS
Comment	Please find a PDF of our comments attached. Note that the system will not accept the comments and exhibits in a zipped folder. We have attempted three times in two separate browsers to submit the comments and exhibits per the instructions below, which state: "If you have more than one attachment to upload, please put all of the attachments in a .ZIP file and send it." Each of our three submission attempts resulted in the same error message. Accordingly, we will be emailing our comments and a ShareFile link to the exhibits to the Clerk at cotb@arb.ca.gov. The exhibits are available for download via that ShareFile link, which is: https://aldf.sharefile.com/public/share/web-sb900fcc4a3614def9843
Attachment	www.arb.ca.gov/lists/com-attach/app-zip/7060-lcfs2024-WyhcNFA3AiIBcm0d.
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BEFORE THE CALIFORNIA AIR RESOURCES BOARD

LEADERSHIP COUNSEL FOR JUSTICE AND ACCOUNTABILITY, CENTRAL VALLEY DEFENDERS FOR CLEAN WATER & AIR, ANIMAL LEGAL DEFENSE FUND, AND FOOD & WATER WATCH COMMENTS ON PROPOSED AMENDMENTS TO THE LOW CARBON FUEL STANDARD

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I. EXECUTIVE SUMMARY

For more than four years, community members and organizations concerned about factory
farm pollution and environmental injustice in the San Joaquin Valley—including the undersigned
coalition of organizations ("Commenters")—have raised the alarm about the consequences of the
California Air Resources Board's ("CARB") monetization of factory farm pollution through the
368.1 Low Carbon Fuel Standard ("LCFS"). Specifically, these community members and organizations
have spotlighted CARB's unlawful operation of the LCFS outside its regulatory authority—
including CARB's operation of the LCFS as a pollution trading scheme that fuels industry and
investor profits while dumping the resulting pollution and related costs on rural, low-income,
and/or Latino/a/e communities. CARB staff, in their proposed rule and Initial Statement of
Reasons ("ISOR"), have ignored these concerns, along with the people raising them and the facts
underpinning them. CARB must comply with its legal obligations and reform the LCFS.

The rulemaking package put forward by CARB staff ("proposed Amendments" or
"Amendments")[1] fails to correct the program and, in fact, makes things worse. First, the proposed
amendments ignore and attempt to displace CARB's mandatory duties to directly regulate manure
368.2 methane emissions pursuant to SB 1383 and prioritize direct emission reductions as mandated by
AB 197. Instead, CARB continues to use the false baseline of perpetually unregulated manure
methane emissions to continue its perverse policy of avoided methane crediting that enriches the
largest and most polluting operations and investors in factory farm gas. Second, the proposed
368.3 Amendments continue to ignore the true carbon intensity of factory farm gas production. Third,
the proposed Amendments continue to ignore that the LCFS is a market-based compliance
368.4 mechanism and that CARB must ensure the additionality of LCFS greenhouse gas emission
reductions. Fourth, the Amendments attempt to use the LCFS to achieve post-2030 greenhouse
368.5 gas emissions reductions, including the development of biomethane and hydrogen fuels for
stationary sources, outside of CARB's delegated authority. Finally, the amendments will continue
and intensify CARB's discrimination against rural, low-income, Latino/a/e communities in the
368.6 San Joaquin Valley both by incentivizing herd consolidation and by increasing pollution associated
with the production and use of factory farm gas.

The proposed LCFS amendments are more than arbitrary and capricious—they are indefensible.

[1] Commenters intend these comments to respond to all LCFS regulatory proposals currently open for public comment. This includes but is not necessarily limited to the Initial Statement of Reasons ("ISOR") and all Attachments, all environmental reviews, all relevant proposed simplified Tier 1 calculators, the proposed CA-GREET4.0, and development of staff's proposed April 2024 workshop. Leadership Counsel for Justice and Accountability also concurrently submit separate comments in response to the Draft Environmental Impact Analysis, Commenters incorporate those comments by reference as though fully set forth herein and intend them to complement those laid out here.

II. FACTUAL BACKGROUND

A. Manure Management & California's Dairy Herd

Dairies have multiple options for manure management. Most dairies in the San Joaquin Valley use free stalls or corrals with a flush system. Other options, used by some dairies, include pasture-based manure management and collection of "manure from feed lanes via regular scraping or vacuuming."[2] The latter two are manure management techniques available to dairies which use less water and produce fewer pollutants overall.

The number of milk cows in California at large dairies has increased since 2017, the number of milk cows at smaller dairies has decreased, and the number of dairy farms has decreased disproportionately more than the overall number of milk cows in the state. The data demonstrate that the California dairy herd is consolidating and concentrating into larger dairies. The data show that for dairies with 2,500 or more milk cows, the milk cow herd increased 26.8 percent from 808,503 milk cows in 2017 to 1,025,716 milk cows in 2022, while the population of cows on dairies with less than 1,000 cows decreased 52.4 percent, from 303,746 milk cows in 2017 to 144,472 in 2022.[3]

The San Joaquin Valley is experiencing the trend and impacts of herd-size expansions more than any other region of the state. While the overall population of cows fell in California, the number of cows in the San Joaquin Valley grew slightly, even while the number of dairy farms dropped dramatically, demonstrating the pattern of herd consolidation and concentration within the San Joaquin Valley and near San Joaquin Valley communities. The San Joaquin Valley is now home to over 90% of dairy cows in California and the average herd size in the San Joaquin Valley grew from about 1,577 to about 2,052 between 2017 and 2022.[4] It bears noting that the consolidation trend in California has accelerated substantially since 2017. For instance, the average dairy herd grew from approximately 940 to 1059 dairy cows between 2012 and 2017,[5] while the average dairy herd jumped from approximately 1059 to 1511 between 2017 and 2022.[6] As
368.6 discussed throughout these comments, the proposed Amendments will continue to contribute to herd expansion and the concentration of milk cows and manure in the San Joaquin Valley.

B. Dairies with LCFS pathways and digester projects are located in a disproportionately Latino/a/e region of the state.

Communities and households near and most directly impacted by large dairies that are installing digesters are disproportionately Latino/a/e. Each of the top 10 counties for dairy

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[2] Ex. 1, Andrew Chang et al., Univ. of Cal., Div. of Agric. and Nat. Res., Managing Dairy Manure in the Central Valley of California (rev. June 2005), https://perma.cc/BS9A-2M5U.
[3] Ex. 2, U.S. Dept. of Agric., 2022 Census of Agriculture: California State and County Data 16, Tbl. 12.
[4] *Id.* at 370 *et seq.*, Tbl. 11.
[5] Ex. 3, U.S. Dept. of Agric., 2017 Census of Agriculture: California State and County Data 20, Tbl. 12.
[6] 2022 Census of Agriculture: California State and County Data, *supra* note 3, at 16, Tbl. 12.

production have a higher percentage of Latino/a/e/ residents than the state as a whole.[7] Similarly, each of the eight counties in the San Joaquin Valley are a higher percentage Latino/a/e than the state as a whole (including the seven San Joaquin Valley counties that are home to 99.3% of DDRDP-funded digesters[8] and 86% of livestock manure LCFS pathways in the state). Moreover, studies have shown that communities near dairies are disproportionately Latino/a/e.[9]

C. Concentrating dairy herds and dairy cows, as well as the use of manure digesters, exacerbate environmental harms in the San Joaquin Valley.

1. Ammonia Emissions and Exposure

Ammonia is a toxic, odorous gas. Prolonged exposure to elevated ammonia levels causes respiratory issues; irritation to the throat, lungs, and eyes; and lung damage. Large livestock operations account for 57% of ammonia emissions in the San Joaquin Valley air basin.[10] As large dairy operations continue to grow in the San Joaquin Valley, so too will ammonia emissions from those operations. Furthermore, the process of manure digestion itself changes the composition of manure such that ammonia emissions increase along with other emissions.[11] This increase in ammonia emissions increases the risk of exposure to toxic levels of ammonia.[12]

2. Fine Particulate Matter (PM2.5)

In addition to the health risks of ammonia exposure on its own, ammonia reacts with nitrogen oxides (e.g., NOx) and contributes to the formation of ammonium nitrate, a fine particulate matter ("PM2.5"). Ammonium nitrate comprises a large portion of the PM2.5 in the San Joaquin

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[7] According to Census data, California's population as a whole is 40.3% Hispanic identifying. The top 10 counties for dairy production, along with their respective percentage Hispanic population, are as follows: Tulare (67%), Merced (63.2%), Stanislaus (50.3%), Kings (57.3%), Kern (56.8%), Fresno (55%), San Joaquin (43.1%), Madera (60.8%), San Bernardino (56.2%), Riverside (52%). Data available at: U.S. Census Bureau, *Quick Facts*, https://www.census.gov/quickfacts/.

[8] Ex. 4, CAL. DEPT. OF FOOD AND AGRIC., DAIRY DIGESTER RESEARCH AND DEVELOPMENT PROGRAM: PROJECT-LEVEL DATA (updated Jan. 5, 2024), https://perma.cc/H6RQ-9TR7.

[9] Ex. 5, Joan A. Casey et al., *Climate Justice and California's Methane Superemitters: Environmental Equity Assessment of Community Proximity and Exposure Intensity*, 55 ENVTL. SCI. & TECH. 14746 (2021), https://pubs.acs.org/doi/full/10.1021/acs.est.1c04328 ("Unadjusted models showed racial/ethnic and SES disparities in the odds of living in close proximity to methane superemitters and intensity of exposure based on multiple industry categories and total methane emissions. In adjusted models, the associations with race/ethnicity persisted …. Further, subanalyses restricted to dairies/manure management facilities and oil and gas production revealed similar racial disparities as the main analysis."); Ex. 6, Sarah Brown Blake, *Spatial Relationships among Dairy Farms, Drinking Water Quality, and Maternal-Child Health Outcomes in the San Joaquin Valley*, 31:6 PUB. HEALTH NURSING (2014) ("ZIP codes with dairy cows had greater overall population ($p = .008$), higher total birth numbers ($p = .010$), and a larger percentage of births to mothers who identified as Hispanic ($p = .001$). In contrast, the percentage of births to mothers who identified as American Indian ($p = .004$), African American ($p = .002$), and White ($p = .012$) was significantly lower in ZIP codes with dairy farms.").

[10] Ex. 7, U.S. ENVTL. PROT. AGENCY, TECHNICAL SUPPORT DOCUMENT, EPA EVALUATION OF PM2.5 PRECURSOR DEMONSTRATION, SAN JOAQUIN VALLEY PM2.5 PLAN FOR THE 2006 PM2.5 NAAQS.

[11] Ex. 8, Paul Rosenfeld, Comments on the Proposed Amendments to the Low Carbon Fuel Standard 1–5 (Feb. 14, 2024).

[12] *Id.*

Valley. For example, ammonium nitrate comprises 38 percent of the PM2.5 mass on an annual average basis in Bakersfield, and 61 percent on high PM2.5 days.[13]

The San Joaquin Valley is classified as an area that fails to meet most federal air quality standards.[14] According to the American Lung Association's annual State of the Air Report, Bakersfield is the most polluted city in the country with respect to short-term exposure to PM2.5, followed by Fresno-Madera-Hanford, with Visalia coming in fourth.[15] Bakersfield and Visalia are tied for the most polluted cities with respect to long term PM2.5 exposure, followed immediately by Visalia.[16] CARB has acknowledged that PM2.5 exposure alone "is responsible for about 1,200 cases of premature death in the Valley each year."[17]

Exposure to PM2.5 is linked to premature deaths in people with heart or lung disease, heart attacks, irregular heartbeat, aggravated asthma, decreased lung function and long-term lung conditions including cancer.

As noted above, increased numbers and concentration of cows will increase ammonia emissions. Similarly, it will increase NOx emissions. Additionally, increased installation and operation of digesters will intensify and increase NOx in the San Joaquin Valley. Digesters that utilize internal combustion engines – either to generate electricity or to power electrolysis – emit large amounts of NOx,[18] Additionally, flaring of biogas creates significant NOx emissions.[19]

Thus, an increase in the size and concentration of dairy cows, along with the increased emissions from digesters and digested manure will contribute to increased PM 2.5 concentrations in the San Joaquin Valley.

3. Ozone Pollution

Dairies are the largest source of volatile organic compounds in the San Joaquin Valley and combine with NOx to make ozone. The San Joaquin Valley also violates health-based standards for ozone.[20] Visalia, Bakersfield, and Fresno-Madera-Hanford are the second, third, and fourth

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[13] Ex. 9, SAN JOAQUIN VALLEY AIR POLLUTION CONTROL DIST., 2018 PLAN FOR THE 1997, 2006, AND 2012 PM2.5 STANDARDS 3-2 to 3-3 (Nov. 15, 2018), https://perma.cc/6GMN-J3MC.

[14] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 1997 PM2.5 Standards, 80 FED. REG. 18528 (Apr. 7, 2015); Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley; Reclassification as Serious Nonattainment for the 2006 PM2.5 NAAQS, 81 FED. REG. 2993 (Jan. 20, 2016); Air Quality Designations for the 2012 Primary Annual Fine Particle (PM[2.5]) National Ambient Air Quality Standards (NAAQS), 80 FED. REG. 2206, 2217 (Jan. 15, 2015).

[15] Ex. 10, AM. LUNG ASSN., STATE OF THE AIR 14 (2023), https://perma.cc/4TDN-LKH3.

[16] *Id.* at 16

[17] Ex. 11, Press Release, *Clean-Air Plan for San Joaquin Valley First to Meet All Federal Standards for Fine Particle Pollution*, CARB (Jan. 24, 2019), https://perma.cc/7YR7-E3C6.

[18] Rosenfeld, *supra* note 11, at 4.

[19] CARB, STANDARDIZED REGULATORY IMPACT ASSESSMENT FOR THE LOW CARBON FUEL STANDARD 2023 AMENDMENTS B-2, Tbl 49 (Sept. 8, 2023), https://perma.cc/9B8H-4ABT.

[20] Designation of Areas for Air Quality Planning Purposes; California; San Joaquin Valley, South Coast Air Basin, Coachella Valley, and Sacramento Metro 8-Hour Ozone Nonattainment Areas; Reclassification, 75 FED. REG. 24409 (May 5, 2010); Air Quality Designations for the 2008 Ozone National Ambient Air Quality Standards, 77 FED. REG. 30088, 30092 (May 21, 2012).

most ozone-polluted cities in the United States.[21] Ozone can cause a variety of respiratory illnesses, especially in children and for people who have asthma. As the numbers and concentration of cows in the San Joaquin Valley increase, so too will NOx and emissions of volatile organic compounds, thus exacerbating ozone pollution.

4. Nitrate Pollution

Large scale dairy operations in the San Joaquin Valley contribute to nitrate groundwater pollution.[22] As more cows are concentrated on large dairies in the San Joaquin Valley, the problem will only intensify. Digesters do not solve this problem. Ninety-four percent of nitrate pollution is the result of application of manure to cropland, a practice that continues whether the manure is or is not digested.[23] Therefore, the installation of a digester, even if the anerobic manure cesspool is lined, does not address the nitrate contamination of groundwater. In fact, rather than mitigate nitrate contamination, the changed chemical composition of digestate post-digestion exacerbates nitrate leaching to groundwater, thus increasing the likely incidence and intensity of groundwater and drinking water pollution in communities near operations that use digesters and apply manure to fields. [24]

Nitrate contamination in drinking water is associated with dangerous human health conditions like colorectal cancer, thyroid disease, birth defects, and premature births.[25] Nitrates in drinking water may be best known for interfering with red blood cells' ability to carry oxygen. This can cause methemoglobinemia, a serious condition in infants (known as "blue baby syndrome") that can be fatal.[26] California agencies are well aware of the public health risks posed by nitrates in drinking water.[27]

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[21] AM. LUNG ASSN., *supra* note 15, at 18.

[22] Ex. 12, CENTRAL VALLEY REGIONAL WATER QUALITY CONTROL BOARD & CENTRAL VALLEY DAIRY REPRESENTATIVE MONITORING PROGRAM, SUMMARY REPRESENTATIVE MONITORING REPORT at 6 (Apr. 1, 2019), https://leadershipcounsel.org/wp-content/uploads/2019/10/Dairy-report.pdf. The Central Valley Summary Representative Monitoring Report presents years of monitoring data from forty-two Central Valley dairies chosen to be representative of the industry in the region. The report found elevated nitrate-N (*i.e.*, as nitrogen) concentrations were present beneath all monitored dairies. Dairies produce an "excess supply of nitrogen" in the form of manure than the amount that can be safely applied to cropland without causing or contributing to nitrate pollution.

[23] *Id*. at 10

[24] Rosenfeld, *supra* note 11, at 5–7; Ex. 13, U.S. DEPT. AGRIC., NAT. RES. CONSERVATION SERV., CONSERVATION PRACTICE STANDARD CODE 366: ANAEROBIC DIGESTER (Aug. 2023) ("land application of digester effluent, compared with fresh manure, may have a higher risk for both ground and surface water quality problems. Compounds such as nitrogen, phosphorus, and other elements become more soluble due to anaerobic digestion and therefore have higher potential to move with water.").

[25] *See, e.g.*, Ex. 14, Mary Ward et al., *Drinking Water Nitrate and Human Health: An Updated Review* 15:7 INT. J. ENVTL. RES. PUB. HEALTH 1557 (2018), https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6068531/; Ex. 15, Roberto Picetti et al., *Nitrate and Nitrite Contamination in Drinking Water and Cancer Risk: A Systematic Review with Meta-Analysis*, 210 ENVT'L RES. 112988 (July 2022), https://www.sciencedirect.com/science/article/pii/S0013935122003152.

[26] *Id.*

[27] Ex. 16, *Nitrate Fact Sheet*, CAL. DEP'T OF PUB. HEALTH (updated May 2014), https://perma.cc/C6SA-QKQF.

Nitrate contamination disproportionately impacts small, rural, disadvantaged communities of color.[28] Rural, disadvantaged communities also tend to be very low-income[29] and pay on average three times the cost for water considered affordable by the U.S. Environmental Protection Agency.[30] Additionally, communities and households reliant on domestic wells, and therefore especially vulnerable to nitrate pollution, are disproportionately Latino/a/e.[31]

Thus, increased concentration of cows, increased herd sizes, and increased use of digesters will exacerbate nitrate contamination in the San Joaquin Valley and will harm lower income communities of color in particular.

5. Groundwater Depletion

The San Joaquin Valley is ground zero for critical groundwater overdraft and water scarcity.[32] Thousands of private and community water wells, upon which many Californians rely for drinking water, have already run dry.[33] Overdraft also impacts water quality. As groundwater supply decreases, concentrations of contaminants, especially arsenic, increase.[34]

Industrial dairies use massive amounts of water including groundwater in the extremely fragile San Joaquin Valley ecosystem. In addition to supplying large amounts of drinking water to cows, dairies need large amounts of water for liquefying and flushing manure and other pollutants for storage in lagoons, cooling animals, cleaning facilities, and irrigating crops. In addition, dairies rely upon water-intensive crops to feed dairy cows such as alfalfa. California's large dairies use an estimated 142 million gallons per day, or almost 52 billion gallons per year.[35]

As stated above, low-income communities and communities of color in the Central Valley rely disproportionately on private wells. As a result, low-income households, people of color, and

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[28] Ex 17, Carolina Balazs et al., *Social Disparities in Nitrate Contaminated Drinking Water in California's San Joaquin Valley*, 119:9 ENVTL. HEALTH PERSPS. (Sept. 2011), https://ehp.niehs.nih.gov/doi/full/10.1289/ehp.1002878.

[29] Ex. 18, JONATHAN LONDON ET AL., UC DAVIS CENTER FOR REGIONAL CHANGE, THE STRUGGLE FOR WATER JUSTICE IN CALIFORNIA'S SAN JOAQUIN VALLEY: A FOCUS ON DISADVANTAGED UNINCORPORATED COMMUNITIES at 8–13 (Feb. 2018), https://perma.cc/XU6W-E86J.

[30] Ex. 19, ELI MOORE ET AL., PACIFIC INSTITUTE, THE HUMAN COSTS OF NITRATE-CONTAMINATED DRINKING WATER IN THE SAN JOAQUIN VALLEY 7 (Mar. 2011), https://perma.cc/2WEL-2EGE.

[31] Balazs et al., *supra* note 28.

[32] *Critically Overdrafted Basins*, CAL. DEPT. OF WATER RES., https://perma.cc/5F94-9HQN (last visited Feb. 20, 2024) (showing most groundwater basins and subbasins in the San Joaquin Valley are critically overdrafted); *see* Ex. 20, ELLEN HANAK ET AL., PUB. POL. INST. OF CAL., WATER AND THE FUTURE OF THE SAN JOAQUIN VALLEY (2019), https://perma.cc/K8BG-SWUB.

[33] Ex. 21, *Groundwater Management and Drought: An Interview with the San Joaquin Valley Partnership*, CAL. DEPT. OF WATER RES. (Mar. 8, 2022), https://perma.cc/SRE5-58P9 (noting that groundwater overdraft is causing domestic well owners to "lose access to their primary source of drinking water," leaving them unable to "afford or obtain services due to drilling backlogs or financial challenges" and forcing them to seek out and rely on emergency sources of drinking water); *see* Ex. 22, Jelena Jezdimirovic et al., *Will Groundwater Sustainability Plans End the Problem of Dry Drinking Water Wells?*, PUB. POL. INST. OF CAL. (May 14, 2020), https://perma.cc/GMA6-KMBD.

[34] *See* Ex. 23, Phillip Dube, *Overpumping California Groundwater Could Lead to Dangerous Arsenic in Water and Food*, YALE ENVT. REV. (June 6, 2019), https://perma.cc/EDP2-VJ4A.

[35] Ex. 24, FOOD & WATER WATCH, BIG AG, BIG OIL AND CALIFORNIA'S BIG WATER PROBLEM, https://perma.cc/5UP6-9D62.

communities already burdened with environmental pollution are disproportionately impacted by groundwater depletion.[36]

Concentration of dairy herds exacerbates localized impacts related to overdraft because more water used in one place creates a “cone of depression” in the groundwater basin.[37] Specifically, “[w]hen the extraction starts, groundwater is taken from storage to create gradients towards the well, and the resulting decline of water levels is observed only locally around the well. When pumping continues, the cone of depression expands and deepens, as more groundwater is released from storage to support the extraction.”[38] As such, even if a dairies’ expansion merely shifts water use from one part of a groundwater basin to another (which is sometimes, but not always, the case), it is likely to expand and deepen the resulting cone of depression in the underlying groundwater, putting nearby domestic wells and public supply wells at risk of being dewatered.

As dairies expand and more cows concentrate in vulnerable regions in the San Joaquin Valley, the crisis of groundwater depletion will continue to grow in severity.

6. Odor and Flies

Commenters are not aware of a study conducted to analyze the nuisance or health impacts of odor or flies near factory farm dairies. However, residents who live near factory farm dairies consistently report intense odors from the dairies. They report that they cannot enjoy time outdoor and even that these odors follow them indoors, permeating their clothes, and causing headaches. Residents also report a high incidence of flies around their communities and their homes.[39] They report that they do not experience an improvement in either with the installation of a digester.[40] Common sense dictates that more cows, more cows concentrated on large farming operations near communities will only exacerbate the impacts of odor and flies on San Joaquin Valley residents.

D. The LCFS Amendments will increase transportation costs for lower income people and people of color.

As outlined in the Standardized Regulatory Impact Assessment (“SRIA”), the proposed
368.7 Amendments will have a significant impact on gas prices.[41] In the ISOR, Staff attempts to walk back this finding, contending that causation between credit prices and gasoline prices is uncertain and asserting that *average* transportation costs will fall.[42] Increased gasoline costs will be borne

[36] Balazs et al., *supra* note 28.
[37] Ex. 25, Andy Louwyck et al., *The Radius of Influence Myth*, 14:2 WATER (Jan. 2022), https://perma.cc/3F3S-FS2N; *see also* University of Minnesota Extension, *What Is a Cone of Depression*, YOUTUBE (Jan. 11, 2021), https://perma.cc/5EXC-54CL.
[38] Louwyck et al., *supra* note 37.
[39] Ex. 26, Letter from Central Valley Defenders of Clean Air and Water, to CARB Chair Liane M. Randolph (June 23, 2022), https://perma.cc/HW82-RNYZ.
[40] *Id.*
[41] CARB, STANDARDIZED REGULATORY IMPACT ASSESSMENT FOR THE LOW CARBON FUEL STANDARD 2023 AMENDMENTS 55–59 (Sept. 8, 2023), https://perma.cc/FV2Y-456V.
[42] CARB, STAFF REPORT: INITIAL STATEMENT OF REASONS 82–84 (released Dec. 19, 2023), https://perma.cc/FJ9B-3UXD (hereinafter “ISOR”).

disproportionately by lower income people, lower income communities,[43] and communities that are disproportionately Latino and Black.[44] Lower income households pay a higher share of income on gas, are less able to adjust their use of gasoline which they need to reach employment and educational opportunities, and lower income people and Latino and Black people have less access to electric vehicles.[45]

E. The LCFS's treatment of dairy digesters creates an incentive for concentrated herds and liquid manure management.

CARB's treatment of factory farm gas under the LCFS has the perverse effect of incentivizing larger, more concentrated herds and methane producing manure management
368.8 systems, the two most important factors that increase a dairy's climate emissions. This is so because under CARB's "avoided methane" crediting, large herd size equates to increased profits from the LCFS and without liquid manure lagoons that cause large methane emissions a dairy cannot claim the extremely negative CI values enjoyed by other factory farm gas projects.

Regarding herd sizes and concentration, operators are increasing the number of animals housed in large confinement operations using liquid manure systems as indicated by the most recent Ag Census data.[46] More animals mean more manure which means more opportunity to generate methane pollution. Larger herds lead to more cost effective and profitable gas production.[47] As the largest factory farms monetize their pollution and reap additional profits from the LCFS, this provides a competitive advantage in the related agricultural markets,[48] thus further incentivizing competitors to expand, change their waste management practices, or otherwise seek to maximize their own methane emissions to profit off the LCFS and minimize their competitors' competitive advantage. As one researcher at UCLA recently wrote, "Investing in industrial dairies further bolsters the competitive edge of these mega-operations at the expense of more sustainable dairying models."[49]

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[43] The bottom quintile of families by income level spends 16% of their income on gas and fuel compared to 8% for the second-lowest income group or 2% for the highest-income group. Ex. 27, Sarah Bohn & Daniel Payares-Montoya, *Gas Prices Stretch Family Budgets*, PUB. POL. INST. OF CAL. (Mar. 16, 2022), https://perma.cc/G78T-XNDL.

[44] Ex. 28, Nadia Lopez and Erica Yee, *Who Buys Electric Cars in California – and Who Doesn't?*, CAL MATTERS (Mar. 22, 2023), https://perma.cc/2NVJ-AZGU ("ZIP codes with the highest rates of electric car ownership tend to be more white and Asian and less Latino and Black than the general population.").

[45] Sarah Bohn & Daniel Payares-Montoya, *supra* note 43. *See also* Nadia Lopez & Erica Yee, *supra* note 44.

[46] The data shows that the average size of a dairy in California shot up from approximately 1059 to approximately 1511 in 2022, a marked increase from the years before CARB implemented avoided methane crediting. *See supra* notes 3 through 6.

[47] *See* Ex. 29, Markus Lauer et al., *Making Money from Waste: The Economic Viability of Producing Biogas and Biomethane in the Idaho Dairy Industry*, 222 APPLIED ENERGY 621 (2018), https://www.sciencedirect.com/science/article/pii/S0306261918305695 ("For each digester type, the total capital cost per additional cow decreases, exhibiting economies of scale in farm size.").

[48] Ex. 30, RUTHIE LAZENBY, EMMETT INSTITUTE ON CLIMATE CHANGE & THE ENVIRONMENT, MITIGATING EMISSIONS FROM CALIFORNIA'S DAIRIES: CONSIDERING THE ROLE OF ANAEROBIC DIGESTERS IN MITIGATING EMISSIONS FROM CALIFORNIA'S DAIRIES 13, 28 (Jan. 2024), https://perma.cc/3RN4-WVFS.

[49] *Id.* at 28.

Petitioners previously documented the strong correlation between the installation of digesters, the issuance of a LCFS pathway, and the concentration of dairy herds.[50] We incorporate those findings here and note that herd expansions in association with factory farm gas development continue. For example, Borba Dairy in California is currently seeking a conditional use permit to expand its herd from 4,450 animals to 6,100 animals. This expansion is intertwined with the dairy's plans to also develop a digester that would collect and digest manure. The expansion includes construction of new lagoons to store liquified manure even though alternatives exist that would avoid producing more methane pollution from this dairy. Pressurized gas from the digester would be transported via truck or pipeline to the Hilmar Biogas Cluster Plant.[51]

Commonsense supports the expectation that an industry known for cutting costs and taking advantage of lax regulation will seek to maximize the very large source of profits presented by avoided methane crediting under the LCFS, especially when CARB staff have broadcast that they do not intend to mandate methane reductions at dairies in the foreseeable future. And while it may be true that a number of factors contribute to the concentration of dairy herds, CARB's choices to incentivize the production of manure and methane are, at a minimum, contributing factors to the consolidation and expansion of herds.

Regarding how dairies manage their manure, the perverse incentives put in place by avoided methane crediting leads factory farms to structure their operations to maximize methane pollution. There are many ways this happens. For example, operators maximize the quantity of volatile organics put into anaerobic environments to maximize gas production instead of lowering methane emissions by diverting solids into dry handling systems.[52] This happens during new construction but also through modifications to exiting operations. Doing otherwise leaves money on the table under CARB's backward incentive structure.

Commenters recognize some large factory farms utilized liquid manure handling systems prior to participating in the LCFS, but CARB's incentives pressure new or modified infrastructure development to double down on the conditions and practices that produce the most methane pollution. And conversely, the LCFS disincentivizes conditions or practices that simply do not produce meaningful methane emissions to begin with. This is predictable as projects that include
368.9 the largest, most polluting factory farms receive the most lavish Carbon Intensity values and thus

[50] Ex. 31, ASSOCIATION OF IRRITATED RESIDENTS ET AL., PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM at 25 (Oct. 27, 2021), https://perma.cc/Z8LP-F7EC; Ex. 32, ASSOCIATION OF IRRITATED RESIDENTS ET AL., PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM at 10–16 (Mar. 25, 2022), https://perma.cc/2YLM-4UHP.

[51] Ex. 33, MERCED COUNTY, DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE BORBA DAIRY FARMS EXPANSION PROJECT (Jan. 18, 2024), https://perma.cc/6ZDZ-G45E.

[52] As just one illustrative example, the Threemile Project, Fuel Pathway Code CNG026B00720100, used solid separation before any anaerobic handling prior to installing digesters, but then moved liquid-solid separation to *after* anaerobic digestion resulting in more organics decomposing anaerobically that thus generating more methane. Ex. 34, CARB, STAFF SUMMARY, IOGEN D3 BIOFUEL PARTNERS II LLC PATHWAY APPLICATION, https://perma.cc/G4L3-QC2J.

credit generation opportunities. In California, nearly all dairies large enough to benefit from LCFS subsidies are disproportionately located in or near Latino/a/e communities.[53]

These counterproductive dynamics are explainable, in part, by the "cobra effect," whereby people are incentivized to produce more of the thing that a program is intended to mitigate.[54] Turning avoidable pollution into a valuable product influences rational economic actors to follow this manner of thinking in their operational decision making. Instead of mitigating the manure methane problem, it has transformed it into a lucrative product that factory farms now seek to maximize for subsequent "capture" under the LCFS.

F. The proposed Amendments' increased benchmark stringency—paired with increased, short-term factory farm gas incentives—will supercharge factory farm gas development and associated harms.

Staff's proposed Amendments are tailor made to exacerbate the problems outlined above. The proposed increased stringency of the CI benchmark will increase LCFS credit prices as demand from deficit generators increases. And the proposed approach to avoided methane crediting sets up a mad dash to build out factory farm CNG and LNG pathways as quickly as possible over the next 5 years to take advantage of up to 30 years of avoided methane crediting.

Staff's analysis of the value added for different fuels under the Amendments and the projected credit prices highlights how increasing the stringency of the CI benchmark as proposed will incentivize even more factory farm gas production. To begin, higher credit prices mean more
368.10 economic incentive to build new projects. But the Amendments would not place that benefit equally among fuels. In 2025, under the increased stringency "dairy natural gas" will reap a massively outsized benefit from credit generation, approximately 50% greater than the runner up and many times more than most other fuels.[55] And by 2045, factory farm gas will be one of only two fuels still seeing a reward from LCFS credit generation.[56] In other words, increasing the stringency of the LCFS as staff propose will benefit factory farm gas producers the most. That lavish crediting would incentivize increased deployment of digesters and further herd concentration and liquid manure management, with all their associated harms.

Pairing that increased value with staff's proposal for avoided methane crediting ramps up the incentives even more. The Amendments would create a "break ground" date of December 31,

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[53] *See supra* section II.B (discussion of manure management and California's dairy herd). Approximately 86% of LCFS pathways approved for fuel derived from livestock manure in California are located in the San Joaquin Valley while over 99% of digesters funded by the state's Dairy Digester and Research Development Program are in the San Joaquin Valley. DAIRY DIGESTER RESEARCH AND DEVELOPMENT PROGRAM: PROJECT-LEVEL DATA, *supra* note 8.

[54] The "cobra effect" refers to a specific anecdote that illustrates how policies can have perverse, unintended consequences. In India, the British Colonial Government implemented a bounty system for bringing dead cobra snakes to administration official to reduce cobra populations in Delhi. At first, the policy appeared successful, but over time the number of dead cobras brought in for bounty continued to increase. Instead of working to capture wild cobras, clever snake catchers simply started breeding cobras to then kill for the bounty. This dynamic has been observed in many contexts. *See* Ex. 35, Barry Newell & Christopher Doll, *Systems Thinking and the Cobra Effect*, UNITED NATIONS UNIVERSITY (Sept. 16, 2015), https://perma.cc/2P9A-2H9E.

[55] ISOR, *supra* note 42, at 79, Tbl. 15.

[56] *Id.*

2029, where projects that break ground prior to that date can receive up to 30 years of avoided methane crediting.[57] But for factory farm CNG or LNG projects that do not break ground before
368.11 December 31, 2029, the Amendments would eliminate their credit generation potential as of December 31, 2040.[58] Similarly, pathways for biomethane used to produce hydrogen that break ground before December 31, 2029, are eligible for up to 30 years of avoided methane crediting, while those that do not will be limited to credit generation through 2045.[59] Finally, the Amendments do not place a restriction on pathways where factory farm gas is burned in internal combustion engines to produce electricity, apparently leaving that fuel type eligible for up to 30
368.12 years of avoided methane crediting regardless when the project broke ground or applies for a pathway.

In sum, the Amendments dramatically ramp up the short-term pressure to build out factory farm gas production before the cutoff date. Comparing approximately 10 years of credit generation with 30 years of unrestrained avoided methane crediting would likely mean a difference of many millions of dollars in profits over the life of a project. Looking to the value added by expected credit prices under the Amendments, by 2040 and 2045 factory farm gas pathways will be unique in their ability to continue reaping a profit from the LCFS. This outsized benefit would be even greater for burning factory farm gas for electricity since a project could be eligible for 30 years of avoided methane crediting even if the project broke ground in 2040, all while the value added for
368.13 most other fuels in the program declines into negative terrain by then.[60] These projections buttress staff's scheme to use the LCFS to prop up a factory farm gas economy in perpetuity by continuing to lavishly reward factory farm gas to electricity pathways without end and subsidizing factory farm gas infrastructure so that it is available for "hard to decarbonize" stationary sources beyond 2045.

Thus, instead of eliminating avoided methane crediting in this rulemaking as Commenters and others have requested for years now, staff have put forward Amendments that super charge short-term factory farm gas production, lock these fuels in with the most lucrative treatment as stringency increases, and massively encourage burning factory farm gas in dirty internal
368.12 ctd combustion engines in the San Joaquin Valley for the long-term.

III. PROCEDURAL BACKGROUND

A. Petition for Rulemaking

More than two years ago, on October 27, 2021, a group of advocates, researchers, and public interest organizations concerned about factory farm pollution and environmental injustice in the San Joaquin Valley ("Petitioners") filed the Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program ("Petition for Rulemaking"), attached here as Exhibit 1 and incorporated by reference as though fully set forth herein,[61] pursuant to Government Code section 11340.6.

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57 *Id.* at 29–31.
58 *Id.* at 30; Appx. A-1 at 34.
59 *Id.* at 30.
60 *See id.* at 79, Tbl. 15.
61 PETITION FOR RULEMAKING, *supra* note 50.

In the Petition for Rulemaking, Petitioners asked CARB to amend the LCFS to exclude all
fuels derived from factory farm gas or, in the alternative, to reform the LCFS to account for the
368.14 full life cycle of factory farm gas production emissions—including all upstream and downstream
emissions from activities and inputs at the source dairy and pig factory farms—and exclude non-
additional emission reductions that occur as a result of other factory farm gas incentives.

The Petition for Rulemaking set forth three main reasons why CARB was—and continues
to be—legally required to grant this relief. First, factory farm gas pathways fail to achieve the
maximum technologically feasible and cost-effective emissions reductions, as Assembly Bill 32
368.15 (AB 32) requires, because they fail to incorporate proper lifecycle analyses (LCAs), leading to
indefensibly low carbon intensity scores and, in turn, an indefensibly high number of credits
generated for factory farm gas production. Second, the LCFS fails to ensure that credited emission
reductions are additional to reductions that would have otherwise occurred as required by section
38562(d)(2) of the Health & Safety Code. This dynamic has increased—and continues to
368.16 increase—manure production and industry consolidation and expansion, exacerbating localized
pollution and disparate impacts to communities. Thus, CARB has failed—and continues to fail—
to achieve the maximum technologically feasible and cost-effective greenhouse gas (GHG)
emissions.[62] Third, factory farm gas pathways fail to maximize additional environmental benefits
368.17 and interfere with efforts to improve air quality.[63]

Petitioners also asked CARB to evaluate and amend the LCFS to remedy its
disproportionate adverse and cumulative impacts on low-income and Latino/a/e communities in
violation of state and federal law.[64] The Petition for Rulemaking provides three main reasons why
368.18 CARB was—and continues to be—legally required to grant this relief. First, LCFS credits and the
subsequent trading of those credits incentivize activities that result in public health and
environmental harms in disproportionately low-income and Latino/a/e communities, particularly
in the San Joaquin Valley.[65] Second, CARB is required to ensure that the LCFS complies with CA
368.19 11135, CA 12955, and Title VI of the Civil Rights Act of 1964 to prevent discrimination.[66] Third,
CARB failed to design the LCFS in a manner that is equitable, and CARB fails on an ongoing
368.20 basis to consider the social costs of GHG emissions and to ensure that the LCFS does not
disproportionately impact low-income communities.[67]

Finally, the Petition for Rulemaking asked CARB to address the lack of transparency as to
pathways for factory farm gas.[68] Specifically, there is no way for the public to access trading data
368.21 to determine the location of facilities purchasing LCFS factory farm credits, and what records are
available are heavily redacted.[69] This makes it difficult to determine potential disparate impacts.[70]

[62] *Id.* at 10–26.
[63] *Id.* at 26–31.
[64] *Id.* at 31–36.
[65] *Id.* at 31–34.
[66] *Id.* at 34–35.
[67] *Id.* at 35–36.
[68] *Id.* at 36–37.
[69] *Id.*
[70] *Id.*

In response, CARB declined to amend the LCFS, stating that "it is premature to consider amending the LCFS regulation until the Scoping Plan update process has informed how the state's portfolio approach to climate mitigation may be best structured to deliver cost-effective, technologically feasible, and direct emissions reductions across various sources."[71] But CARB also stated in its response that it "agrees it is important, as petitioners urge, to ensure the LCFS provides environmental benefits and does not degrade water quality and interfere with efforts to improve air quality in the San Joaquin Valley."[72] CARB further affirmed its commitment to ensuring that its programs "focus on environmental justice and environmental integrity."[73] CARB also acknowledged its legal obligation under SB 1383 to "reduc[e] statewide livestock manure methane emissions 40 percent below 2013 levels by 2030."[74]

B. Petition for Reconsideration

Soon after, on March 25, 2022, Petitioners filed the Petition for Reconsideration of the Denial of the Petition for Rulemaking to Exclude All Fuels Derived from Biomethane from Dairy and Swine Manure from the Low Carbon Fuel Standard Program, attached here as Exhibit 3 and incorporated by reference as though fully set forth herein.[75]

The Petition for Reconsideration emphasized three main reasons why CARB should reconsider and grant the Petition for Rulemaking. The first reason was that CARB's response to the Petition for Rulemaking neither disputed nor responded to the evidence that including factory farm gas in the LCFS violates applicable law and undermines the purpose and goals of AB 32.[76]
368.22 The first piece of evidence is that factory farm gas credits distort and undermine the LCFS.[77] The second piece of evidence was that the LCFS perversely incentivizes herd expansions, greater geographic concentration of factory farm pollution, and maximum methane generation at factory farms.[78] The third piece of evidence was that CARB did not dispute and has arbitrarily and capriciously failed to consider the issue of whether the LCFS may allow non-additional reductions from factory farm gas.[79] The fourth piece of evidence was that factory farm gas causes adverse and disparate environmental impacts.[80] The second reason for CARB to reconsider and grant the
368.23 Petition for Rulemaking was that SB 1383 mandates neither the inclusion nor the overvaluation of factory farm gas in the LCFS.[81] The third reason for CARB to reconsider and grant the Petition for Rulemaking was that San Joaquin Valley communities could not wait until 2023 or later for CARB
368.24 to address the issues raised in the Petition for Rulemaking, which disproportionately harm them.[82]

[71] Ex. 36, CARB, RESPONSE TO PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM 2 (Jan. 26, 2022), https://perma.cc/F8VW-YLGC.
[72] *Id.* at 2.
[73] *Id.*
[74] *Id.* at 5.
[75] PETITION FOR RECONSIDERATION, *supra* note 50.
[76] *Id.* at 7.
[77] *Id.*
[78] *Id.* at 10.
[79] *Id.* at 16.
[80] *Id.* at 20.
[81] *Id.* at 32.
[82] *Id.* at 34.

Petitioners also asked CARB in the Petition for Reconsideration to at least suspend factory farm gas pathway certifications pending an LCFS rulemaking.[83] CARB had authority to do this
368.25 for three reasons. First, the LCFS regulations governing pathway certifications impose no duty on CARB to approve Tier 1 or Tier 2 applications on a specific timeline and also give CARB authority to modify its implementation of factory farm gas credit certification.[84] Second, CARB's well to
368.26 wheels interpretation for biomethane from dairy and pig manure is a matter of agency interpretation and is not codified.[85] Finally, CARB has a duty to ensure its policies and programs
368.27 comply with AB 32 and civil rights laws.[86]

In response, CARB denied the Petition for Reconsideration but also acknowledged the "need for continued action and coordination to address the complex issues associated with dairy and livestock operations in the Central Valley[.]"[87] CARB also acknowledged once again SB 1383's "***requirement*** that CARB adopt and implement regulations to reduce methane emissions from livestock manure management operations and dairy manure management operations to meet the 2030 methane reduction target after January 1, 2024."[88] Moreover, CARB admitted that the dairy and livestock sector is only expected to achieve "about half of the emissions reductions needed to achieve the 2030 target."[89] CARB also claimed in the denial that the requirements of Health and Safety Code section 38562—including additionality—do not apply to the LCFS, as it is "designed to incentivize increased production of low carbon intensity fuels by rewarding the supply of volumes of such fuels."[90] Finally, CARB denied Commenters' request to suspend factory farm gas pathway certifications pending an LCFS rulemaking.[91]

C. Workshop on Methane, Dairies and Livestock, and Renewable Natural Gas in California

At the January 27, 2022, Board meeting, Chair Randolph directed staff to hold "a public workshop specifically on [the issues raised in the Petition for Rulemaking], ideally within the next few months, and then come back to the Board with an item after that public workshop, and -- where staff could share the findings and the discussion and really kind of allow the Board to hear about the issues in more detail and provide guidance in terms of moving forward with a rulemaking process."[92]

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[83] *Id.* at 35.
[84] *Id.* at 36.
[85] *Id.* at 37.
[86] *Id.* at 38.
[87] Ex. 37, CARB, RESPONSE TO PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM 4 (Apr. 25, 2022), https://perma.cc/86VC-LVP9.
[88] *Id.* at 3 (emphasis added).
[89] *Id.*
[90] *Id.* at 2, n.4.
[91] Ex. 38, CARB, RESPONSE TO REQUESTS TO DENY OR DELAY CONSIDERATION OF LOW CARBON FUEL STANDARD (LCFS) PATHWAY CERTIFICATIONS (Apr. 26, 2022), https://perma.cc/ZZB8-KFTM.
[92] Ex. 39, Transcript of Videoconference Meeting, State of California Air Resources Board at 172 (Jan. 27, 2022), https://perma.cc/7AHY-V5TD.

Staff held that workshop on March 29, 2022,[93] and used it primarily to platform industry.[94]
368.28 Staff never brought the findings and discussion back to the board, as the Chair directed. Staff chose instead to ignore the Chair's unambiguous direction to at least acknowledge and present concerns from impacted residents to the Board.

D. Comments on the 2022 Scoping Plan

Commenters engaged throughout the Scoping Plan process, submitting written comments,[95] which are incorporated by reference as though fully set forth herein, and providing verbal testimony at Scoping Plan Board meetings.[96] Commenters critiqued the Scoping Plan's reliance on manure digestion as a means of addressing livestock pollution.

The Environmental Justice Advisory Committee (EJAC) submitted recommendations to CARB regarding the Scoping Plan, and some of those recommendations specifically concern factory farm gas in the LCFS.[97] For example, EJAC recommended that CARB "[e]valuate whether to remove livestock and dairy gas from the LCFS based on the role of the LCFS in incentivizing herd concentration near pollution-burdened communities and in pollution-burdened regions, accurate GHG emissions analyses, and conformity with additionality requirements."[98] EJAC further recommended that CARB "[r]eevaluate the carbon intensity value of livestock and dairy gas based on a full life cycle analysis, an analysis of additionality for each project, and relevant regulatory programs."[99]

CARB did not address any of these concerns in the Scoping Plan, and the staff's proposed Amendments similarly ignore those concerns.

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[93] Ex. 40, *Workshop on Methane, Dairies and Livestock, and Renewable Natural Gas in California*, CARB, https://perma.cc/SJC4-GFDG; *see Short-Lived Climate Pollutants Program: Meetings & Workshops*, CARB, https://perma.cc/5G24-6LGZ (see details and materials re: "Workshop on Methane, Dairies and Livestock, and Renewable Natural Gas in California").

[94] Ten of the twenty-six presentations were delivered directly by industry representatives. These ten are: (1) Perspectives on the future of Dairies in California, Paul Sousa, Western United Dairies; (2) Manure management methane emissions reduction strategies, Mark Stoermann, Newtrient LLC; (3) Overview digester operations at California dairy farms, Neil Black, California Bioenergy LLC; (4) Overview of environmental protections for California digesters, David De Groot, 4Creeks, Inc.; (5) Funding of dairy methane mitigation projects, Sam Wade, Coalition for Renewable Natural Gas; (6) Perspectives on dairy management decisions, Joey Airoso, Airoso Dairy; (7) Perspectives on dairy management decisions, Diana Giacomini Hagan, Giacomini Dairy; (8) Subgroup Findings: Fostering Markets for Non-Digester Projects, J.P. Cativiela, Dairy Cares; (9) Subgroup Findings: Fostering Markets for Digester Projects, Michael Boccadoro, Dairy Cares; (10) Considerations for Methane Emissions Reduction Incentives and Regulation, Michael Boccadoro, Dairy Cares.) *Workshop on Methane, Dairies and Livestock, and Renewable Natural Gas in California, supra* note 93.

[95] Ex. 41, Leadership Counsel for Justice and Accountability et al., Comments on the 2022 Draft Scoping Plan (June 22, 2022).

[96] This engagement includes members of Central Valley Defenders of Clean Water & Air and other impacted residents of the San Joaquin Valley who traveled to attend the June 2022, Scoping Plan Board meeting.

[97] Ex. 42, Environmental Justice Advisory Committee 2022 Scoping Plan Recommendations 16–17 (September 30, 2022), https://perma.cc/M4CC-MFKA.

[98] *Id.* at 16.

[99] *Id.*

E. Comments in Opposition to Tier 2 Pathway Applications for Factory Farm Gas

368.29

To date, Commenters and/or their allies have submitted comments in opposition to seventy-six Tier 2 applications for pathways for factory farm gas, and those comments are incorporated by reference as though fully set forth herein.[100] In those comments, Commenters raised concerns about the consequences of the LCFS's monetization of manure, including environmental injustice, environmental degradation, lack of additionality, and inadequate LCA. As many of these pathway applications illustrate, the LCFS is a moneymaker for some of the largest factory farms in California and beyond, often in regions already overburdened with agricultural pollutants. CARB has the certified Tier 2 applications over Commenters' objections.

F. Engagement in the LCFS Rulemaking

Commenters have been heavily engaged in the LCFS rulemaking process and have urged CARB to reform the LCFS every step of the way, including by eliminating avoided methane crediting in 2024. For example, Commenters submitted comments in response to the May 31 and June 1, 2023, community workshop, and those comments are incorporated by reference as though fully set forth herein.[101] At that same workshop, Dr. Michael Wara presented "Simulating an 'EJ Scenario' for the Low Carbon Fuel Standard Rule update using the ARB CATS Model."[102] This presentation illustrated the feasibility of LCFS policy changes that would advance air quality, climate, and environmental justice goals ("the EJ Scenario") without massive credit generation from factory farm gas production.[103] The EJ Scenario Dr. Wara presented assumed the end of avoided methane crediting in 2024.

After that workshop, on August 28, 2023, EJAC passed a resolution recommending that, among other things, CARB formally consider the EJ Scenario as a regulatory alternative in the LCFS rulemaking process; eliminate avoided methane crediting effective January 1, 2024; conduct a full accounting of GHG and air pollution emissions associated with pathways relying on the

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[100] *2023 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2023-lcfs-pathways-requiring-public-comments (applications B0514, B0461, B0459, B0490, B0473, B0422, B0403, B0396, B0400, B0450, B0438, B0383, B0430, B0401, B0393, B0404, B0382, B0369); *2022 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments (applications B0370, B0371, B0347, B0345, B0392, B0391, B0385, B0366, B0352, B0353, B0311, B0315, B0346, B0338, B0282, B0349, B0360, B0350, B0373, B0348, B0308, B0250, B0310, B0307, B0283, B0215, B0216, B0217, B0280); *2021 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/2021-lcfs-pathways-requiring-public-comments (applications B0218, B0242, B0207, B0220, B0214, B0198, B0185, B0175, B0197, B0173, B0166, B0163, B0148); *2020 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2020-lcfs-pathways-requiring-public-comments (applications B0127, B0096, B0097, B0109, B0108, B0072, B0098, B0059, B0089); *2019 LCFS Pathways Requiring Public Comments*, CARB, https://ww2.arb.ca.gov/resources/documents/2019-lcfs-pathways-requiring-public-comments (applications B0019, B0010, B0060, B0058, B0037, B0038, B0019); *see* Ex. 43, CARB Certified Pathways Spreadsheet (last updated Feb. 9, 2024).

[101] Ex. 44, Comments on Low Carbon Fuel Standard Community Workshops (June 14, 2023).

[102] Ex. 45, Michael Wara et al., Stanford Climate and Energy Policy Program, Woods Institute for the Environment, *Simulating an "EJ Scenario" for the Low Carbon Fuel Standard Rule update using the ARB CATS Model* (May 31, 2023), https://perma.cc/GU9C-R8PC (PowerPoint presentation).

[103] *Id.*

production of fuel from livestock and dairy manure; and eliminate credit generation for pathways relying on the production of fuel from livestock and dairy manure for emissions reductions that otherwise would have occurred or were legally or contractually required to occur.[104]

Commenters also provided verbal testimony at the Board meeting on September 28, 2024, and that testimony is incorporated by reference as though fully set forth herein. For example, Commenter Leadership Counsel for Justice & Accountability urged the Board to end avoided methane crediting in 2024 and to adopt Senate Bill 1383 regulations.[105] Leadership Counsel for Justice & Accountability also presented comments from a resident in Pixley who was unable to attend and urged CARB to regulate dairies.[106] Commenter Food & Water Watch addressed herd size and consolidation incentives created by avoided methane crediting and urged the Board to end avoided methane crediting in 2024.[107] Food & Water Watch also urged direct regulation under Senate Bill 1383.[108] Nonetheless, Executive Officer Cliff stated that CARB has no plans to initiate Senate Bill 1383 direct regulation in 2024.[109]

In its analysis supporting the proposed Amendments, CARB staff failed to address the
concerns laid out in the Petition for Rulemaking, the Petition for Reconsideration, the Workshop
on Methane, Dairies and Livestock, and Renewable Natural Gas in California, Comments on the
368.30 2022 Scoping Plan, legion comments in opposition to Tier 2 pathway applications for factory farm
gas, and throughout Commenters' engagement in the LCFS rulemaking. CARB staff has also
368.31 ignored the EJAC resolution and recommendations and rebuffed the EJ Scenario. In sum, CARB
has failed to give any consideration to the extremely well-documented harms and environmental injustice that it is causing via its monetization of factory farm pollution in the LCFS. Instead, CARB is doubling down in the proposed Amendments and making matters even worse.[110]

IV. Necessary Changes to the Proposed LCFS Amendments

368.3 ctd CARB must make changes to the proposed LCFS amendments. First, CARB must account
for the true carbon intensity of factory farm gas. Second, the LCFS is a market-based compliance
368.32 mechanism and, as such, CARB must ensure the validity of LCFS greenhouse gas emissions
reductions pursuant to state law. Third, CARB may not attempt to use the LCFS Amendments to
368.33 achieve the Senate Bill 1383 methane reduction mandate. Fourth, CARB may not attempt to use
the LCFS Amendments to implement the 2022 Scoping Plan to achieve post-2030 policies and the
368.34 2045 target set by Assembly Bill 1279. Finally, CARB must ensure that the proposed Amendments
368.35 do not violate state and federal civil rights and fair housing laws.

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[104] Ex. 46, Assembly Bill 32 Environmental Justice Advisory Committee (EJAC) Draft Recommendations to the California Air Resources Board (CARB) on the Low Carbon Fuel Standard Regulation Updates, Draft Version 2: August 28, 2023, Amended Language Highlighted Based on 8/25/2023 EJAC Discussion (Aug. 28, 2023), https://perma.cc/Y3NN-WADG.

[105] Ex. 47, Transcript of Videoconference Meeting, State of California Air Resources Board at 195 (Sept. 28, 2023), https://perma.cc/3D4W-QQC5.

[106] *Id.* at 231–32 ("[CARB] staff has ignored us, their staff has refused to consider our concerns. My community can't wait. It won't breathe because of your choices. Do your duty, regulate the state's biggest methane emitter.").

[107] *Id.* at 289–90.

[108] *Id.*

[109] *See id.* at 81 (Executive Officer Cliff's statement that "We don't currently have a rule planned for 2024.").

[110] *See supra* section II.F.

A. CARB must account for the true carbon intensity of factory farm gas.

368.36 The proposed rulemaking package dramatically miscalculates the carbon intensity ("CI") of factory farm gas, resulting in extremely negative CI values that bear little relationship to the real-world climate footprint of these fuels. CARB has certified some factory farm gas projects with CIs lower than -750 gCO^2eq/MJ.[111] This flawed accounting distorts the LCFS and causes severe consequences for human health, the state's clean transportation goals, and agriculture. The extremely negative CIs for factory farm gas fuels are based on avoided methane crediting and an artificially truncated lifecycle analysis ("LCA"). To remedy these problems, CARB must eliminate avoided methane crediting in this rulemaking and revise the LCA parameters in the proposed simplified Tier 1 calculators and CA-GREET4.0.

368.37 As discussed above, Commenters first brought these issues to CARB's attention in 2021. But despite growing concern from environmental justice advocates, clean transportation advocates, scientists, academics, and CARB Board Members over the ensuing years, the proposed rulemaking would lock these erroneous and misleading CI calculations into the LCFS. In fact, staff intends this rulemaking to supercharge the number of factory farm gas fuel producers that will benefit from this faulty accounting for years to come. Were CARB to adopt staff's proposal it would do so counter to science and common sense and would make the perverse incentives that currently plague the LCFS even worse.

1. Avoided methane crediting is based on faulty assumptions and exacerbates GHG emissions.

368.8 ctd Avoided methane crediting should be eliminated in this rulemaking because it is premised on flawed assumptions and is having severe and counterproductive effects in the real world, both in California and beyond. By lavishly monetizing GHG emissions at factory farms, avoided methane crediting encourages the very practices that generate manure methane emissions in the first place. The policy counterproductively distracts from and disincentivizes methane *avoidance* despite readily available tools and programs designed for that purpose.[112] The result on the ground is an industry dependent on "capturing" the intentional and increased climate emissions at the largest factory farms to generate LCFS credits. CARB's experiment with avoided methane crediting shows that the policy is detrimental to the LCFS and California's commitments to climate equity and environmental justice, and it must be eliminated from the program.

368.33 ctd First, free methane venting at factory farms is not a valid baseline. As explained below, CARB has a duty to directly regulate manure methane emissions from California dairies under SB 1383[113] and therefore the baseline must reflect regulatory reality. And CARB knows there are
368.38 ctd feasible, available, and more effective ways to reduce manure methane emissions than attempting

[111] *E.g.*, Ex. 48, CARB, TIER 2 PATHWAY APP. B016301 (certified June 21, 2021), https://perma.cc/L982-4M9H.
[112] For example, California's Alternative Manure Management Program. *Alternative Manure Management Program*, CDFA, https://perma.cc/742V-KGW3 (last visited Feb. 20, 2024).
[113] Cal. Health & Safety Code § 39730.7.

to capture and burn emissions after the fact.[114] Therefore, the appropriate baseline would reflect
368.39 CARB's regulatory authority to directly regulate manure methane emissions to achieve "direct emission reductions" as prioritized by AB 197.

Second, CARB cannot ignore that avoided methane crediting results in the perverse incentives to create more methane at factory farms as described in the Factual Background, and in
368.40 the process more co-pollutants that contaminate the local environment. The policy creates pressure to house more animals in larger and larger confinement facilities using the most climate polluting manure management practices. In the process, avoided methane crediting undermines climate progress, causes environmental injustice, and distorts agricultural markets.

Avoided methane crediting has become a festering problem for the integrity of the LCFS and CARB's climate and environmental justice efforts. It is time for CARB to fix its mistake and remove this detrimental policy.

a) Perpetual free venting of manure methane from factory farms is not a valid baseline.

Avoided methane crediting relies on the assumption of perpetual free venting of methane manure from the most polluting factory farm practices. This assumption is arbitrary because CARB is legally *obligated* to consider and have a preference for direct, regulatory reductions in
368.33 ctd manure methane emissions.[115] As explained blow, CARB cannot use the LCFS in place of absolute, direct reductions under SB 1383; it likewise cannot set a baseline for determining factory farm gas fuels' CI under the LCFS that pretends SB 1383 does not exist.

Furthermore, it is arbitrary for CARB to assume that raising livestock must result in massive manure methane emissions. It was only when factory farms began structuring their operations to expand in size and reduce costs by relying on liquification, storage in lagoons, and disposal via land application that manure methane became a major climate issue.[116] For example, manure allowed to decompose on a pasture or handled and managed in a dry system does not emit meaningful methane. The reason is simple: methane is generated in anaerobic environments. Allow manure to decompose in the presence of oxygen, and methanogenic microorganisms will not proliferate and thus will not produce methane and other gasses.[117] But as the California dairy industry expanded into larger and larger factory farms, it "tend[ed] to utilize more liquid-based systems to manage … and store manure. Thus, the shift toward larger dairy cattle and swine

[114] For example, CARB knows that solid separation before lagoon or digester storage effectively reduces methane and that "when dry systems are used … emissions can be dramatically reduced – perhaps by more than 90 percent." Ex. 49, CAL. DEPT. FOOD & AGRIC., RECOMMENDATIONS FOR SHORT-LIVED CLIMATE POLLUTANTS: AN AGRICULTURAL WORKGROUP REPORT FOR THE CALIFORNIA AIR RESOURCES BOARD AND CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE 12–13 (June 2015), https://perma.cc/9CEA-U4NX.
[115] SB 1383; AB 197.
[116] Ex. 50, U.S. ENVTL. PROT. AGENCY, DRAFT INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2022 5-11 to 5-13, https://perma.cc/UX33-BZLQ.
[117] *E.g.*, Ex. 51, *Practices to Reduce Methane Emissions from Livestock Manure Management*, U.S. ENVTL. PROT. AGENCY, https://perma.cc/6S8U-RQMV (last visited Feb. 20, 2024) ("In general, liquid manure management systems lead to anaerobic conditions and increased methane production, and switching to practices that manage manure in drier, aerobic conditions reduced methane emissions.").

facilities since 1990 has translated into an increasing use of liquid manure management systems, which have higher potential CH^4 emissions than dry systems."[118]

And now that CARB has structured incentives, through avoided methane crediting, to encourage and entrench liquid manure systems, CARB's use of a baseline that it itself has manufactured due to its failure to adopt direct regulations has become circular and self-fulfilling. Factory farms intentionally and unrestrictedly polluting the climate cannot be used as the standard by which progress is measured.

The LCFS did not always have this problem. For years, CARB did not incentivize the production of GHGs from manure by monetizing its deliberate creation. Under the prior approach, factory farm gas fuel could generate credits but through more accurate, positive CI values similar to landfill biomethane. CARB did not assume the perpetual, unregulated free venting of methane from factory farm cesspools, instead it used a capture-and-destroy baseline that did not incentivize the intentional production of biogases.[119] This responsible approach provided opportunities for reasonable credit generation but did not lead to such windfall profits that agricultural operations structured themselves to profit off the LCFS.

But when CARB adopted avoided methane venting, it transformed factory farms utilizing liquid manure management systems into natural and unavoidable features of the landscape, and thus mitigating any amount of their emissions acts as a carbon sink in the environment. This approach transformed factory farm gas into the most lucrative and incentivized source of fuel in the entire LCFS. While this was never a valid framework for achieving California's climate objectives, CARB's obligation to actually regulate these emissions makes it patently arbitrary moving forward. California will never achieve SB 1383's goal of a 40% manure methane reduction so long as CARB assumes, accepts, and encourages the worst from the dairy industry.

b) CARB cannot ignore the perverse incentive to expand pollution generation for purported methane capture.

CARB cannot ignore that avoided methane crediting causes factory farms to expand and structure their operations in ways that maximize methane pollution. This is a critical flaw in CARB's treatment of factory farm gas because intentionally produced methane emissions are always climate intensive.[120] CARB cannot rationally amend the LCFS on the belief that factory farms will not respond to the strong incentives avoided methane crediting sends when CARB has simultaneously shown no indication of reining in methane emissions with mandatory, regulatory reductions.[121] In other words, CARB is using a one-way ratchet, and the result is predictable.

[118] DRAFT INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2022, *supra* note 116, at 5-12 to 5-13.
[119] *See* Ex. 52, CARB, FINAL REGULATIONS ORDER, https://perma.cc/N254-ZSBM (2015 LCFS Regulations Lookup Table – CNG004).
[120] Ex. 53, Emily Grubert, *At Scale, Renewable Natural Gas Systems Could be Climate Intensive: The Influence of Methane Feedstock and Leakage Rates*, 15 ENV'T RESEARCH LETTERS (2020), https://doi.org/10.1088/1748-9326%2Fab9335.
[121] In fact, CARB has disclosed it has no such plans. *See* Transcript of Videoconference Meeting, *supra* note 105, at 81.

CARB must amend the LCFS to eliminate avoided methane crediting.

2. *CARB fails to require a full lifecycle analysis for factory farm gas fuels.*

368.3 ctd CARB further distorts the CI of factory farm fuels by failing to account for significant up and downstream GHG emissions directly associated with production of the fuel. The Amendments fail to address this flawed system boundary and continue to leave out known and significant emissions.[122] Ignoring GHG emissions directly associated with factory farm gas production arbitrarily pushes CI values for these fuels even lower and in effect infuses the LCFS with bogus credits that do not represent real emissions reductions.

Both up and downstream GHG emissions must be added to the LCA for factory farm gas fuels. Emissions from factory farm operations upstream of liquid manure collection must be included in the LCA because the LCFS regulations define a "fuel pathway" to include "a complete well-to-wheel analysis."[123] And when a project applies for an LCFS Tier 2 pathway, the application's life cycle analysis must take into account "feedstock production."[124] For factory farm gas production, "feedstock" is manure from confined animals and thus "feedstock production" must include consideration of the processes and animals that produced the methane-emitting manure. CARB may believe that upstream emissions are attributable to other products from factory farming, like milk or meat, but the "manure gold rush" now in effect mandates that CARB treat liquified manure emitting methane as a co-product of raising animals in these conditions, especially when the LCFS distorts agricultural markets such that herds may be larger than justified by agricultural production alone.[125]

But CARB has failed to require a full upstream LCA and arbitrarily refuses to correct that in the proposed Amendments. Under staff's proposal, the system boundary for these fuels would continue to exclude all emissions associated with raising, feeding, housing, and otherwise sustaining the concentrated and confined herds that produce factory farm gas feedstock. These emissions include but are not limited to enteric emissions and those from the production, transport, and storage of animal feed. Without manure collection at animal confinement facilities, there is no gas production; and with no animals in confinement there is no manure collection. Therefore, factory farm operations and particular manure management systems are inextricably part of "feedstock production."

Downstream emissions must be included in the LCA because anaerobic digestion of manure results in digestate that is more prone to emitting GHGs than undigested manure. The

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[122] CARB has adopted portions of the Compliance Offset Protocol Livestock Projects established under the California Cap-and-Trade program, including the LCA system boundary, and those parameters are manifested in the Tier 1 simplified calculators and CA-GREET4.0. *See* Ex. 54, CAL. EPA, COMPLIANCE OFFSET PROTOCOL LIVESTOCK PROJECTS Fig. 4.1 (Nov. 14, 2014), https://perma.cc/B3HF-F353.
[123] Cal. Code Regs. Tit. 17 § 95481(a)(66).
[124] Cal. Code Regs. Tit. 17 § 95488.7(a)(2)(B).
[125] *See* Ex. 55, Jeremy Martin, *Something Stinks: California Must End Manure Biomethane Accounting Gimmicks in Its Low Carbon Fuel Standard*, UNION OF CONCERNED SCIENTISTS, THE EQUATION (Feb. 15, 2024), https://perma.cc/5DRT-KTE7.

LCFS regulations require consideration of “waste generation, treatment and disposal.”[126] Yet, CARB has failed to include emissions from the “generation, treatment and disposal” of digestate in factory farm gas fuels’ CI values. As the U.S. Department of Agriculture’s Natural Resources Conservation Service recognizes in its Conservation Practice Standard for anaerobic digestion, “digestate has increased potential for some air and nutrient emissions compared to raw manure.”[127] This includes up to a threefold increase in methane emissions during digestate handling and storage,[128] as well as increased nitrous oxide emissions.[129] Despite Commenters and others repeatedly presenting compelling scientific evidence to CARB staff that the storage and land application of digestate can increase nitrous oxide and other emissions, the proposed Amendments retain an exclusion of nitrous oxide emissions from storage or land application of digestate that is arbitrary and not supported by any evidence.[130]

CARB’s deliberate indifference to these known, increased GHG emissions resulting from factory farm gas production is arbitrary and without support.

3. *Inaccurate CI values for factory farm gas threaten to undermine green hydrogen production.*

How CARB calculates CI for factory farm gas also threatens to undermine any hope of a “green” hydrogen future in California.[131] CARB proposes to use the LCFS to build up and entrench factory farm gas production, with a goal of eventually “shift[ing] biomethane to the production of renewable hydrogen or for use in other sectors by 2045.”[132] Using the same flawed carbon intensity
368.41 analyses for hydrogen produced from combusted biogas or steam methane reformation paired with factory farm gas offset credits will disadvantage and undercut truly green, electrolytic hydrogen produced from solar, wind, or other clean energy sources. This is because producing dirty hydrogen and buying factory farm gas credits results in *lower* carbon intensity hydrogen on paper than solar electricity used for electrolysis.

Existing hydrogen pathways exemplify this perversity. For example, CARB recently certified several pathways for hydrogen produced by steam methane reformation of fossil natural

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[126] Cal. Code Regs. Tit. 17 § 95488.7(a)(2)(B).

[127] Conservation Practice Standard Code 366: Anaerobic Digester, *supra* note 24.

[128] Ex. 56, Lena K.K. Rodhe et al., *Greenhouse Gas Emissions from Storage and Field Application of Anaerobically Digested and Non-Digested Cattle Slurry*, 199 Ag., Ecosystems & Env’t 358 (Jan. 2015), https://perma.cc/LE8U-W87U; Ex. 57, Hambaliou Baldé et al., *Methane Emissions from Digestate at An Agricultural Biogas Plant*, 216 Bioresources Tech. 914 (Sept. 2016), https://perma.cc/BVQ9-XKN2.

[129] Ex. 58, Michael A. Holly et al., *Greenhouse Gas and Ammonia Emissions from Digested and Separated Dairy Manure During Storage and After Land Application*, 239 Agric, Ecosystems & Env’t 410, 411 (Feb. 2017), https://www.sciencedirect.com/science/article/pii/S0167880917300701.

[130] Compliance Offset Protocol Livestock Projects, *supra* note 122, at 16; Ex. 59, CARB, Tier 1 CI Calculator for Dairy and Swine Manure Biomethane, Instruction Manual (proposed Dec. 19, 2023), https://perma.cc/AY6F-Y6UP (only discussing avoided emissions from land application without reference to potentially increased emissions).

[131] *See* Ex. 60, Food & Water Watch, Hydrogen: The Good, The Bad, The Ugly (Apr. 2021), https://perma.cc/AEW5-G5G7 (defining green hydrogen as a “sustainable energy source” that is “produced through electrolysis (splitting water into hydrogen and oxygen) using renewable electricity like wind or solar”).

[132] ISOR, *supra* note 42, at 30.

gas paired with factory farm gas credits from dairies in New York state.[133] While this is for the production of dirty, fossil fuel-based hydrogen, CARB certified CI values ranging from -102.79 to -181.75, many times more lucrative than zero emission hydrogen production using solar or wind that would receive at best a CI of zero.[134] And CARB staff have certified other dirty hydrogen pathways with even more extreme CI values.[135] As staff make clear, this is the supposedly "renewable hydrogen" future that the proposed Amendments are designed to lock in.

4. *Real world monitoring shows that factory farm digesters are ineffective at the one thing they are purported to do: capture methane.*

368.42 CARB is also vastly overestimating the effectiveness of factory farm digesters, calling into question fundamental assumptions built into how CARB assesses these fuels. For example, CARB uses a default methane capture efficiency of 95% for lagoon digesters and 98% for fully enclosed vessels, unless a pathway applicant discloses otherwise.[136] Were these default values remotely close to real-world conditions, they would align with real-world monitoring of LCFS-supported dairy digesters. But they do not. Instead, the actual monitoring data are showing that LCFS-supported digesters are relatively *ineffective* at total methane capture, with one peer-reviewed study finding no statistically significant difference between methane emissions at California dairies with and without covered lagoon digesters.[137] And an analysis of Carbon Mapper data conducted by Food & Water Watch shows that fifteen LCFS-supported dairy digesters continue to have massive methane plumes despite installation of a digester and certification to generate LCFS credits.[138] Therefore, real-world conditions appear to disagree significantly with CARB's assumptions regarding methane capture and loss to the atmosphere from factory farm digester operations.

B. The LCFS is a market-based compliance mechanism and, as such, CARB must ensure the validity of LCFS greenhouse gas emissions reductions pursuant to state law.

368.43 The LCFS bears all the identifying features of a market-based compliance mechanism. Accordingly, CARB must ensure that greenhouse gas emissions reductions are real, permanent, quantifiable, verifiable, enforceable, and additional. CARB initially adopted the LCFS as a discrete early action measure. But now CARB insists that the LCFS remains an early action measure for

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[133] Ex. 61, CARB, TIER 2 PATHWAY APP. B0494, STAFF SUMMARY (updated Dec. 29, 2023), https://perma.cc/L8AX-RSFT; *see supra* note 100, CARB, Certified Pathways Spreadsheet (listing App. B0392 certified Dec. 22, 2022).

[134] *See* TIER 2 PATHWAY APP. B0494, STAFF SUMMARY, *supra* note 133; Certified Pathways Spreadsheet, *supra* note 100.

[135] Ex. 62, CARB, TIER 2 PATHWAY APP. B0392, STAFF SUMMARY (posted for comment Nov. 28, 2022), https://perma.cc/5CKU-ZE66; *see* CARB Certified Pathways Spreadsheet, *supra* note 100 (listing App. B0392 certified Dec. 22, 2022, with CI values as low as -308.67 for dirty hydrogen).

[136] Ex. 63, CARB, PROPOSED TIER 1 CI CALCULATOR FOR DAIRY AND SWINE MANURE BIOMETHANE, Reference, Table A.3. Biogas Collection Efficiency by Digester Type, https://perma.cc/N7X2-KCXR (release date Dec. 19, 2023).

[137] Ex. 64, N.T. Vechi et al., *Ammonia and Methane Emissions from Dairy Concentrated Animal Feeding Operations in California, Using Mobile Optical Remote Sensing*, 293 ATMOSPHERIC ENVT. 119448 (2023), https://www.sciencedirect.com/science/article/pii/S1352231022005131.

[138] Ex. 65, FOOD & WATER WATCH, THE PROOF IS IN THE PLUMING: FACTORY FARM BIOGAS HAS NO PLACE IN THE LOW CARBON FUEL STANDARD (Feb. 2024), https://perma.cc/MN7Q-HNEV.

which CARB need not ensure additionality,[139] despite the fact that the LCFS is no longer discrete or early. CARB was never authorized to dodge the safeguards the Legislature thought necessary for market-based compliance mechanisms by transforming early action measures into long-term, evolving, and expansive programs. But this is precisely what CARB did in 2018 when it amended the program to establish carbon intensity benchmarks and greenhouse gas emissions beyond the 2020 statewide greenhouse gas emissions limit. And CARB now proposes amendments to increase the 2018 amendments' carbon intensity benchmarks between 2020 and 2030 and establish new carbon intensity benchmarks between 2031 and 2045. The early action measure provision of AB 32 does not authorize CARB's 2018 amendments for post-2020 emissions reductions or the proposed Amendments. The LCFS today, as an AB 32 program authorized by Cal. Health & Safety Code § 38562 and not an early action measure under section 38560.5, is subject to the Legislature's command to ensure that market-based compliance mechanisms provide real, permanent, quantifiable, verifiable, enforceable, and additional reductions.

1. *The LCFS is a market-based compliance mechanism, and any greenhouse gas emissions reductions shall be real, permanent, quantifiable, verifiable, enforceable, and additional.*

Section 38562(d)(1) of the Health & Safety Code requires that any regulation CARB adopts pursuant to Parts 4 and 5 of Division 25.5 of the Health & Safety Code shall ensure that any reduction in greenhouse gas emissions is real, permanent, quantifiable, verifiable, and enforceable. Moreover, any market-based compliance mechanism adopted pursuant to Part 5 must ensure the
368.43 ctd reductions are "in addition to any greenhouse gas emission reduction otherwise required by law or regulation, and any other greenhouse gas emission reduction that otherwise would occur."[140] The LCFS unquestionably meets the definition of a market-based compliance mechanism.[141] The LCFS imposes an economy-wide limit on the carbon intensity of transportation fuels, requires any fuel producer to meet the carbon intensity benchmark, and any producer that does not meet their obligation—a deficit holder—must purchase credits to lower the overall carbon intensity of their fuels to comply with the LCFS.[142] And CARB maintains the LCFS credit bank, acting as a market maker between the purchasers and sellers of LCFS credits.[143]

CARB itself described the LCFS as a market-based mechanism when promulgating amendments to the LCFS:

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[139] *See* RESPONSE TO PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM, *supra* note 87, at 2, n.4.

[140] Health & Safety Code § 38562(d)(2).

[141] "Market-based compliance mechanism means either of the following: (1) A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases; and (2) Greenhouse gas emissions exchanges, banking, credits, and other transactions, governed by rules and protocols established by the state board, that result in the same greenhouse gas emission reduction, over the same time period, as direct compliance with a greenhouse gas emission limit or emission reduction measure adopted by the state board pursuant to this division." Health & Safety Code § 38606(k); *see Rocky Mountain Farmers Union v. Corey*, 730 F.3d 1070, 1106 (9th Cir. 2013) (noting the LCFS is a market-based program).

[142] *See, e.g.*, Ex. 66, CARB, LCFS BASICS (2019), https://perma.cc/5LN8-TS6D (last visited Feb. 20, 2024).

[143] *See* Ex. 67, *LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS)*, CARB, https://perma.cc/T4KF-33L6 (last visited Feb. 20, 2024).

> The LCFS is a market-based approach designed to reduce the carbon intensity of transportation fuels by 10 percent by 2020, from a 2010 baseline. It is important to note that the Cap-and-Trade Program and the LCFS program have complementary, but not identical programmatic goals: Cap-and-Trade is designed to reduce greenhouse gasses from multiple sources by setting a firm limit on GHGs; the LCFS is designed to reduce the carbon intensity of transportation fuels. As a market-based, fuel-neutral program, the LCFS provides regulated parties with flexibility to achieve the most cost-effective approach for reducing transportation fuels' carbon intensity. . . .
>
> CARB staff disagrees that the LCFS is fundamentally a command-and-control system. The LCFS is a fuel-neutral, market-based program that does not give preference to specific transportation fuels and instead bases compliance on a system of credits and deficits based on each fuel's carbon intensity. Carbon intensity (CI) is a measure of the GHG emissions associated with the various production, distribution, and consumption steps in the "life cycle" of a transportation fuel. It is difficult to respond with depth to this assertion because the commenter provides no specifics to support the claim that the LCFS is not market-based. Notably, the commenter does not describe what components of the program could be considered command-and-control.[144]

Additionally, CARB's descriptions of the LCFS program closely parallel the statute's definition of "market-based compliance mechanism." The definition states that a market-based compliance mechanism means either of the following:

> (1) A system of market-based declining annual aggregate emissions limitations for sources or categories of sources that emit greenhouse gases.
>
> (2) Greenhouse gas emissions exchanges, banking, credits, and other transactions, governed by rules and protocols established by the state board, that result in the same greenhouse gas emission reduction, over the same time period, as direct compliance with a greenhouse gas emission limit or emission reduction measure adopted by the state board pursuant to this division.[145]

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[144] Ex. 68, CARB, FINAL STATEMENT OF REASONS FOR RULEMAKING, INCLUDING SUMMARY OF COMMENTS AND AGENCY RESPONSE 679–81 (2015), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf; *see also* Ex. 69, CARB, RESPONSES TO COMMENTS ON THE DRAFT ENVIRONMENTAL ANALYSIS FOR THE AMENDMENTS TO THE LOW CARBON FUEL STANDARD AND ALTERNATIVE DIESEL FUEL REGULATIONS B4-42 (2018), https://perma.cc/U6H6-6LBU (CARB responding, "Because the LCFS is a market-based mechanism…"); Ex. 70, CARB, STAFF DISCUSSION PAPER: RENEWABLE NATURAL GAS FROM DAIRY AND LIVESTOCK MANURE 6 (Apr. 13, 2017), https://perma.cc/ACG4-XTSP (CARB staff noting in 2017 discussion paper that additionality requirements for the LCFS *are* intended to be identical to those of the compliance offset protocol, to "ensure any crediting is for GHG reductions resulting from actions not required by law or beyond business as usual").

[145] CAL. HEALTH & SAFETY CODE § 38505(k).

CARB explains that the LCFS has a "market for credit transactions," where "entities with credits to sell can opt to pledge credits into the market and entities needing credits must purchase their pro-rata share of these pledged credits."[146] CARB explains that credits are generated relative "to a declining CI benchmark for each year."[147] The LCFS exhibits many if not most of the features of a market-based compliance mechanism, including a Cap-and-Trade allowance-like system with yearly declinations,[148] transaction rules,[149] recordkeeping and auditing requirements,[150] an account system to manage credit transfers—the LCFS Reporting Tool and Credit Bank & Transfer System (LRT-CBTS)[151]—and a portal that applicants must use to demonstrate compliance,[152] among others. In addition to CARB's interpretation, designation, and treatment of the program as a market-based mechanism and the overall structure of the regulation evincing the same, the designation of California's LCFS as a market-based mechanism is ubiquitous in academic and technical literature.[153]

Moreover, the self-evident nature of the LCFS as a market-based compliance mechanism gives rise to the primary objective for these proposed amendments. CARB seeks to correct an over-supply of credits in the market which the 2018 LCFS amendments caused when CARB adopted its avoided methane crediting policy and failed to limit crop-based biofuels. Both of these policy choices caused market failure, with an oversupply of credits from manure-based and crop-based fuels that cratered credit prices.[154] CARB now proposes to increase the carbon intensity benchmark from 20 percent in 2030 to 30 percent in 2030, as well as a significant increase in the carbon intensity benchmark in 2025, to drastically increase the demand for credits and thus increase credit prices. CARB projects these changes to its control of, and regulation over, the market will yield 558 MMTCO_2e of cumulative emissions reductions between 2025 and 2045.

As a market-based compliance mechanism that plainly meets both prongs of the statutory definition, CARB has no authority to ignore the mandates in Health & Safety Code § 38562(d)(1) and (d)(2). Rather, the LCFS must ensure that the greenhouse gas emissions reductions CARB

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[146] LCFS BASICS, *see supra* note 142.
[147] Ex. 71, *Low Carbon Fuel Standard: About*, CARB, https://perma.cc/7CR3-MC5M (last visited Feb. 20, 2024).
[148] *See* CAL. CODE REGS. TIT. 17 §§ 95482–95486.
[149] *See* CAL. CODE REGS. TIT. 17 § 95491.
[150] *See* CAL. CODE REGS. TIT. 17 § 95491.1.
[151] CAL. CODE REGS. TIT. 17 § 95483.2(b) ("The LRT-CBTS is designed to support fuel transaction reporting, compliance demonstration, credit generation, banking, and transfers.").
[152] *See* Ex. 72, CARB, LOW CARBON FUEL STANDARD – ANNUAL REPORTING AND VERIFICATION USER GUIDE 3–4 (Aug. 9, 2021), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/Reporting_and_Verification_User_Guide.pdf.
[153] *See, e.g.*, Ex. 73, CTR. FOR CLIMATE AND ENERGY SOLUTIONS, POLICY CONSIDERATIONS FOR EMERGING CARBON PROGRAMS 2 (June 2016), https://perma.cc/62AJ-QNF4 (describing Low Carbon Fuel Standards as an example of a market-based policy option, specifically of a baseline-and-credit program); Ex. 74, *Regional Activities*, NAT'L LOW CARBON FUEL STANDARD PROJECT, https://perma.cc/H8KA-WAYR (stating California's "LCFS is a market-based mechanism") (last visited Feb. 20, 2024).
[154] Ex. 75, Silvia Secchi, Comments on the Amendments to Low Carbon Fuel Standard; Ex. 76, Aaron Smith, *Cow Poop Is Now a Big Part of California Fuel Policy, Are the State's New Low-Carbon Fuel Regulations Full of BS?*, U.C. DAVIS DEPT. AGRIC. RES. ECON. (Jan. 22, 2024), https://perma.cc/3LXQ-HVD4; Ex. 77, Jeremy Martin, *Everything You Wanted to Know About Biodiesel and Renewable Diesel. Charts and Graphs Included*, UNION OF CONCERNED SCIENTISTS, THE EQUATION (Jan. 10, 2024), https://perma.cc/C9YC-LK2V.

claims through 2030 are real, permanent, quantifiable, verifiable, enforceable, and additional.[155] No provision of the proposed amendments complies with this mandate and CARB thus unlawfully and arbitrarily proposes to adopt the LCFS amendments without ensuring the validity of claimed emissions reductions.

2. The LCFS is not an early action measure as CARB asserted when it denied the Petition for Reconsideration.

368.44 CARB has claimed that it may implement the LCFS as an early action measure not subject to additionality for as long as and for whatever purposes staff wish.[156] However, the Legislature did not enact an open-ended early action measure provision to authorize subsequent rules and regulations for emissions reductions beyond the 2020 statewide greenhouse gas emissions limit. The plain language of the early action measure provision and its place within the broader statutory scheme demonstrates that early action measures served the narrow function of implementing certain measures before CARB adopted the primary measures authorized by section 38562 of the Health & Safety Code to achieve the 2020 statewide greenhouse gas limit.[157] Nor did the Legislature amend section 38560.5 of the Health & Safety Code at any point after its initial adoption to expand the limited role early action measures played in the statutory scheme. In sum, early action measures were designed to be just that - measures that could be implemented prior to implementation of those measures authorized by section 38562 and measures that could help reach the statewide greenhouse gas emissions limit by 2020. CARB thus lacks statutory authority to proceed with these proposed Amendments as an early action measure. Accordingly, the LCFS today is only authorized by section 38562 and therefore CARB must ensure the additionality of emissions reductions before certifying credit generation.

3. CARB has unlawfully and arbitrarily failed to ensure the greenhouse gas emissions reductions achieved by certified pathways for fuels derived from livestock manure are additional.

368.45 CARB adopted the 2018 LCFS amendments in violation of Health & Safety Code § 38562(d)(2) because it failed in those amendments to ensure that LCFS emissions reductions would be additional. Further, CARB has approved dozens of fuel pathways for fuels derived from dairy and swine manure despite comments on the lack of additionality for those fuel pathways.[158] The Commenters specifically identified how those pathways lack additionality because the emissions reductions are required by the DDRDP program, are required by the Aliso Canyon Mitigation Agreement, and are thus required by law and/or otherwise would have occurred regardless of the LCFS. Despite those comments, CARB has certified those pathways and allowed those biofuel producers to generate LCFS credits which deficit holders may utilize to sell polluting

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[155] *See* Health & Safety Code §§ 38562(d)(1), (d)(2); 38570(a). CARB lacks authority to adopt these LCFS amendments insofar as the amendments would reduce emissions to meet the Assembly Bill 1279 target in 2045. *See infra* section IV(D).

[156] *See* CARB, RESPONSE TO PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM, *supra* note 87, at 2, n.4.

[157] *See* Health & Safety Code §§ 38560.5(a), (c); 38562.

[158] *Supra* section III (citing and incorporating by reference all comments).

fossil fuels. These unlawful pathway certifications represent exactly the type of double-counting abuse (indeed triple-counting abuse for pathways related to the DDRDP and the Aliso Canyon Mitigation Agreement) the Legislature specifically prohibited. CARB should correct these fuel pathways pursuant to its authority under the existing LCFS regulations[159] and proceed as the Legislature has commanded.

C. CARB unlawfully and arbitrarily proposes to use the LCFS Amendments to achieve the Senate Bill 1383 methane reduction mandate.

In 2016, the Legislature passed Senate Bill 1383 and required CARB to adopt regulations to reduce methane emissions from manure management by 40 percent from 2013 levels by 2030.[160]
368.33 ctd The Legislature also directed CARB to prioritize direct emissions reductions.[161] But the proposed LCFS amendments ignore these mandatory duties. Instead, CARB arbitrarily and capriciously proposes these amendments as the policy mechanism to achieve the legislatively required methane reductions. CARB relies on alleged methane reductions achieved by current and anticipated anaerobic digester projects receiving LCFS credits. But CARB's preferred policy ignores its duty to adopt regulations and its duty to prioritize direct emissions reductions.

CARB also fails to reconcile the claimed progress towards the Senate Bill 1383 reductions with the facts that (1) the LCFS considers digester projects as achieving methane reductions; (2) rewards those projects with LCFS credits representing those methane reductions; (3) authorizes deficit holders – oil companies – to buy those credits to offset the carbon intensity of their fossil fuels; and (4) the methane reductions from digesters offset fossil fuel emissions. With the LCFS
368.46 transferring the alleged methane reductions from anaerobic digester-related fuel pathways to authorize more climate pollution from fossil fuels in the LCFS, CARB arbitrarily and capriciously proposes to credit the same methane reductions toward the Senate Bill 1383-required methane reductions. CARB cannot have it both ways and cannot explain how the same digesters generate credits that allow more emissions from fossil fuels yet also somehow reduce the climate pollution the Legislature required. As a result, CARB violates its legislatively imposed duties to limit methane pollution and arbitrarily and capriciously claims the LCFS pollution trading scheme reduces methane pollution.

1. *CARB has a mandatory duty to adopt regulations to achieve the Senate Bill 1383 methane reduction mandate.*

As CARB has acknowledged, the dairy and livestock sector produces more than half of
368.33 ctd California's methane emissions.[162] Senate Bill 1383 mandates that CARB "***shall adopt regulations*** to reduce methane emissions from livestock manure management operations and dairy manure

[159] Cal. Code Regs. Tit. 17, § 95495.
[160] Cal. Health & Safety Code § 39730.7(b)(1).
[161] Cal. Health & Safety Code § 38562.5(a) & (b).
[162] Ex. 78, CARB, SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY 63 (Mar. 2017), https://perma.cc/FL5E-SWBX ("California's dairy and livestock industries account for more than half of the State's total methane emissions[.]").

management operations" to meet the 2030 target.[163] As CARB has further acknowledged, Senate Bill 1383 "sets a methane emissions reductions target . . . of 40 percent below 2013 levels, or . . . 9 million metric tons carbon dioxide equivalent (MMTCO_2e) by 2030."[164]

As required by Senate Bill 1383, CARB prepared a progress report. But the report concedes that, even with assumed statewide dairy herd size decreases, the dairy and livestock sector would achieve "only about half of the emissions reductions needed to achieve the 2030 target."[165] But despite the legal duty to promulgate regulations, CARB's Executive Officer recently disavowed any intention of initiating such rulemaking in 2024.[166] And CARB takes several years to adopt major regulations.[167] Instead of adopting regulations and complying with Health & Safety Code section 39730.7(b)(1), CARB proposes to rely on the LCFS instead.[168]

CARB has no authority to ignore the Legislature and choose its own preferred policy for securing methane reductions. Thus, CARB must honor its duty to adopt regulations and immediately initiate rulemaking on an expedited basis.

2. CARB has a mandatory duty to prioritize direct emissions reductions.

The Legislature has further commanded CARB to favor direct emissions reductions over pollution trading schemes like the LCFS. Assembly Bill 197 imposes a duty on CARB to prioritize direct emissions reductions when adopting regulations like those mandated by Senate Bill 1383.
368.39 ctd Specifically, CARB "shall . . . prioritize . . . [e]mission reduction rules and regulations that result in direct emission reductions[.]"[169] In other words, CARB has a mandatory duty to prioritize "greenhouse gas emission reduction action[s] made by a greenhouse gas emission source at that source"[170] over voluntary, market-based pollution trading schemes.[171]

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[163] Cal. Health & Safety Code § 39730.7(b)(1) (emphasis added); *see* SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY, *supra* note 162, at 69 ("The regulations ***are to be implemented*** on or after January 1, 2024." (emphasis added)).
[164] Ex. 79, CARB, ANALYSIS OF PROGRESS TOWARD ACHIEVING THE 2030 DAIRY AND LIVESTOCK SECTOR METHANE EMISSIONS TARGET ES-1 (Mar. 2022), https://perma.cc/U494-SVV3; *see supra* notes 74 & 88 and associated text.
[165] RESPONSE TO PETITION FOR RECONSIDERATION OF THE DENIAL OF THE PETITION FOR RULEMAKING TO EXCLUDE ALL FUELS DERIVED FROM BIOMETHANE FROM DAIRY AND SWINE MANURE FROM THE LOW CARBON FUEL STANDARD PROGRAM, *supra* note 87, at 3; *see* ANALYSIS OF PROGRESS TOWARD ACHIEVING THE 2030 DAIRY AND LIVESTOCK SECTOR METHANE EMISSIONS TARGET, *supra* note 164, at ES-2 ("the dairy and livestock sector is projected to achieve just over half of the annual methane emissions reductions necessary to achieve the target by 2030").
[166] Transcript of Videoconference Meeting, *supra* note 105, at 81.
[167] *See* Ex. 80, Decl. of Sylvia Vanderspeck in Support of Defendants' Opposition to Plaintiffs' Motion for Summary Judgment ¶¶ 21-22, *Central California Environmental Justice Network v. Randolph*, No. 2:22-cv-01714-DJC-CKD (E.D. Cal.) (Dkt. No. 21-1).
[168] ISOR, *supra* note 42, at 8; *see also id.* at 30 ("The LCFS supports CARB's work to meet Short Lived Climate Pollutant (SLCP) targets set by Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016) by incentivizing dairies to capture and convert methane-rich biogas into transportation fuels (compressed natural gas, hydrogen, and electricity).").
[169] Cal. Health & Safety Code § 38562.5(a) & (b).
[170] *Id.* Health & Safety Code § 38505(e).
[171] *See e.g.*, Ex. 81, Alice Kaswan, *California Climate Policies Serving Climate Justice* 14, NAT. RESOURCES & ENV'T (2019).

This legislative mandate further underscores CARB's unequivocal duty in Senate Bill 1383 to adopt regulations to limit methane from manure management with a priority for direct emissions reductions. CARB acknowledged the difference between direct emissions reductions and market-based mechanisms, and that the LCFS does not substitute for rules and regulations that result in direct emissions reductions, when it contrasted "Regulations to Ensure Emission Reductions" with "Incentives and Market Development" in its Short-Lived Climate Pollutant Reduction Strategy.[172] For example, under "Incentives and Market Development," CARB discusses "help[ing] the industry reduce emissions before regulatory requirements take effect."[173] In this section CARB also discusses "environmental credits from dairy-related transportation fuel projects," "credits under the LCFS, increasing the market value of manure products," "installing anaerobic digesters at dairies," and "[e]nabling pipeline injection of biomethane and minimizing associated costs" to "help direct dairy biogas into the transportation sector and allow for the generation of LCFS and RIN credits, which [can] provide an especially valuable revenue stream."[174]

Accordingly, CARB should initiate a rulemaking pursuant to Senate Bill 1383 and prioritize direct emissions reductions rather than continuing to undermine those mandates through LCFS subsidies.

3. *CARB arbitrarily and capriciously finds that the LCFS Amendments provide methane reductions from manure management that could or would satisfy the Senate Bill 1383 methane reduction mandate.*

CARB claims that the proposed LCFS amendments will achieve 558 $MMTCO_2e$ in cumulative greenhouse gas emissions reductions by 2045.[175] At the same time, CARB concludes that the LCFS provides the methane reductions required by Senate Bill 1383. "SB 1383 (Lara, Chapter 395, Statutes of 2016) requires a 40% reduction in California's methane emissions by 2030 and the LCFS facilitates significant private investment in technologies that provide the methane reductions from dairy, livestock manure, organic waste, and landfill management operations called for by SB 1383."[176] CARB also finds that the LCFS achieves these reductions by providing incentives to dairies to reduce methane. "The LCFS supports CARB's work to meet Short Lived Climate Pollutant (SLCP) targets set by Senate Bill 1383 (Lara, Chapter 395, Statutes of 2016) by incentivizing dairies to capture and convert methane-rich biogas into transportation fuels (compressed natural gas, hydrogen, and electricity)."[177]

But CARB does not explain how methane reductions count towards the Senate Bill 1383
368.46 ctd obligation when the incentives for private investment in digesters—LCFS credits awarded for compressed natural gas, hydrogen, and electricity fuels—serve a direct function as offsets in the LCFS pollution trading scheme. The LCFS allows producers of fossil transportation fuels with high greenhouse gas emissions to offset their fuels' impact on the climate buy purchasing credits

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[172] SHORT-LIVED CLIMATE POLLUTANT REDUCTION STRATEGY, *supra* note 162, at 67, 69.
[173] *Id.* at 67.
[174] *Id.* at 68.
[175] ISOR, *supra* note 42, at 5.
[176] *Id.* at 8.
[177] *Id.* at 30.

derived from fuels such as manure-based natural gas, hydrogen, and electricity.[178] A given fuel's carbon intensity represents the greenhouse gas emissions of a given fuel divided by its energy content.[179] As explained herein, CARB awards manure-based fuels negative carbon intensities based on the avoided methane crediting policy. Those credits representing methane emission reductions are then purchased by fossil fuel producers to comply with the carbon intensity benchmark, thereby assigning those claimed reductions to their own fossil fuel operations. CARB thus arbitrarily and capriciously claims the LCFS provides methane reductions to comply with Senate Bill 1383 when those reductions are used by oil companies to demonstrate their own compliance with the LCFS.

D. CARB unlawfully and arbitrarily proposes LCFS Amendments to implement the 2022 Scoping Plan to achieve post-2030 policies and the 2045 target set by Assembly Bill 1279.

368.5 ctd CARB's proposed LCFS amendments exceed its statutory authority when it proposes post-2030 carbon intensity benchmarks and unilaterally decides to use the LCFS to build-out biomethane and hydrogen infrastructure for use as stationary source fuels. The Legislature has not authorized such rulemaking authority or otherwise directed CARB to use the LCFS as the mechanism for developing hydrogen infrastructure. Because CARB does not operate with unbounded rulemaking authority, CARB may not proceed as proposed and should instead seek appropriate authority from the Legislature.

1. CARB proposes to amend the LCFS to achieve greenhouse gas emissions reductions above and beyond achieving the 2030 targets required by Senate Bill 32 and Senate Bill 1383.

In 2018, CARB amended the LCFS to align the regulation with the 2030 target set by Senate Bill 32 (2016, Pavley).[180] Those amendments increased the carbon intensity from a 10 percent benchmark by 2020 to a 20 percent benchmark by 2030.

The ISOR describes the objectives of the proposed 2024 amendments.[181] Among those objectives, CARB proposes to amend the LCFS to achieve long-term greenhouse gas emissions reductions above and beyond the 2030 Senate Bill 32 emissions reductions target, including:

> Improve California's *long-term* ability to support the production and use of increasingly lower-CI transportation fuels and to improve the program's overall effectiveness.
>
> Update the annual carbon intensity benchmarks through 2030 and *establish more stringent post-2030 benchmarks* in alignment with the 2022 Scoping Plan Update.

[178] *Id.* at 10–12.
[179] *Id.* at 11.
[180] *Id.* at 22; Health & Safety Code § 38566.
[181] ISOR, *supra* note 42, at 22–37.

> Incentivize fuel production and refueling infrastructure buildout needed to meet California's *long-term* climate goals and reduce dependence on petroleum fuels, including opportunities to leverage federal funding for low-carbon hydrogen production and ZEV fueling, and *support the transition of biomethane fuel pathways for combustion out of transportation*.[182]

CARB proposes to increase the carbon intensity benchmark to align with the 2022 Scoping Plan, which CARB adopted within the authority conferred by Assembly Bill 1279 (2022, Muratsuchi).[183] CARB describes the carbon intensity benchmark amendments as the "most significant change in this proposal" to support "California's goal for achieving carbon neutrality by 2045 and achieving an 85% reduction in GHG emissions by 2045, as called for by AB 1279 and the 2022 Scoping Plan Update."[184] And CARB acknowledges that adjusting the benchmarks are necessary to correct market failures, or in other words, too many biomethane and biofuel credits flooded the market and depressed credit prices.

CARB explains the over supply problem. Renewable diesel "has grown substantially and far exceeds what was previously modeled in 2018 when the current CI benchmarks were established."[185] Electricity and hydrogen fuels "have increased over 50% between 2019 and 2022 and are far outpacing the projections staff used to establish the existing CI benchmarks during the previous 2018 rulemaking."[186] "Biomethane supplies have also increased as more methane capture projects are developed."[187] "Taken together, these trends suggest that the market is outpacing previous fuels and crediting projections used for the 2018 LCFS benchmark modeling and that re-evaluation of near-term targets is needed to accelerate action and plan beyond 2030."[188] To correct the market depressed by low credit prices, CARB proposes to accelerate the 20% benchmark from 2030 to 2025 (the "step-down") and set a 30 percent benchmark by 2030.[189] CARB further proposes a linear increase in the benchmarks between 2031 and 2045 to reach a 90 percent benchmark in 2045.[190] "Scenarios modeled both in-house by CARB and by external stakeholders indicate that a reduction of at least 30% by 2030 and 90% by 2045 is achievable and necessary to accelerate decarbonization of the transportation fuels sector and support the State's broader climate goals."[191]

CARB also describes the objectives of the proposed amendments as necessary to reduce methane and to use the LCFS pollution trading scheme **to develop fuels for stationary sources**.

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[182] *Id.* at 22 (emphasis added).
[183] *Id*. at 22.
[184] *Id*. at 17.
[185] *Id*.
[186] *Id*. at 22–23.
[187] *Id*. at 23.
[188] *Id*.
[189] *Id.*; *see* CARB, APPENDIX A-1, PROPOSED REGULATION ORDER, PROPOSED AMENDMENTS TO THE LOW CARBON FUEL STANDARD REGULATION REDLINE AMENDMENTS 64–65, https://perma.cc/ZQ7Z-25UN (§ 95484 Table 1).
[190] ISOR, *supra* note 42, at 25 (Figure 6); APPENDIX A-1, PROPOSED REGULATION ORDER, PROPOSED AMENDMENTS TO THE LOW CARBON FUEL STANDARD REGULATION REDLINE AMENDMENTS, *supra* note 189, at 64–65.
[191] ISOR, *supra* note 42, at 24.

"Capturing methane from California's methane sources (e.g., landfills, dairies, and wastewater) is critical for achieving California's climate targets, including the targets identified by SB 32, SB 1383, and AB 1279."[192] CARB acknowledges, as it must, that biomethane-based fuels have no future in California's transportation fuels market. But CARB further proposes – without any
368.5 ctd authority from the Legislature – to adopt regulations that turn the LCFS into the policy mechanism to build out fuel supplies and fuel infrastructure, especially for hydrogen fuel ultimately for use in stationary sources.

> The 2022 Scoping Plan Update reinforces the message that while there is clearly a role for biomethane in decarbonizing California's energy use in the long term (particularly as a feedstock for renewable hydrogen production), biomethane used as an end-use vehicle fuel will decline as ZEVs penetrate the market, and this resource should be transitioned to other sectors. Biomethane can play a key role in decarbonizing stationary sources or other energy applications, and the 2022 Scoping Plan Update identifies additional end uses in the industrial, commercial, and residential sectors; production of hydrogen; and electricity generation by displacing the need for fossil gas. For the fuel to transition to other sectors in the long term, the existing market signals will need to transition accordingly to avoid stranded assets and the closure of methane capture projects. With this background, staff is proposing changes for pathways related to biomethane as a transportation fuel under the LCFS program. These changes would continue to incentivize the methane reductions needed in the next decade, while aligning with the 2022 Scoping Plan Update to shift biomethane to the production of renewable hydrogen or for use in other sectors by 2045.[193]

The facts CARB acknowledge include the minor role manure-based fuels play among California's transportation fuels and the major contribution those fuels make as credit-generating fuels. CARB's lavish avoided methane crediting policy means that credits derived from biomethane fuels comprise approximately 16 percent of total credits.[194] Revenue from credits vary significantly among different fuels, yet dairy biomethane receives by far the largest windfall between 2025 and 2045 compared to all other fuels.[195]

Despite the acknowledged lack of market demand for biomethane fuels, CARB
368.11 ctd nevertheless proposes to inject steroids in avoided methane crediting. CARB proposes to retain avoided methane crediting – regardless of the EJAC recommendations to terminate the policy – and convey a strong market signal for biogas companies to get their pathways certified or break ground on their digesters before the end of this decade. If they do, they can receive up to ***30 years***

[192] *Id.* at 30.
[193] *Id.* at 30.
[194] *Id.* at 16. The ISOR lacks clarity in whether electric fuel pathways derived from combusting biogas at dairy and swine operations qualify as biomethane or electricity credit-generating pathways as categorized in the ISOR at page 16. CARB should clarify how it classifies such fuels.
[195] *Id.* at 79, Tbl. 15.

of avoided methane credits. "For projects that break ground after December 31, 2029, staff is proposing to phase out pathways for crediting biomethane used in CNG vehicles after December 31, 2040. Pathways for biomethane used to produce renewable hydrogen would be eligible to receive credits until December 31, 2045."[196] Fuel pathways that produce electric vehicle fuel using biogas combusted on-site at dairy and swine operations could conceivably enjoy the benefits of avoided methane crediting in perpetuity under the plain language of the Amendments.

2. ***CARB lacks statutory authority to adopt these proposed Amendments to the LCFS.***

CARB only has the authority to promulgate regulations that the Legislature has granted. CARB does not operate with carte blanche regulatory authority. And the Legislature has not given CARB the power to adopt these proposed amendments to the LCFS.

In 2006, the Legislature authorized CARB to adopt early action measures, greenhouse gas emissions limits, and emissions reduction measures when it passed Assembly Bill 32.[197] This rulemaking authority extended only to achieving the statewide greenhouse gas emissions limit

368.34 ctd (1990 greenhouse gas emission levels) by 2020.[198] In 2016, the Legislature passed several, interrelated pieces of climate legislation including Senate Bill 32 and Senate Bill 1383. These bills modified and limited CARB's rulemaking authority.

The Legislature authorized CARB to adopt rules and regulations to achieve the 2030 targets set by Senate Bill 32 and Senate Bill 1383. Specifically, the Legislature gave CARB the authority to adopt "rules and regulations to achieve the maximum technologically feasible and cost-effective greenhouse gas emissions reductions authorized by this division" and mandated that CARB "ensure that statewide greenhouse gas emission are reduced to at least 40 percent below the below the statewide greenhouse gas emissions limit."[199] The Legislature also specifically directed CARB to adopt regulations to reduce methane from manure management. "The state board, in consultation with the department, shall adopt regulations to reduce methane emissions from livestock manure management operations and dairy manure management operations, consistent with this section and the strategy, by up to 40 percent below the dairy sector's and livestock sector's 2013 levels by 2030."[200]

The Legislature has not authorized CARB to adopt rules or regulations to achieve reductions in greenhouse gas emissions to achieve the 2045 policy goals of Assembly Bill 1279. Unlike the framework of the earlier climate legislation, the Legislature directed CARB to prepare a Scoping Plan Update to ***recommend*** policies for achieving carbon neutrality and an 85 percent

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196 *Id.* at 30.
197 *See* Health & Safety Code § 38560.5; AB 32, 2006 Cal. Legis. Serv. Ch. 488 (former section 38562).
198 Health & Safety Code § 38560.5; AB 32, 2006 Cal. Legis. Serv. Ch. 488 (former section 38562).
199 Health & Safety Code § 38566; SB 32, 2016 Cal. Legis. Serv. Ch. 249.
200 Health & Safety Code § 39730.7(b)(1). CARB's Executive Officer has already unequivocally stated that CARB has not initiated, and has no plans to initiate, the rulemaking the Legislature mandated. Transcript of Videoconference Meeting, *supra* note 105, at 81.

reduction in greenhouse gas emissions by 2045.[201] Unlike Senate Bill 32, the Legislature ***did not*** give CARB rulemaking authority to adopt rules and regulations to achieve the AB 1279 goals.[202]

Other legislation recently adopted by the Legislature provide further indicia of CARB's limited rulemaking authority. Most significantly, the Legislature passed Senate Bill 596 and Senate Bill 1075 to provide policy direction on the cement and hydrogen sectors, respectively.[203] Senate Bill 596 directs CARB to prepare a comprehensive strategy for the cement sector by July 1, 2023, one of the hard to decarbonize stationary source sectors which the 2022 Scoping Plan Update
368.47 identifies. The Legislature authorizes CARB to implement that cement strategy only "upon appropriation by the Legislature."[204] In Senate Bill 1075, the Legislature directed CARB to prepare an evaluation of hydrogen, including green hydrogen, by June 1, 2024, that shall include policy recommendations, a description of potential strategies supporting hydrogen infrastructure, and an analysis of hydrogen use as a climate strategy.[205] Senate Bill 1075 did not authorize CARB to adopt rules or regulations to implement the hydrogen strategy.

As a result, CARB does not have the rulemaking authority to adopt the proposed LCFS amendments. CARB lacks authority under Health & Safety Code § 38560.5 – the Assembly Bill 32 early action measure provision – to proceed with a rulemaking to achieve post-2020 emissions
368.48 reductions. CARB rulemaking authority to achieve the 2030 targets established by Senate Bill 32 and Senate Bill 1383 authorize and cabin CARB's rulemaking authority related those 2030 targets. Critically, the Legislature has not authorized CARB to adopt rules or regulations to implement the LCFS after 2030, including establishing carbon intensity benchmarks through to 2045. Where the Legislature has established climate policy for the post-2030 period, it has directed CARB to make ***recommendations*** and to date has not authorized CARB to adopt rules or regulations to implement those recommendations. CARB does not enjoy carte blanche rulemaking authority to achieve its stated objectives, and these proposed amendments are thus *ultra vires*.

E. The proposed Amendments will violate state and federal civil rights and fair housing laws.

1. The proposed Amendments will result in a disparate impact on protected classes in violation of Title VI and 11135.

State law provides that "[n]o person…shall, on the basis of…race, color, …ancestry,
368.35 ctd national origin, ethnic group identification" or other protected classes "be unlawfully denied full and equal access to the benefits of, or be unlawfully subjected to discrimination under, any program or activity that is conducted, operated, or administered by the state or by any state agency…."[206]

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[201] Health & Safety Code § 38562.2(d)(1); AB 1279, 2022 Cal. Legis. Serv. Ch. 250.
[202] Health & Safety Code § 38562.2(d)(1); AB 1279, 2022 Cal. Legis. Serv. Ch. 250.
[203] *See* SB 596, 2021 Cal. Legis. Serv. Ch. 246; SB 1075, 2022 Cal. Legis. Serv. Ch. 250.
[204] Health & Safety Code § 38561.2(c).
[205] Health & Safety Code § 38561.8(b).
[206] Cal. Gov. Code § 11135; *see also* Cal. Gov. Code § 65008 (Any discriminatory action taken "pursuant to this title by any city, county, city and county, or other local governmental agency in this state is null and void if it denies to any individual or group of individuals the enjoyment of residence, land ownership, tenancy, or any other land use in this state…"); Cal. Gov. Code §§ 12955, subd. (l) (unlawful to discriminate through public or private land use practices, decisions, or authorizations).

Further, Section 601 to Title VI of the Civil Rights Act provides that no person shall, "on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity."[207]

It is important to note that "... a disparate impact claim can be established without proving discriminatory intent."[208] However, "just as '[e]vidence of discriminatory intent can bolster a disparate impact case,' allegations of discriminatory intent can bolster allegations that a disparate impact was caused by the challenged practice."[209]

Here, for the reasons discussed above, and in this section, CARB's proposal to continue incentivizing the capture of dairy methane and production of factory farm gas will cause a disparate impact on Latino/a/e communities in the San Joaquin Valley based on race, national origin, and ethnic group identification.

Specifically, as discussed more fully below, the proposed amendments exacerbate and entrench disproportionate impacts on Latino/a/e people and communities due to their role in supporting the development of more methane digesters and encouraging herd expansions and consolidation. These two complementary phenomena—the expansion and concentration of dairy herds and the installation and operation of digesters—disproportionately impact people and communities living near those facilities and the San Joaquin Valley, where the vast majority of large-scale dairies, expanding dairies, and digesters are located.

a) Concentration of dairy herds and manure causes disparate impacts on Latino/a/e communities.

Large dairies are disproportionately located in Latino/a/e regions and near Latino/a/e communities.[210] The vast majority of state-funded dairy digesters and dairies with LCFS pathways are also disproportionately located in the San Joaquin Valley,[211] a disproportionately Latino/a/e/ region.[212] The LCFS and the proposed Amendments will encourage further concentration of dairy
368.6 ctd herds, dairy cows, and wet manure in the San Joaquin Valley.[213] In doing so, it will disproportionately impact Latino/a/e communities and people. Specifically, Latino/a/e communities and people will disproportionately suffer (a) increased discharge of nitrate to

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[207] 42 U.S.C. § 2000d.
[208] *Martinez v. City of Clovis*, 90 Cal. App. 5th 193, 255 (Cal. Ct. App. 2023).
[209] *Id.* at 261.
[210] See *supra* section II.B (discussion of how dairies with LCFS pathways and digester projects are located in a disproportionately Latino/a/e region).
[211] *See supra* section II.A (discussion of manure management and California's dairy herd). Approximately 86% of LCFS pathways approved for fuel derived from livestock manure in California are located in the San Joaquin Valley while over 99% of digesters funded by the state's Dairy Digester and Research Development Program are in the San Joaquin Valley. DAIRY DIGESTER RESEARCH AND DEVELOPMENT PROGRAM: PROJECT-LEVEL DATA, *supra* note 8.
[212] *See supra* section II.A; DAIRY DIGESTER RESEARCH AND DEVELOPMENT PROGRAM: PROJECT-LEVEL DATA, *supra* note 8.
[213] *See supra* section II(E) (discussion of the ways in which the LCFS's treatment of dairy digesters creates an incentive for concentrated herds and liquid manure management).

groundwater within the localized zone of contribution;[214] (b) decreased groundwater levels within the localized cone of depression;[215] (c) increased air pollution, including exposure to ammonia, ozone, and pm 2.5;[216] and (d) increasing and exacerbating impacts to odor and flies.[217] They will also experience higher rates of the associated health impacts, as stated above.[218]

b) Anerobic digesters negatively impact disproportionately Latino/a/e communities.

Increased installation and operation of digesters will also worsen local air and water pollution, by increasing nitrate pollution and ammonia emissions.[219] Additionally, flaring of excess
368.49 biogas and use of combustion engines to convert biogas into electricity will increase NOx
emissions in the San Joaquin Valley.[220] Increased nitrate pollution will contaminate drinking water sources, while increased ammonia and NOx emissions will increase exposure to ammonia along with PM2.5 and ozone pollution. Digesters are almost exclusively installed at large dairies located in disproportionately Latino/a/e regions of the state. Therefore, anaerobic digesters, and incentives to build them, disproportionately impact Latino/a/e communities and people by increasing pollution and the resulting health and quality of life impacts.

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[214] *See supra* section II.C.3 (discussion of nitrate impacts); *see also* Balazs et al., *supra* note 28; Ex. 82, Anne Weir Schechinger, *In California, Latinos More Likely to Be Drinking Nitrate-Polluted Water*, ENVTL. WORKING GROUP (Oct. 2020), https://perma.cc/WR6T-SVZP.

[215] *See supra* section II.C.4 (discussion of groundwater depletion); *see also* Louwyck et al., *supra* note 37; Ex. 83, LAURA FEINSTEIN ET AL., DROUGHT AND EQUITY IN CALIFORNIA 21 (Jan. 2019), https://perma.cc/5TNC-Q9FS ("Low-income communities and communities of color in the Central Valley rely disproportionately on private wells because adequate public services were not developed in those communities."); Ex. 84, CHIONE FLEGEL ET AL., CALIFORNIA UNINCORPORATED: MAPPING DISADVANTAGED COMMUNITIES IN THE SAN JOAQUIN VALLEY 29 (2013), https://www.policylink.org/resources-tools/california-unincorporated-mapping-disadvantaged-communities-in-the-san-joaquin-valley ("low-income households, people of color, and communities already burdened with environmental pollution suffered the most severe impacts [from drought]").

[216] *See supra* sections II.C.1–3 (discussion of ammonia emissions and exposure, fine particulate matter, and ozone); *see also* Casey et al., *supra* note 9 ("Unadjusted models showed racial/ethnic and SES disparities in the odds of living in close proximity to methane superemitters and intensity of exposure based on multiple industry categories and total methane emissions. In adjusted models, the associations with race/ethnicity persisted…. Further, subanalyses restricted to dairies/manure management facilities and oil and gas production revealed similar racial disparities as the main analysis.").

[217] *See supra* section II.C.6 (discussion of odor and flies).

[218] *See supra* section II.C. According to a study by UC Davis, Madera County already has the highest asthma-related emergency room visit rates for children in the state, with Merced County following close behind. In addition, 11.3% of children in Madera County have been diagnosed with asthma. In Merced County, a staggering 32.5% of children—***nearly one in three***—have been diagnosed with asthma. Ex. 85, U.C. DAVIS, CENTER FOR REGIONAL CHANGE, CALIFORNIA'S SAN JOAQUIN VALLEY: A REGION AND ITS CHILDREN UNDER STRESS (Jan. 2017), https://perma.cc/TB42-F9MG.

[219] *See supra* sections II.C.1 and II.C.4 (discussion of nitrate and ammonia).

[220] *See supra* sections II.C.2 and II.C.5 (discussion of PM 2.5 and ozone).

c) Gas price increases will have a disparate impact on Latino/a/e and Black people and communities.

368.7 ctd As stated above, increased gasoline prices that will result directly from the proposed Amendments[221] will be borne disproportionately by lower income people, lower income communities,[222] and communities that are disproportionately Latino/a/e and Black.[223] Additionally, lower income rural communities and other lower income areas that do not have access to reliable transit and are less able to mitigate increased gas prices.

d) Staff's failure to consider the harmful impacts of the LCFS on the San Joaquin Valley constitutes a disparate impact on Latino/a/e communities.

As discussed throughout these comments, CARB staff has consistently failed to consider or address public comments from community residents who live near dairies, including dairies
368.50 producing factory farm gas and dairies participating in LCFS fuel pathways.[224] These comments have included specific information about how dairies and digesters impact public health and quality of life. CARB staff's failure to consider or address these comments has a disparate impact itself. Additionally, it distorts the administrative record in a manner that has secondary disparate impacts, as articulated throughout these comments.

e) The proposed Amendments and the circumstances surrounding the development and release of the staff proposal indicate intentional discrimination.

Intentional discrimination under Title VI of the Federal Civil Rights Laws can be found
368.35 ctd when, based on the totality of the circumstances, direct and circumstantial evidence demonstrates that action was taken at least in part because of its adverse impact on a protected class.[225] Similarly, state civil rights law recognizes intentional discrimination. Notably regulations pending final approval indicate that there's a cognizable claim of intentional discrimination if discriminatory or purposeful intent is simply *a* motivating factor (among several motivating factors) in a decision.[226]

Courts have considered a non-exhaustive list of factors which can demonstrate intentional discrimination under Federal civil rights law even without explicit statements of that impermissible

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[221] *See supra* section II.D.
[222] Sarah Bohn & Daniel Payares-Montoya, *supra* note 43 ("The bottom quintile of families by income level spend 16% of their income on gas and fuel compared to 8% for the second-lowest income group or 2% for the highest-income group.").
[223] Nadia Lopez & Erica Yee, *supra* note 44 ("ZIP codes with the highest rates of electric car ownership tend to be more white and Asian and less Latino and Black than the general population.").
[224] *See supra* section III (discussing Procedural Background).
[225] *Village of Arlington Heights v. Metro. Hous. Dev. Corp.*, 429 U.S. 252, 266–268 (1977); *see also* Ex. 86, *Title VI Legal Manual*, U.S. DEP'T OF JUSTICE, https://perma.cc/8CKY-PSED (last visited Feb. 20, 2024).
[226] Cal. Gov. Code § 11135; *see also* Ex. 87, Cal. Code Regs. Tit. 14, § 14027 (pending final approval, available at https://perma.cc/4KB2-MRV3).

intent.[227] These factors are considered in the totality of circumstances and no single factor is necessary in order to show discriminatory intent.[228] These factors include[229,230]:

- Statistics demonstrating a clear pattern of discriminatory effect
- The historical background of the decision
- The sequence of events leading up to the decision
- Departures from normal procedures or substantive conclusions
- Foreseeability of the consequences of the state action

(1) Statistics Demonstrating a Clear Pattern of Discriminatory Effect

As discussed throughout these comments, the existing LCFS program results in disproportionate and negative harm on communities of color and people of color, particularly Latino/a/e people and communities. The proposed Amendments will intensify these impacts.

(2) The Historical Background of the Decision

As discussed throughout these comments along with the Petition for Rulemaking, the Petition for Reconsideration, and myriad other written and oral comments,[231] the growth and intensification of industrial-style dairy operations in California over the past several decades has occurred almost exclusively in the San Joaquin Valley despite known environmental and human health impacts. Local governments in the San Joaquin Valley facilitated this trend with lax environmental oversight.[232] This concentration of dairy herds and dairy cows took place – and continues to take place - near communities that are disproportionately Latino/a/e and in the San Joaquin Valley which has higher percent Latino/a/e population than the state as a whole.

CARB itself has facilitated growth and intensification of dairy operations through the Low Carbon Fuel Standard which provides preferences for large-scale dairy operations and encourages the production of manure and liquified manure management techniques and by
368.6 ctd failing to initiate rulemaking to directly regulate livestock methane. Other state agencies have similarly provided incentives for the intensification of dairy operations in the San Joaquin Valley by providing grant funds for the development of digesters and associated factory farm gas infrastructure.

(3) The Sequence of Events Leading Up to the Decision

Commenters and other stakeholders—most importantly people living near dairies—have repeatedly conveyed information to CARB about the environmental and human health harms that

[227] *Arlington Heights*, 429 U.S. at 266–268; *see also Title VI Legal Manual*, *supra* note 225.
[228] *Arlington Heights*, 429 U.S. at 266–268; *see also Title VI Legal Manual*, *supra* note 225.
[229] *Arlington Heights*, 429 U.S. at 266–268; *see also Title VI Legal Manual*, *supra* note 225.
[230] *Columbus Bd. of Educ. v. Penick*, 443 U.S. 449, 464–465 (1979).
[231] *See supra* section III.
[232] *See*, *e.g.*, Ex. 88, KINGS COUNTY DAIRY ELEMENT PROGRAM EIR 4.2-83 to 4.2-85, https://perma.cc/G6NL-G256.

368.50 ctd dairy digester subsidies and the LCFS create in the San Joaquin Valley.[233] Staff's proposed Amendments and ISOR entirely ignore this information. In fact, even the "Environmental Justice" section of the ISOR fails to acknowledge the testimony, data, and facts from residents of the San Joaquin Valley about the impacts they face as a result of dairy operations, dairy expansions, and the installation and operation of digesters.

Additionally, CARB's failure to initiate rulemaking to adopt livestock methane emission regulations in advance of adopting LCFS amendments indicates CARB's lack of consideration for the role its policies play in causing negative and disproportionate impacts on Latino/a/e communities.

In sum, the sequence of events leading up to the release of the ISOR shows a clear pattern of CARB staff's refusal to address or even consider the adverse and detrimental impacts of the proposed Amendments to the San Joaquin Valley and Latino/a/e communities. Staff chose instead to move forward with a policy that would perpetuate and exacerbate this harm.

(4) Departures from Normal Procedures or Substantive Conclusions

CARB staff's actions depart from CARB's policies on Racial Equity. On October 22, 2020, CARB adopted Resolution 20-33, alternatively entitled "A Commitment to Racial Equity and Social Justice"[234] to advance racial equity and social justice. It is CARB policy to "continue identifying and implementing best practices for community engagement, especially in communities suffering environmental injustice and racial discrimination and to apply these practices throughout all of CARB's activities." Further, CARB committed to create an "environment in which all people feel safe, valued, acknowledged and respected."[235]

368.51 In order to implement Resolution 20-33, CARB developed a "racial equity lens," which consists of questions "for CARB staff to plan develop, and review regulations, policy documents, and informational materials and for items going before the Board" in orders to "conduct meaningful racial equity analysis."[236] According to CARB's website, these questions assist CARB decision making by: "Describing the legal, policy, and organizational frameworks at CARB for staff to consider racial equity; Identifying the information staff should consider in assessing the equity impacts of actions and decision making at CARB; and characterizing and highlighting questions about racial equity that staff should ask and address in each step of the process."[237] This lens also requires CARB to consider alternatives with a focus on "which would do the most to address existing disparities and which might have unintended consequences."[238]

[233] *See supra* section III.
[234] Ex. 89, CARB, RESOLUTION 20-33, A COMMITMENT TO RACIAL EQUITY AND SOCIAL JUSTICE (Oct. 22, 2020), https://perma.cc/RP2X-3DND.
[235] *Id.*
[236] Ex. 90, CARB, UPDATE ON CARB'S RACIAL EQUITY AND DIVERSITY EFFORTS (May 19, 2022), https://perma.cc/8NTK-BB98 (PowerPoint presentation).
[237] Ex. 91, *Model of Change*, CARB https://perma.cc/7JHV-TKWK (last visited Feb. 20, 2024).
[238] *Id.*

In direct departure from this policy, staff's ISOR and proposed Amendments disregard racial equity and testimony of residents living in "communities suffering environmental injustice and racial discrimination." As stated above, despite consistent, sustained, and clear engaged from residents of communities near factory farm dairies, the ISOR makes not a single refence to that engagement. Residents can hardly feel "valued, acknowledged, and respected" when their sustained engagement is erased by staff from the rulemaking record. Staff's failure to follow its own community engagement best practices or apply its racial equity lens to its treatment of factory farm gas in the LCFS is evidence of intentional discrimination.

(5) Foreseeability of the Consequences of the State Action

The negative and disproportionate consequences of CARB staff's proposed Amendments are foreseeable. The current LCFS creates a disproportionate impact on Latino/a/e people and
368.24 ctd communities. CARB staff's proposed Amendments, if adopted and implemented, will continue and intensify the same series of incentives that will create disproportionate harm on the Latino/a/e communities for decades due to larger herd sizes, concentrated herds, the use of digesters, and increased transportation costs.

Considering the totality of the circumstances, CARB's actions and decisions leading up to and including the release of the proposed Amendments support a cognizable claim of intentional discrimination pursuant to federal and state civil rights law. At minimum, the above evidence of discriminatory intent bolsters the above allegations of disparate impact laid out in detail above.

2. *The proposed LCFS Amendments violate state and federal fair housing laws.*

The Federal Fair Housing Act prohibits discrimination against any person in the terms, conditions, or privileges of sale or rental of a dwelling, or in the provision of services or facilities in connection therewith, because of race, color, religion, sex, familial status, or national origin.[239] Similarly, the state Fair Employment and Housing Act prohibits actions that "make unavailable or deny a dwelling based on discrimination because of race . . .or national origin."[240] And further prohibits discrimination through "through public or private land use practices, decisions, and authorizations because of race...[or]national origin." [241]

As discussed above, the Amendments, if implemented, will increase groundwater pollution, groundwater depletion, ammonia emissions, odor, flies, and air pollution in communities near dairies and the San Joaquin Valley broadly. Such impacts effectively preclude the full use and
368.35 ctd enjoyment of dwellings by impacting drinking water supplies, increasing exposure to noxious and toxic emissions, and creating a nuisance. Similarly, the proposed LCFS amendments would have probable impacts on land use decisions, including livestock operation expansions and installation of digesters which in turn will increase air and water pollution along with nuisance odors and flies the San Joaquin Valley and communities near large-scale dairy livestock operations. Accordingly,

[239] 42 U.S.C. § 3604(b).
[240] Cal. Gov. Code § 12955(k).
[241] Cal. Gov. Code § 12955(l).

the proposed Amendments will, if adopted and implemented, violate both state and federal fair housing laws.

3. CARB's proposed Amendments are at odds with its duty to affirmatively further fair housing.

Public agencies, including state agencies, must administer their programs and activities relating to housing and community development in a manner that affirmatively furthers fair housing. Affirmatively furthering fair housing "means taking meaningful actions that, taken together, address significant disparities in housing needs and in access to opportunity...transforming racially and ethnically concentrated areas of poverty into areas of opportunity."[242]

Guidance from the state's Housing and Community Development Department issued guidance on agencies' duty to Affirmatively Further Fair Housing noting the expansive nature of
368.52 the mandate: "Any program or activities that impact housing and community development should address the obligation to affirmatively further fair housing. Community development should be considered broadly as any processes or issues related to community members or social and physical surroundings."[243]

HCD's guidance memo goes on to identify ways in which agencies should ensure their compliance with their duty to AFFH. Potential activities include:

- Gather and Analyze Data: To better understand affirmatively furthering fair housing, agencies should explore available data related to the topic area to identify spatial patterns and trends and evaluate the impacts of programs and activities.
- Engage the Community: Proactively reach out to individuals and organizations that represent lower income households, people in protected classes, and households with special needs to develop open and mutual communication. Solicit input and communicate on a regular and ongoing basis, not just during formal public comment periods.
- Assess Programs and Activities: Inventory programs and activities and explore opportunities to affirmatively further fair housing.

The proposed amendments will exacerbate economic and environmental obstacles to opportunity in lower income communities and people and communities of color in the San Joaquin Valley. The proposed Amendments, if adopted and implemented, would increase exposure to ammonia in communities near large dairies, increase PM2.5 and ozone in an already compromised San Joaquin Valley, increase nitrate contamination of drinking water, increase odors inside and outside homes, and deplete groundwater in already over drafted aquifers. All of these impacts negatively impact access to opportunity in lower income communities of color in violation of CARB's duty to Affirmatively Further Fair Housing. Furthermore, CARB's failure to consider the significant and disproportionate impacts, especially in light of the numerous comments the agency has received highlighting these impacts, constitutes a further violation of their duty to affirmatively

[242] Cal. Gov. Code § 8899.50.

[243] Ex. 92, CAL. DEP'T. OF HOUSING AND COMMUNITY DEV., AFFIRMATIVELY FURTHERING FAIR HOUSING (updated Apr. 2021), https://perma.cc/XQ8Y-B3J8.

further fair housing. CARB appeared to neither gather and analyze data regarding the impacts of the LCFS on lower income communities of color in the San Joaquin Valley, nor meaningfully engage community members as evidenced by a complete erasure of concerns raised throughout the LCFS rulemaking process, nor assess opportunities to affirmatively further fair housing through the LCFS.

Additionally, the proposed Amendments will have a significant impact on gas prices, a cost that will be borne disproportionately by Latino and Black people and communities and lower income people and communities, especially communities that have limited access to transit. Increasing costs for Latino and Black people and communities, lower income people, lower income communities, and communities without reliable transit has a direct and negative impact on access to opportunity. Accordingly, CARB's failure to address increased and disproportionate costs of the program for lower income households and communities, people and communities of color, and communities without adequate transit options is directly at odds with CARB's duty to affirmatively further fair housing.

4. The proposed Amendments violate CARB's AB 32 duty to prevent disproportionate impacts on lower income people.

368.27 ctd

According to Assembly Bill 32 (2006) CARB must "ensure that activities undertaken to comply with the regulations do not disproportionately impact low-income communities."[244] As stated above, the current LCFS and staff's proposed amendments operate in a manner that disproportionately impacts low-income communities with increased pollution and increased transportation costs. The proposed Amendments will, if adopted, violate AB 32's requirement to prevent disproportionate impacts on lower income communities.

V. CONCLUSION

368.53

For the foregoing reasons, and in the foregoing ways, CARB must update the proposed Amendments to comply with its legal obligations and reform the LCFS. To do otherwise would be arbitrary, capricious, and indefensible.

Respectfully submitted February 20, 2023

Jamie Katz
Phoebe Seaton
Michael Claiborne
Leadership Counsel for Justice & Accountability

Central Valley Defenders of Clean Water & Air

[244] Cal. Health & Safety Code § 38562(b)(2).

Brent Newell
Law Offices of Brent J. Newell

Tyler Lobdell
Food & Water Watch

Christine Ball-Blakely
Animal Legal Defense Fund

Attachments to this comment available for review at the LCFS Public Comment Docket here: https://www.arb.ca.gov/lispub/comm/iframe_bccommlog.php?listname=lcfs2024

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Comment 378 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Joshua
Last Name	Wilson
Email Address	Josh.Wilson@poet.com
Affiliation	POET
Subject	POET's Comments On December 2023 Proposed Low Carbon Fuel Standard Amendments
Comment	
Attachment	www.arb.ca.gov/lists/com-attach/7061-lcfs2024-BXVROAdjUHcBWABj.pdf
Original File Name	POET Comment on LCFS Proposed Amendments 2.20.24_FINAL.pdf
Date and Time Comment Was Submitted	2024-02-20 20:29:27

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

900 7th St. NW, Suite 820
Washington, D.C. 20001
Ph: (605) 965-2200
poet.com

February 20, 2024

Clerk of the Board
California Air Resources Board
P.O. Box 2815
Sacramento, CA 95812

Submitted electronically via:
https://www.arb.ca.gov/lispub/comm/iframe_bcsubform.php?listname=lcfs2024

RE: POET COMMENTS ON DECEMBER 2023 PROPOSED LOW CARBON FUEL STANDARD AMENDMENTS

Dear CARB Board Members:

POET appreciates the opportunity to provide comments on the California Air Resources Board's ("CARB") December 2023 Proposed Low Carbon Fuel Standard ("LCFS") Amendments ("Proposed Amendments").

Since the LCFS program's inception, POET's biofuels have delivered continuous carbon reductions and public health benefits to the State of California. Through technological innovation, investments in carbon capture and renewable energy, and programs to reduce on-farm emissions, POET is steadily lowering the carbon intensity ("CI") of its fuel to meet the ambition of California's program as it grows and evolves. In several respects, however, CARB's proposed Low Carbon Fuel Standard Amendments adopt assumptions and establish requirements that will raise the cost and limit the future of low carbon liquid fuel in California. Specifically, by placing new and unnecessary burdens on the production of bioethanol, the proposal threatens to reduce the volume of bioethanol used in California's transportation fuel supply or impose new costs that would be passed on to California consumers. A reduction in bioethanol blending would result in higher greenhouse gas ("GHG"), particulate matter ("PM"), and other pollutant emissions from vehicles. As set forth below, we urge CARB to reconsider its proposal, and embrace the critical role that ever cleaner low-carbon liquid fuels must play to achieve the decarbonization of California's transportation sector.

We note that CARB has postponed its previously scheduled March 21, 2024, public hearing regarding its proposed LCFS amendments, in part, to facilitate "more consideration of the proposed sustainability guardrails."[1] We urge CARB to consider our comments as the agency reevaluates the current proposal regarding sustainability verifications for crop-based feedstocks.

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[1] *See* California Air Resources Board, *Low Carbon Fuel Standard, Low Carbon Fuel Standard Public Hearing Postponed*, https://ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard (last visited Feb. 16, 2024).

I. Overview

POET's vision is to create a world in sync with nature. As the world's largest producer of biofuel and a global leader in sustainable bioproducts, POET creates plant-based alternatives to fossil fuels that unleash the regenerative power of agriculture and cultivate opportunities for America's farm families. Founded in 1987 and headquartered in Sioux Falls, POET operates 34 bioprocessing facilities across eight states and employs more than 2,200 team members. With a suite of bioproducts that includes POET Distillers Grains, POET Distillers Corn Oil, POET Purified Alcohol, and POET Biogenic CO_2, POET nurtures an unceasing commitment to innovation and advances powerful, practical solutions to some of the world's most pressing challenges. Today, POET holds more than 80 patents worldwide and continues to break new ground in biotechnology, yielding ever-cleaner and more efficient renewable energy. POET is also a leading champion for nationwide access to E15, a renewable fuel blend made with 15% bioethanol.

POET supports CARB's dedication to decarbonizing the transportation sector and is committed to delivering low-carbon biofuels that will help California achieve its climate goals. The Proposed Amendments, however, fail to accurately recognize health and emissions benefits associated with bioethanol. In the comments below, POET argues that the proposed sustainability requirements should not apply to corn feedstocks. In the event CARB applies the sustainability requirements to corn, the LCFS should recognize emissions reductions associated with agricultural feedstock production and should not apply a land use change penalty to corn ethanol. POET also urges CARB to expedite its approval of E15 fuel in California and to reconsider several factual misconceptions regarding the costs, emissions reductions, and public health benefits associated with E15 adoption.

II. <u>The California LCFS Must Recognize Bioethanol Climate and Health Benefits.</u>

Bioethanol offers significant air quality and GHG emissions reduction benefits compared to petroleum-based gasoline. To achieve California's emissions reduction and air quality goals, CARB must ensure that bioethanol continues to play a central role in the LCFS program. The 2022 Scoping Plan acknowledges that liquid petroleum fuel will remain in California's transportation fuel mix for decades because legacy internal combustion vehicles will remain on the road for years.[2] CARB should incentivize the reduction of gasoline's CI in this legacy fleet, and we urge CARB to look to bioethanol to achieve these reductions.

Multiple studies show that blending bioethanol into the transportation fuel supply results in significantly lower lifecycle GHG emissions compared to petroleum-based gasoline. Specifically, studies show that emissions reductions attributable to bioethanol range from 41 to 46 percent compared to emissions associated with petroleum-based gasoline. According to the Department of Energy's Argonne National Laboratory ("ANL"), typical corn ethanol provides a 44 percent GHG reduction compared to gasoline.[3] Similarly, researchers affiliated with Harvard University, MIT, and Tufts University conducted a meta-analysis showing that corn ethanol as of 2021 offers an

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[2] California Air Resources Board, *2022 Scoping Plan for Achieving Carbon Neutrality*, at 190 https://ww2.arb.ca.gov/sites/default/files/2022-12/2022-sp_1.pdf (Nov. 16, 2022).
[3] Lee, Uisung et al., *Retrospective Analysis of the U.S. Corn Ethanol Industry for 2005–2019: Implications for GHG Emission Reductions*, Biofpr Vol. 15 Issue 5, at 1328 (May 4, 2021) https://doi.org/10.1002/bbb.2225.

average GHG reduction of 46 percent compared to gasoline ("Scully study").[4] For comparison, the average CI of pure gasoline is approximately 96 gCO2e/MJ.[5]

According to the USDA, from 2011 to 2019, the average CI of ethanol fuel has decreased by approximately 25 percent.[6] This decrease can be attributed to (a) market-driven changes in corn production that lowered the intensity of fertilizer and fossil fuel use on farms; (b) more efficient use of natural gas and electricity at ethanol production facilities; and (c) improvements in land use change analyses based on hybrid economic-biophysical models that account for land conversion, land productivity, and land intensification.[7] In other words, older assessments using inexact data overestimated bioethanol's CI, and bioethanol has improved in environmental performance over time. As a result, more recent studies demonsrate that bioethanol provides much more significant emissions reductions that previously understood.[8]

Under CARB's own CA-GREET model, bioethanol provides significant GHG benefits. CA-GREET has found that bioethanol used in the state in 2022 reduced emissions by 40 percent, on average, compared to gasoline.[9] From 2011 to 2020, CARB data show that the use of bioethanol cut GHG emissions from the California transportation sector by 27 million MT CO_2e, more than any other fuel used to meet the state's LCFS requirements.[10]

POET plants selling bioethanol into California provide significant emissions reduction benefits compared to gasoline. Multiple POET facilities have current certified CIs in the mid-60s,[11] and POET supplies corn kernel fiber ethanol to California with certified CIs in the 20s.[12]

In addition to GHG benefits, a recent analysis from leading national experts found air quality and public health benefits associated with higher biofuel blends in gasoline, including reductions in

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[4] Scully, Melissa et al., *Carbon Intensity of Corn Ethanol in the United States: State of the Science*, ENVIRONMENTAL RESEARCH LETTERS, at 16 (March 10, 2021) https://iopscience.iop.org/article/10.1088/1748-9326/abde08; *see* Appendix B, Environmental Health & Engineering, *Comments on 2024 Proposed Low Carbon Fuel Standard Amendments*, at 10 (Feb. 20, 2024) [hereinafter "Appendix B"].
[5] *Id*.
[6] U.S. Dep't of Agriculture, *The California Low Carbon Fuel Standard: Incentivizing GHG Mitigation in the Ethanol Industry*, at 1 (Nov. 2020) https://www.usda.gov/sites/default/files/documents/CA_LCFS_Incentivizing_Ethanol_Industry_GHG_Mitigation.pdf.
[7] *Supra* note 5, at 2.
[8] A 2022 study by Lark, et al., estimates a higher LUC value for corn starch bioethanol. This higher estimate is an outlier, and rebuttals were published by Environmental Health & Engineering, https://www.pnas.org/doi/10.1073/pnas.2213961119, and the U.S. Department of Energy, https://greet.es.anl.gov/publication-comment_environ_outcomes_us_rfs. *See* Lark, Tyler et al., *Environmental Outcomes of the US Renewable Fuel Standard*, PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES (PNAS) (2022), https://doi.org/10.1073/pnas.2101084119.
[9] California Air Resources Board, *LCFS Data Dashboard*, Figure 5a (last visited Feb. 17, 2024) https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard.
[10] California Air Resources Board, *Low Carbon Fuel Standard Reporting Tool Quarterly Summaries, Quarterly Data Summary and Spreadsheet* (last visited Feb. 17, 2024) https://ww2.arb.ca.gov/resources/documents/low-carbon-fuel-standard-reporting-tool-quarterly-summaries.
[11] California Air Resources Board, *Current Pathways*, *e.g*. Jewel, Hanlontown. Ashton, Mitchel (last updated Feb. 9, 2024) https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/current-pathways_all.xlsx.
[12] *Id., e.g*. Ashton, Mitchell, Gowrie, Leipsic, Preston, Alexandria, Fostoria.

particulate matter ("PM"), carbon monoxide ("CO"), and total hydrocarbons ("THC").[13] This study was the first large-scale analysis of data from light-duty vehicle emissions that examines real-world impacts of bioethanol-blended fuels on regulated air pollutant emissions. The study found that CO and THC emissions were significantly lower for higher bioethanol fuels for port fuel injected engines under cold-start conditions. The study found no statistically significant relationship between higher bioethanol blends and nitrogen oxides ("NOx") emissions. With regard to PM, studies show that emissions decrease by 15 – 18% on average for each 10% increase in ethanol content under cold-start conditions.[14] A 2022 University of California Riverside ("UC") study funded in part by CARB assessing the impact of E15 on air pollutant emissions for model year vehicles 2016 to 2021 was consistent with these results, finding that replacing E10 with E15 reduced PM emissions by 18%, with cold-start emissions being reduced by 17%.[15] Analyses by professors at Tufts University show that the associated health benefits may be most significant in disadvantaged communities in areas of high traffic density and congestion.[16] CARB recently published a Multimedia Evaluation of E11- E15 Tier 1 Report with conclusions consistent with these studies.[17]

Bioethanol's current CI is a ceiling — not a floor. As the Scully study notes, "[m]arket conditions that favor greater adoption of precision agriculture systems, retention of soil organic carbon, and demand for co-products from ethanol production may lower the CI of corn ethanol further."[18] And under the federal Inflation Reduction Act, biofuel producers like POET are incentivized to make investments in carbon-reducing technologies, including carbon dioxide capture and utilization strategies, and investments in low-carbon process energy that have the potential to drastically lower the CI of every gallon of ethanol we produce. As the ANL chart below shows, through investment and innovation, bioethanol has the ability to become a zero-carbon fuel.[19]

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[13] *See* Kazemiparkouhi, Fatemeh et al., *Comprehensive US Database and Model for Ethanol Blend Effects on Regulated Tailpipe Emissions*, SCIENCE OF THE TOTAL ENVIRONMENT, at 15 (March 2022), https://www.sciencedirect.com/science/article/pii/S0048969721065049?via%3Dihub; *see* Appendix B at 4-5.

[14] *Comprehensive US Database and Model for Ethanol Blend Effects on Regulated Tailpipe Emissions* at 5, 11, 13; *see* Appendix B at 4-5.

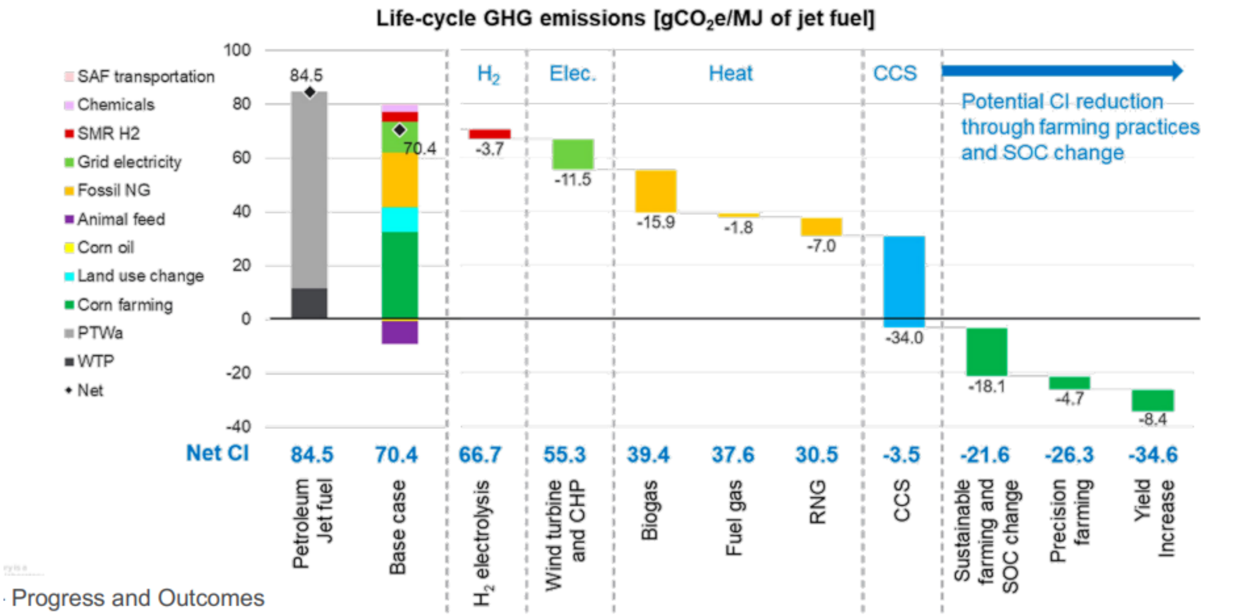
[15] Karavalakis, Georgios et al., *2022 Comparison of Exhaust Emissions Between E10 CaRFG and Splash Blended E15. Final Report*, prepared for Riverside, California Air Resources Board, Growth Energy Inc./Renewable Fuels Association, and USCAR., at 22-23, 36 (June 2022), https://ww2.arb.ca.gov/sites/default/files/2022-07/E15_Final_Report_7-14-22_0.pdf; *see* Appendix B at -5.

[16] *See* Appendix C, Tufts University Department of Civil and Environmental Engineering, *Air Quality and Public Health Comments to RFS* (Feb. 3, 2022); *see* Appendix B at 8-9.

[17] *See* Renewable Fuels Association and Growth Energy, *Multimedia Evaluation of E11-E15 Tier 1 Report* (June 4, 2020), https://ww2.arb.ca.gov/sites/default/files/2022-07/E15_Tier_I_Report_June_2020.pdf.

[18] *Supra* note 5, at 2.

[19] Argonne National Laboratory, *DOE Bioenerty Technology Office (BETO) 2023 Project Peer Review, Life Cycle Analysis of Biofuels and Bioproducts and GREET Development*, at 18 (April 4, 2023), https://www.energy.gov/sites/default/files/2023-05/beto-16-project-peer-review-dma-apr-2023-wang.pdf.



CARB recognized bioethanol's role in the LCFS program's success in the Initial Statement of Reasons for these proposed amendments and during the December 7, 2021, Public Workshop on Potential Future Changes to the LCFS program.[20] As CARB noted, bioethanol has effectively displaced fossil fuels to reduce GHG emissions. In 2020, bioethanol was the largest source of LCFS compliance by volume and the second-largest source by number of credits. Because of the GHG and air quality emissions reductions associated with bioethanol, incentives to increase bioethanol blending into California fuel advance California's decarbonization and air quality goals. As bioethanol producers continue to reduce lifecycle emissions, bioethanol will continue to drive the emissions reductions California needs to decarbonize and improve air quality.

III. <u>CARB Should Expedite E15 Adoption Rather Than Restrict Ethanol Imports into California as Proposed.</u>

In its rulemaking materials, CARB assumes that "E10 will continue to be used in California through 2046."[21] This assumption inconsistent with the near universal adoption of E15 throughout the United States. California the only state in the Union yet to approve E15 as part of its transportation fuel supply, and its reluctance to do so is in tension with the State's climate goals. Even under the most aggressive targets for electric vehicle adoption, there will be millions of
369.1 internal combustion engines on the road for decades to come. Authorizing the use of E15, which is EPA-approved for 96% of light duty vehicles, will help decarbonize these legacy vehicles and, according to California's own studies, deliver improved public health outcomes in areas most affected by tailpipe emissions.

[20] *See* California Air Resources Board, *Staff Report: Initial Statement of Reasons* [hereinafter "ISOR"], at 18 (Dec. 19, 2023), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf; California Air Resources Board, *Low Carbon Fuel Standard Public Workshop: Potential Future Changes to the LCFS Program*, at 6 (Dec. 7 2021), https://ww2.arb.ca.gov/sites/default/files/2021-12/LCFS%2012_7%20Workshop%20Presentation.pdf.
[21] *See* California Air Resources Board, *Proposed Low Carbon Fuel Standard Amendments, ISOR*, Appendix C-3, at 1 (Dec. 19, 2023), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/appc-3.pdf.

369.1 cont

A. E15 offers significant climate and public health benefits.

The skepticism CARB expresses towards E15 adoption in the ISOR appears to arise from a series of factual misconceptions. First, CARB notes that E15 adoption requires a Multimedia Evaluation ("MME") and approval by the Environmental Policy Council ("EPC"), and states that the process "takes years to complete."[22] But the E15 MME process in California has been underway for over four years, with revisions to a Tier III Report now under review by the Multimedia Working Group ("MMWG"). UCR's research conducted in connection with the MME process demonstrates public health benefits in association with the adoption of E15, concluding that E15 reduces CO, $PM_{2.5}$, VOCs, and GHGs with no increase in NO_x.[23] As discussed above, another study conducted by Environmental Health & Engineering, Inc., a multi-disciplinary team of environmental health scientists and engineers affiliated with Harvard and Tufts Universities, found that corn-based bioethanol has a 46% lower lifecycle CI on average than gasoline.[24] This finding confirms recent studies conducted by the Department of Energy and Department of Agriculture showing that bioethanol reduces lifecycle emissions by 43-52%.[25] A study by Air Improvement Resource, Inc. also showed that shifting from E10 to E15 in California would cut 1.8 million metric tons of GHG emissions annually, equivalent to removing more than 411,000 cars off the road.[26] In short, there is no basis for the MMWG or the EPC to conclude that "allowing E15 use in California would have significant adverse impacts on public health or the environment."[27] To the contrary, MMWG, EPC and CARB have every reason to conclude that E15 adoption will promote Calfornia's climate goals and alleviate air pollution. Indeed, E15 is likely to assist California in complying with EPA's recently stregthened National Ambient Air Quality Standards for Particlulate Matter.[28]

B. Assumed barriers to E15 adoption identified in the ISOR are easily surmountable.

CARB expresses concern that "even if E15 is approved in California, there are still several market barriers that would limit its adoption and availability in the state including vehicle compatibility, fuel infrastructure readiness, and consumer acceptance."[29] Each of these assumed barriers is either overstated or proceeds from factual misconceptions.

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[22] *Id.*
[23] *Supra* note 14, at 54.
[24] *Supra* note 5, at 16; *see* Appendix B at 10.
[25] *Supra* note 4, at 1328; ICF, *A Life-Cycle Analysis of the GHG Emissions of Corn-Based Ethanol* (prepared for U.S. Department of Agriculture), at 99 (Sept. 5, 2018) https://www.usda.gov/sites/default/files/documents/LCA_of_Corn_Ethanol_2018_Report.pdf.
[26] Air Improvement Resource, Inc., *GHG Benefits of 15% Ethanol (E15) Use in the United States*, at 4 (Nov. 30, 2020) http://www.airimprovement.com/reports/national-e15-analysis-final.pdf.
[27] ISOR, Appendix C-3 at 1.
[28] *See* EPA, *Reconsideration of the National Ambient Air Quality Standards for Particulate Matter* (Feb. 5, 2024) (to be codified at 40 CFR Parts 50, 53, and 58), https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-final-frn-pre-publication.pdf; EPA, *EPA Finalizes Stronger Standards ror Harmful Soot Pollution, Significantly Increasing Health And Clean Air Protections for Families, Workers, and Communities* (Feb 7, 2024), https://www.epa.gov/newsreleases/epa-finalizes-stronger-standards-harmful-soot-pollution-significantly-increasing (According to EPA, of the 52 counties projected to be out of attainment with the new standards, 23 are in California.).
[29] *See* ISOR, Appendix C-3 at 1.

369.1 cont First, CARB presents as an obstacle to E15 adoption the fact that EPA has approved E15 for "only vehicles model year 2001 and newer."[30] But that vehicle cohort constitutes the overwhelming majority of cars and trucks on the road in Califoirnia. CARB next notes that "some automakers have warned that using E15 may void vehicle warranties or cause damage to engines and fuel systems."[31] But almost every automaker warranties for E15 in their new vehicles now, and Honda, Toyota, Volkswagen, GM, Ford, Hyundai, and Tata have done so since at least 2014.[32] CARB also states that "the existing fuel infrastructure in California is not universally compatible with E15, as some tanks, pipes, pumps, and dispensers may need to be upgraded or replaced to handle higher ethanol blends." But most retail fueling infrastructure is ready for E15 today. According to numerous reports by the National Renewable Energy Laboratory, U.S. Department of Energy, EPA, Steel Tank Institute, and Fiberglass Tank and Pipe Institute,[33] most underground storage tanks made in the last 30 years are approved up to 100% bioethanol, and most fuel dispensing equipment is already manufacturer-approved for E15. In fact, since the 1980s, petroleum equipment manufacturers have offered compatible products for blends above 10% bioethanol, including storage tanks, piping, valves, hanging hardware, dispensers, hoses, and nozzles, as standard equipment.[34] Furthermore, any concerns regarding midstream infrastructure are also misplaced: 5% less gasoline flowing through California's existing pipelines, storage tanks, and terminals can be reallocated to accommodate 5% more ethanol in order blend E15. And contrary to CARB's stated concerns, there is evidence throughout the United States that consumers will choose E15 where it is offered. Among retailers that offer E15, the fuel has developed a strong sales record, generating 30 to 56% of total fuel sales in many locations.[35]

In short, there is no reason for CARB to delay the E15 approval process in California, which will result in climate and public health benefits consistent with the agency's policy goals.

IV. CARB's Proposed Sustainability Requirements Should Not Apply to Corn as a Biofuel Feedstock.

369.2

CARB's Proposed Amendments would impose "sustainability requirements" on crop-based and forest-based feedstocks. Although it does not delineate any prescribed standards, the proposal

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[30] *Id.*
[31] *Id.* at 2.
[32] *See* Renewable Fuels Association, *E15 Warranty Data Compiled*, https://d35t1syewk4d42.cloudfront.net/file/2648/MY2024%20E15%20Chart_RFA%20vEngines.pdf.
[33] *See e.g.*,U.S. Department of Energy, *Handbook for Handling, Storing and Dispensing E85 and Other Ethanol-Gasoline Blends*, at 11 (Feb, 2016), https://afdc.energy.gov/files/u/publication/ethanol_handbook.pdf; *see* EPA, *Report on UST System Compatibility with Biofuels*, at 5 (July 2020), https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.epa.gov%2Fsites%2Fdefault%2Ffiles%2F2020-07%2Fust_compatibility_booklet_formatted_final_7-13-2020.docx%23%3A~%3Atext%3DMost%2520currently%2520installed%2520UST%2520systems%2Chigher%2520blends%2520are%2520now%2520available.&wdOrigin=BROWSELINK; Steel Tank Institute, *Steel Tanks: Compatible with All Biofuel Blends*, (last visited Feb. 17, 2024), https://stispfa.org/resource/steel-tanks-compatible-with-all-biofuel-blends/.
[34] *See* PEI, *Petroleum Equipment Institute Compliance Letters by Manufacturer*, (last visited Feb. 17, 2024), https://stispfa.org/resource/steel-tanks-compatible-with-all-biofuel-blends/.
[35] Growth Energy, *The E15 Advantage: The Secrets to Success*, at 1 (Feb. 2021), https://e15advantage.com/wp-content/uploads/2021/02/GE-E15-Advantage-White-Paper.pdf.

mandates that crop-based and forestry-based feedstocks "[m]aintain continuous third-party sustainability certification under an Executive Officer approved certification system."[36]

369.2 cont

Under the proposal, if feedstock crops are not certified as required, the resulting biofuels are subject to harsh penalties: a noncompliant bioethanol fuel would receive a CI value equivalent to ultra-low sulfur diesel of 105.76 g/MJ.[37] Uncertified ethanol would lose its status as a significant credit generator under the current program and be treated instead as a deficit generator under the new regime. Indeed, uncertified ethanol would be regarded as having a higher CI than gasoline, which would mean that obligated parties would have to purchase credits to cover the deficit generated by ethanol blended into fuels. This would create a significant disincentive to the continued blending of ethanol into California fuel. The result would be either less blending and higher GHG emissions and air pollution, or higher prices that would ultimately be passed on to California consumers.

As explained further below, CARB's proposal would cause adverse environmental consequences if the sustainability requirements as proposed are applied to corn. We urge CARB to reevaluate this proposal and exclude corn from any "sustainability requirements" to be imposed on crop-based feedstocks.

A. CARB's "sustainability requirements" as applied to corn threaten to increase GHG, toxic, and criteria pollutants in California.

CARB's proposed "sustainability requirements" would impose significant costs on the ethanol supply chain. These costs would disincentivize ethanol use in the fuel supply or be passed along to consumers. Decreased ethanol use would increase GHG, PM, and other emissions associated with transportation in California.

1. The cost of the sustainability certifications would impose significant costs on biofuels producers, which would be passed through the supply chain.

Although CARB has not yet specified the sustainability programs which may qualify for certification under the LCFS, aspects of the proposed regulations point strongly to certain existing certification systems as likely candidates for CARB approval. Of particular note, the proposed regulation requires that a certification system be recognized by an international, national, or state/provincial government for at least 24 months, among other requirements.[38] POET is concerned that the only certification systems that will be able to satisfy these requirements are those designed to meet the EU RED II standards, such as ISCC. To the extent that assumption is mistaken, POET seeks clarification regarding the types of sustainability schemes that CARB believes may satisfy the proposed regulations.

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[36] California Air Resources Board, *Appendix A-1 Proposed Regulation Order: Proposed Amendments to the Low Carbon Fuel Standard Regulation* [hereinafter "Proposed Reg."], at Section 95488.9(g)(1) (Dec. 19, 2023), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/lcfs_appa1.pdf.
[37] *Id.* at § 95488.9(g)(1)(A). It is notable that all crop-based fuels are assigned the diesel default CI if they do not obtain sustainability certification, rather than the diesel CI for diesel substitutes and the gasoline CI for gasoline substitutes.
[38] *Id.* at § 95488.9(g)(1)(B)(1).

Because of the likely significance of RED II and ISCC certifications in the proposed CARB framework, we summarize some of the relevant aspects of each in Appendix A. In that Appendix, we explain that ISCC Plus is the ISCC certification framework that would most likely apply to the American biofuel supply chain because ISCC Plus is designed for non-EU markets.

369.2 cont

POET certifies some of its biofuels for export under both ISCC Plus and the closely related ISCC EU standard. Compliance with these standards comes with significant costs in the form of premiums paid to farmers to shoulder the burden of regulatory scrutiny. California currently utilizes approximately 1.4 billion gallons of ethanol per year,[39] which translates to approximately 500 million bushels of corn.[40] A premium cost of even a few cents per bushel would add up to millions per year in certification-related costs for just the corn that is shipped to the California market, not to mention the broader pool of corn that would have to comply in order to maintain the option of derivative ethanol being shipped to California without a penalty. Costs of this magnitude could translate to an increase of several cents per gallon in gasoline prices when passed down to the consumer.

2. Significant logistical hurdles present substantial challenges to certification of the corn supply used to make ethanol shipped to California by 2028.

Forty percent of the corn grown in the United States is used for ethanol production.[41] California is by far the largest ethanol market in the country. As a result, CARB's proposed certification scheme will require huge swaths of American farmland to come into compliance with the certification requirements in just a few years.

As described in greater detail in Appendix A, the logistical challenge is magnified because the frameworks like ISCC require the entire corn ethanol supply chain to obtain certification in order to comply with ISCC Plus. The supply chain to California involves thousands of parties, including farmers, corn aggregators, biofuel processors, traders and marketers. It is likely that such certification will be the largest task that the ISCC system has ever undertaken. It is not clear that there are even a sufficient number of certification bodies (the entities that do the work to obtain ISCC certification) to certify the entire corn supply chain in America, let alone the supply chains for the other crop-based fuels to which CARB's proposed sustainability requirements would apply. Thus, there is significant risk that not all ethanol that could potentially ship to California will be made from certified crops in 2028. This means that a substantial volume of ethanol may be penalized and treated as a deficit-generating fuel whether or not the feedstock used to produce the fuel could actually satisfy sustainability criteria.

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[39] Renewable Fuels Association, *California* (May 2023), https://d35t1syewk4d42.cloudfront.net/file/2619/2023%20Infographic_CA.pdf.

[40] Irwin, Scott, *2019 Ethanol Production Profits: Just How Bad Was It?*, Department of Agricultural and Consumer Economics University of Illinois (Jan. 29, 2020) (finding that there are approximately 2.8 gallons of ethanol per bushel of corn), https://farmdocdaily.illinois.edu/2020/01/2019-ethanol-production-profits-just-how-bad-was-it.html.

[41] USDA, *Global Demand for Fuel Ethanol Through 2030*, at 6 (Feb. 2023), https://www.ers.usda.gov/webdocs/outlooks/105762/bio-05.pdf?v=5239.1.

3. The increased costs associated with corn ethanol would lead to either decreased ethanol blending or higher prices for consumers.

As described above, ethanol derived from uncertified feedstocks would face a significant CI penalty, creating a CI surcharge associated with continued blending of ethanol into the California fuel supply. On the other hand, ethanol that meets certification requirements would face significant costs associated with enrolling farmers in certification programs. Either way, the certification requirements will significantly increase the price of ethanol compared to current levels.

Fuel blenders will be faced with limited options: use less ethanol in fuel, pass the additional costs on to consumers, or both.

369.2 cont

4. Less ethanol blending would result in increased PM and other emissions from cars.

As discussed above and in the attached report by EH&E, lower levels of ethanol blending would like result in increased levels of PM and other pollutants. This has been confirmed by UCR in a study funded by CARB. As a result, the proposal threatens to increase the emission of both criteria and toxic air pollutants in California.

5. A rule that increases PM and other emissions would be inconsistent with AB 32.

AB 32,[42] the authorizing legislation for the Low Carbon Fuel Standard Program, directs CARB to adopt market-based measures to achieve the GHG reduction goals of the law.[43] However, AB 32 also placed important limits on such measures. Specifically, the legislature was acutely concerned with the impacts of GHG reduction measures on the levels of other significant pollutants. As such, it provided that market-based GHG reduction measures must be designed "to prevent any increase in the emissions of toxic air contaminants or criteria air pollutants."[44]

As discussed above, ethanol reduces a number of pollutants, including PM. However, CARB's proposal may result in CI penalties for a significant volume of importedethanol, disincentivizing ethanol use in California fuels. Pursuant to the attached EH&E analysis, a reduction in ethanol blending would raise criteria and toxic pollutant emissions in California in a manner inconsistent with AB 32. CARB should avoid adopting a rule that would increase both GHG emissions and other pollutants in California.

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[42] California Global Warming Solutions Act, Cal. Health & Safety Code § 38500-38599.
[43] Cal. Health & Safety Code § 38570.
[44] *Id.* § 38570(b)(2).

369.3 **B. <u>CARB Should Focus Any Sustainability Requirements on the Feedstocks That Present the Most Concern.</u>**

1. Starch feedstocks do not present the same land use change concerns as oils.

As discussed in greater detail by EH&E in Appendix B, starch-based biofuels generally present significantly lower land-use change concerns than oil-based fuels.[45] Prior assessments have determined that oil feedstocks may have land use change impacts several times that of starch feedstocks, with some types of oils have order of magnitude greater impacts than corn starch.[46] This makes sense given the relatively direct connection between palm oil and land use change versus the more tenuous and indirect assertions regarding the impact of corn as a feedstock.

2. CARB's prior workshops and presentations focus on non-starch feedstocks.

Consistent with the heightened concerns presented by non-starch feedstocks in the EH&E paper, recent CARB workshops and presentations do not focus on corn starch as the feedstock of most concern with respect to sustainability. For example, the Stanford presentation at the May 31, 2023, CARB workshop only focused on concerns with crop oils and presented a crop oil cap as the proposed policy mechanism.[47] The workshop materials did not discuss or address concerns with corn starch feedstocks.

Similarly, in a January 11, 2024, presentation at the OPIS Conference, CARB presented on concerns with crop-based biofuels. The presentation, however, only highlighted data indicating the sharp increase in oil feedstocks utilized for biofuel production.[48] The slides do not present any data related to starch.

In fact, the administrative record does not appear to highlight information that supports the contention the corn starch is a feedstock that presents such significant concern that new sustainability certification requirements are warranted, especially when ILUC is already accounted for under the existing LCFS framework.

3. Other jurisdictions such as the EU recognize that sustainability concerns associated with non-starch feedstocks are significantly higher than concerns with ethanol.

To the extent CARB is more focused on land-use change concerns associated with oils, it is not alone. As discussed in greater detail in Appendix A, the EU, for example, has found much more significant land use change concerns associated with oils than starch. While the EU does not assign ILUC penalties to CI scores because of the inherent uncertainty associated with ILUC, it estimates that corn-based feedstocks have an ILUC impact of 12 g/MJ, while it assigns an estimate of 55 g/MJ (almost five times higher) to oil feedstocks. Even with the land-use change figure estimated

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[45] *See* Appendix B at 10-12.
[46] Appendix B at 11.
[47] California Air Resources Board, *Low Carbon Fuel Standard Virtual Community Meetings, Stanford Presentation*, at 6 (May 31, 2023), https://ww2.arb.ca.gov/sites/default/files/2023-05/Stanford%20Presentation.pdf.
[48] *See* Appendix D.

by Europe or California, ethanol still presents a significant GHG benefit compared to petroleum fuels, while the 55 g/MJ figure significantly erodes the benefits of oil-based fuels.[49]

369.3 cont

C. Any ILUC risks associated with ethanol are already accounted for in CA-GREET.

Whatever ILUC concerns CARB may have with respect to starch, the issue is already addressed by the ILUC penalty of 19.8 g/MJ incorporated in California's GREET model. This contrasts directly with the European and Canadian systems where no ILUC penalty is assessed. In Europe and Canada, feedstock sustainability requirements serve the purpose of addressing land use change concerns in the absence of an ILUC penalty.[50] In California, where the CI framework already addresses ILUC, there is no need for a second set of requirements designed to address the same issue.

D. Penalizing uncertified corn ethanol would impair the LCFS's ability to achieve its GHG reduction goals.

As discussed above, all ethanol derived from uncertified feedstocks would receive a penalty and be assigned a CI of 105.76 g/MJ no matter how advanced and energy efficient the ethanol plant, and no matter how low the fuel's actual CI as calculated through CA-GREET.

Assigning a high default CI value to ethanol regardless of the CI of its production process cuts against the purpose of the LCFS program, which is to incentivize lower carbon behaviors. Treating all uncertified ethanol identically (and worse than gasoline) would remove the incentive to innovate and pursue carbon reducing manufacturing practices. Uncertified plants would have no incentives from the LCFS to engage in behaviors that would lower emissions.

Further, the contemplated CI penalties could chase low-CI ethanol out of the California market. The modeling performed by CARB around the feasibility of the LCFS program for decades to come assumes that relatively low CI corn ethanol will continue to be available in California in the form of E10. If some volume of the ethanol flowing into California is uncertified, those assumptions may fail because E10 will become a higher CI fuel that generates increased carbon emissions under the LCFS system. Further, any decrease in ethanol blending would tighten the availability of carbon credits and impact CARB's projections of the marketplace.

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[49] Note that corn oil derived as a co-product of ethanol production would not be assessed a similar penalty. Much of the CI burden is attributed to the ethanol rather than such corn oil.

[50] Notably, the model used to determine the CI of fuel under Canada's Clean Fuel Regulations ("CFR") does not assess an ILUC penalty, and the sustainability requirements applied to American bioethanol under the CFR is satisfied by "legislative recognition" that acknowledges safeguards imposed by the United States' federal environmental laws. Clean Fuel Regulations, SOR/2022-140 §§ 53(1), 55(1); *see* Canada's Fuel Lifecycle Assessment Model available at https://www.canada.ca/en/environment-climate-change/services/managing-pollution/fuel-life-cycle-assessment-model.html.

369.4 **V.** **<u>CARB Has Not Clearly Articulated a Standard for Sustainability, and Delegates Standard Setting to Third Parties.</u>**

CARB's proposed sustainability requirements do not articulate a substantive standard, and do not define the concept of "sustainability." Instead, the proposed regulation describes in broad strokes the type of certification system that can be used to demonstrate "sustainability" and then requires adherence to rules generated and applied by third-party auditors. This approach is problematic.

As discussed above, the proposed regulation seems to suggest that the ISCC certification system could be used to meet CARB's proposed sustainability requirements. But that certification framework is designed to meet the substantive standards for sustainability established by RED II in the EU.[51] If CARB were to approve the ISCC certification program, they would, in effect, be adopting the EU's substantive sustainability criteria into California law, without the opportunity to modify those requirements and without opportunity for notice and comment by the public.

There are legal obstacles here. California law prohibits the delegation of certain governmental functions to non-governmental third parties.[52] The nondelegation doctrine "requires the legislature or a regulatory agency to exercise the final say over whether any particular regulation becomes law."[53] Delegation is especially discouraged when it involves control over fundamental policy decisions and when inadequate safeguards are present that would allow the California government to control the delegation of authority and prevent its misuse.[54]

By leaving the determination of sustainability standards to the ISCC, CARB would be delegating a fundamental policy decision to third parties. The EU went to great lengths to engage with the public and negotiate among its members to establish legislation defining sustainability in a manner that is palatable to that government and those member states. CARB would be abdicating its role in that important process, and assigning the task to third parties, perhaps to even the EU if it approves EU-based certification systems.

Although CARB does retain the ability to approve or disprove certification systems, since CARB does not define "sustainability," it does not retain the ability to control the most central element of the certification schemes. In other words, the ISCC or other sustainability certification programs must necessarily rely on a definition of "sustainability" established by an authority other than CARB. As a result, CARB cannot control the ultimate policy outcomes that could result from such a definition.

Finally, under the proposed framework the public will have no notice or opportunity to comment on the substantive sustainability principles that CARB will adopt by approving a certification scheme. If it chooses to approve a system like ISCC, CARB will be adopting an entire legislative and regulatory system developed and approved entirely by foreign entities, without opportunity

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[51] *See* Appendix A.
[52] *Monsanto Co. v. Office of Environmental Health Hazard Assessment*, 22 Cal. App. 5th 534, 556 (5th Dist. 2018) (citing *International Assn. of Plumbing etc. Officials*, 55 Cal.App.4th 251, 254 (3rd Dist. 1997) (holding that legislation violated the nondelegation doctrine when it delegated regulatory determinations to individuals)).
[53] *Light v. State Water Resources Control Bd*., 226 Cal. App. 4th 1463, 1491 (5th Dist. 2014).
[54] *See Golightly v. Molina*, 229 Cal. App. 4th 1501, 6 (2nd Dist. 2014); M*onsanto Co. v. Office of Environmental Health Hazard Assessment*, 22 Cal. App. 5th 534, 555 (5th Dist. 2018).

for engagement by California stakeholders. This procedure presents significant problems under the California Administrative Procedure Act and other laws.

369.5

VI. CARB's Environmental Analysis Does not Adequately Assess the GHG and Air Pollutant Impacts of its Sustainability Proposal.

CEQA requires that an agency's environmental analysis contain "[a] discussion and consideration of environmental impacts, adverse or beneficial, and feasible mitigation measures which could minimize significant adverse impacts identified," as well as "[a] discussion of cumulative and growth-inducing impacts."[55] CEQA requires CARB to discuss "inconsistencies between the proposed project and applicable general plans, specific plans and regional plans," which includes the State Implementation Plan ("SIPs") and plans for the reduction of GHG emissions.[56]

As discussed above, either penalizing uncertified ethanol or imposing significant certification costs on the ethanol supply chain would create incentives to reduce ethanol blending in California through a straightforward causal connection: increasing the cost of a fuel component threatens to decrease use of that component.

Despite this implication of the Proposed Amendments, the Draft Environmental Impact Analysis[57] fails to analyze the possibility of and impacts resulting from lower ethanol blends in California. Again as already discussed, lower ethanol blending would result in higher emissions of PM and several other pollutants. Failure to consider and analyze these impacts is a failure to prepare an adequate environmental analysis under CEQA.

In addition to a general analysis of adverse environmental impacts, CEQA requires CARB to discuss inconsistencies between the Proposed Rule and any SIPs or other state plans regarding PM. This discussion is especially important given EPA's recent decision to tighten the PM NAAQS, which impacts counties across California.[58] According to the EPA figures below, the tightened standards will cause most of California to be in non-attainment for PM for years to come. CARB is therefore not analyzing the potential impacts of its own rule on one of the few fuel additives that can reduce PM emissions in the existing fleet, and without which California would struggle to meet PM standards.[59]

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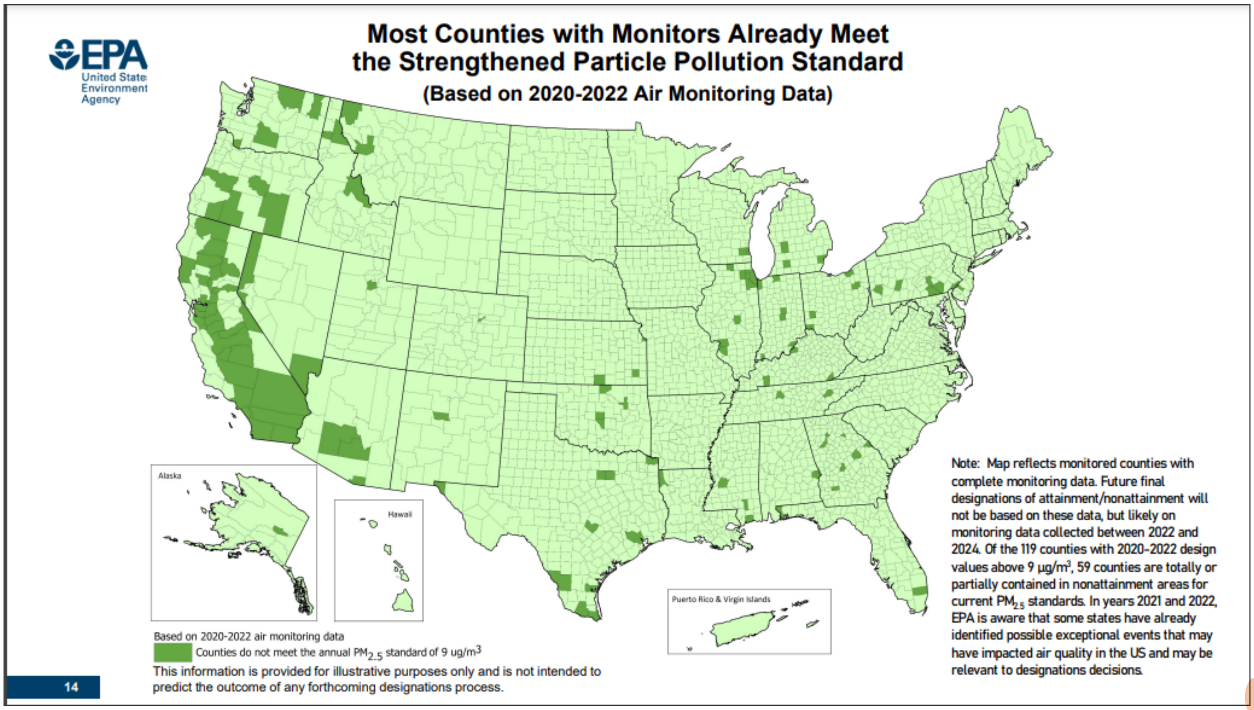
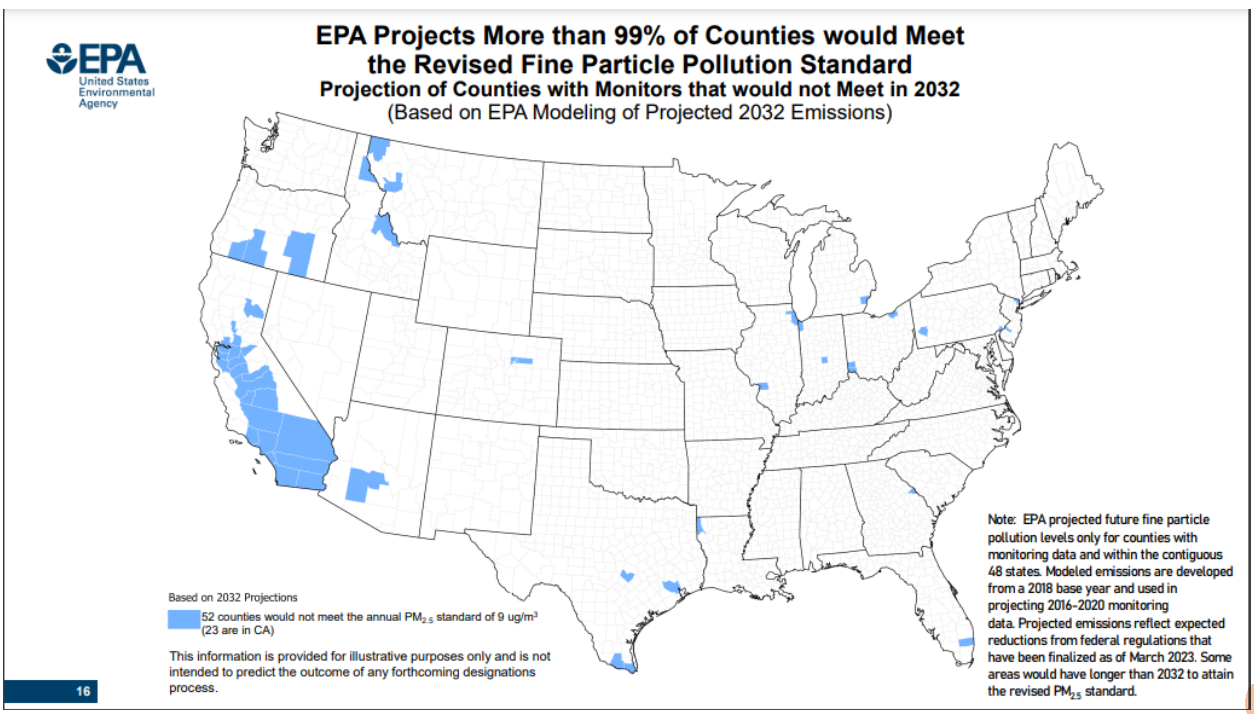
[55] 17 CCR § 60004.2(a).
[56] 14 CCR § 15125(d).
[57] *See Appendix D: Draft Environmental Impact Analysis for the Proposed Low Carbon Fuel Standard Regulation* (Jan. 2, 2024), https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/appd.pdf.
[58] *See* EPA, *Reconsideration of the National Ambient Air Quality Standards for Particulate Matter* (Feb. 5, 2024) (to be codified at 40 CFR Parts 50, 53, and 58), https://www.epa.gov/system/files/documents/2024-02/pm-naaqs-final-frn-pre-publication.pdf.
[59] *See* EPA, *Most Counties with Monitors Already Meet the Strengthened Particle Pollution Standard* (2022), https://www.epa.gov/system/files/documents/2024-02/2024-pm-naaqs-final-2020-22-dv-map.pdf; *see* EPA, *EPA Projects More than 99% of Counties would Meet the Revised Fine Particle Pollution Standard* (2023), https://www.epa.gov/system/files/documents/2024-02/2024-pm-naaqs-final-2032-projections-map.pdf; Appendix B at 5-7.





369.6

VII. CARB's SRIA Failed to Analyze the Significant Costs that Will Be Associated with Adding a Sustainability Certification Requirement and with Potentially Excluding Significant Amounts of Ethanol from the California Market.

The Standardized Regulatory Impact Assessment ("SRIA") of the Proposed Amendments fails to address the impacts of the proposed "sustainability requirements." The SRIA thus falls short of statutory requirements meant to ensure informed agency decision making and informed stakeholder participation.

Under Sections 11346.3 of the California Government Code, any "state agency proposing to adopt, amend, or repeal any administrative regulation shall assess the potential for adverse economic impact on California business enterprises and individuals, avoiding the imposition of unnecessary or unreasonable regulations or reporting, recordkeeping, or compliance requirements."[60] Among the issues that must be addressed in a SRIA, CARB must assess the competitive advantages or disadvantages for businesses currently doing business within the state, the increase or decrease of investment in the state and the incentives for innovation in products, materials, or processes, and the benefits to the health safety, and welfare of California residents.[61]

However, in the SRIA of the proposed LCFS Amendment, CARB does not discuss the proposed sustainability requirements or certification measures in any way. Indeed, it does not even mention these provisions of the proposal, let alone include the detailed analysis on the costs and benefits required by the statutes and regulations. The legal framework is meant to ensure that all regulatory proposals are accompanied by a SRIA that clearly outlines the potential economic impacts, including direct costs to regulated entities and the broader implications for the state's economy.

As discussed above, the potential costs to the supply chain and to California consumers of the sustainability regulations are significant. It may be costly to incentivize farmers to participate in sustainability certification programs. In addition, uncertified ethanol will lose the ability to generate LCFS credits, and instead will generate deficits. The additional CI costs for liquid fuel in addition to the reduced supply of low carbon fuel to the California market will further impose costs on the fuel supply chain. All of these costs will likely be passed down to California consumers, and none are analyzed in the SRIA.

In addition, the SRIA contains no discussion of the costs associated with the potential adverse environmental impacts of lower ethanol blending in California. There is no discussion of the greater PM and other emissions that may result if ethanol is made significantly more costly by the program.

By failing to include *any* discussion of the impacts of the proposed sustainability requirements or the certification systems for crop-based biofuel feedstocks, CARB cannot receive accurate stakeholder input on these issues, and the agency risks proceeding with the amendments without having an accurate or full picture of the economic or environmental impacts. CARB will be unable to assess and understand how the proposed sustainability requirements and certification systems will cause significant unnecessary costs in corn biofuel production without resulting in environmental benefits, and will also not have the stakeholder input critical to evaluating how the market will react to higher ethanol costs and the associated environmental impacts.

[60] Cal. Gov't Code § 11346.3(a) (West 2023).
[61] Cal. Gov't Code § 11346.3(c)(1) (West 2023).

VIII. If CARB does Implement Sustainability Requirements for Corn, it Must Also Provide a Mechanism for Crediting low-CI Farming Practices and Eliminate the Numerical ILUC penalty.

369.7

A. CARB should allow the use of certified farming data to calculate farm-by-farm CI scores.

As discussed in Appendix A, certifications systems like ISCC involve the collection of significant amounts of data related to farming practices such as fertilizer application, crop rotation, and soil organic carbon content. CARB is requiring that third-party auditors ensure that information regarding these variables be properly collected and documented.

Many of these factors are the same factors that are the biggest components of farm CI. At the end of the certification process, CARB will likely be in possession of fully verified data sets that allow calculations of farm-by-farm CI values.

Nonetheless, CARB has not proposed amendments that would allow biofuel producers to apply for CI scores that depart from regional agricultural averages. This undermines incentives that the LCFS program could be communicating to farmers to improve their practices. If CARB moves forward with the crop certification requirement, POET urges CARB to allow biofuel producers to use their certified data sets to calculate farm-specific CI scores.

369.8

B. The ILUC penalty would be duplicative and unnecessary if crop certification were required.

As described in Appendix A, the sustainability certification requirements that likely qualify under CARB's regulations were put into place in Europe in part because Europe does not apply a numerical land use change penalty to crop-based fuels. Instead of such a penalty, the certification systems deal with ILUC by requiring farmers to demonstrate that they are not impacting high carbon land, and that the feedstocks that most threaten high carbon lands are phased out of use. RED II and ISCC even provide a mechanism affirmatively demonstrating that crops present low ILUC risk.

CARB, on the other hand, is layering both approaches on top of each other. Even though risks from ILUC are already incorporated (in our view, in an overly conservative manner) into California CI scores, CARB is requiring validation that feedstock farmland has been used historically for agricultural purposes..

If CARB moves forward with crop certification, POET urges CARB to remove the ILUC penalty from certified farms. At a minimum, these farms should face a reduced penalty, and CARB should provide a pathway for demonstrating low ILUC risk to completely remove the ILUC penalty in a manner that is consistent with the EU.

IX. **CARB Should Recognize Off-Site Renewable Energy Production for Bioethanol Plants.**

369.9 California LCFS regulations prohibit the use of indirect accounting mechanisms to demonstrate production of fuel using low-CI process energy.[62] Although CARB's Proposed Amendments contemplate wholesale power contracting as part of a narrow set of fuel pathways (certain hydrogen pathways and direct air capture projects), these revisions do not extend to a fuller range of low carbon fuels like bioethanol. POET believes this is a missed opportunity, and we urge CARB to consider the revisions proposed by the Low-CI Power Coalition,[63] which would broadly incentivize the production of low-CI electricity. POET is a signatory to a separate comment letter submitted today by the Low-CI Power Coalition, and we refer CARB to the discussion presented in that letter, and the proposal submitted by the Coalition in June of 2023.

CONCLUSION

POET appreciates the opportunity to comment and looks forward to working with CARB to make the LCFS a continued success for California. If you have any questions, please contact me at Josh.Wilson@POET.com or (202)756-5612.

Sincerely,

Joshua P. Wilson
Senior Regulatory Counsel

[62] *See* 17 C.C.R. § 95488.8(h).
[63] *See Low CI Power Coalition Comment Letter* submitted by Noyes Law Corporation in LCFS Pre-Rulemaking workshop (June 6, 2023), available at: https://ww2.arb.ca.gov/system/files/webform/public_comments/3666/Low%20CI%20Power%20ARB%20LCFS%20Comments%20w%20Appendices%206%20June%202023.pdf.

APPENDIX A

RED II and ISCC Overview

RED II

RED II is the currently applicable version of the European Union Renewable Energy Directive, adopted in December 2018.[64] In general, RED II requires that in each future year EU member states must use increasing amounts of renewable energy sources, including biofuels.

Article 29 of RED II establishes a number of "sustainability and GHG emissions saving criteria" for biofuels, with the requirements vary with the specific feedstock involved (e.g., wastes and residues, forest biomass, or agricultural biomass). RED II establishes GHG reduction requirements for biofuels, with plants built below 2015 required to show a 50% production scaling up to new plants that are required to show a 65% reduction.

RED II specifically recognizes the concept of indirect land use change.[65] The EU also states that "the highest risks of indirect land-use change have been identified for biofuels, bioliquids and biomass fuels produced from feedstock for which a significant expansion of the production area into land with high-carbon stock is observed."[66] However, the Directive states that ILUC emissions are too uncertain to be incorporated into CI calculations.[67] RED II mitigates this concern by prohibiting crops grown on land with high-carbon stock from generating compliance credit.[68] A subsequent European Commission regulation further addresses the highest risk ILUC categories by establishing criteria for the highest ILUC risk feedstocks that will be unable to generate credits under RED II after 2030.[69] The only such feedstock identified in the Appendix to the regulation is palm oil.[70]

RED II also recognizes the existence of feedstocks that present low risk of ILUC.[71] The Directive sates, "[w]here there is evidence that [yield enhancing] measures have led to an increase of production going beyond the expected increase in productivity, biofuels, bioliquids and biomass fuels produced from such additional feedstock should be considered to be low indirect land-use change-risk biofuels, bioliquids and biomass fuels."[72]

RED II recognizes that some feedstocks present more significant ILUC concerns than others, and even suggests that EU states would be warranted in placing more stringent limits on the feedstocks of most concern such as crop-based oils.[73] Corn starch is not identified as a feedstock of high

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[64] Directive (EU) 2018/2001 of the European Parliament and of the Council [hereinafter "RED II"] (Dec. 18, 2018), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L2001.
[65] RED II at 94.
[66] *Id.*
[67] *Id.*
[68] *Id.* at 130-31.
[69] *See Commission Delegated Regulation (EU) 2019/807* at 2, 4 (March 13, 2019), https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32019R0807.
[70] *Supra* note 62, at 7.
[71] RED II at 104.
[72] *Id.* at 94.
[73] *Id.* at 126.

concern. As discussed above, an EU regulation designates palm oil as a feedstock that should be phased out by 2030. More generally, though, Annex VIII of RED II provisionally estimates an iLUC penalty of 55 g/MJ for oil, while assigning corn starch a 12 g/MJ ILUC value. In other words, the EU feels that oil crops present an ILUC risk of nearly 5 times higher than starch crops.

ISCC

ISCC describes itself as "a system for the implementation and certification of sustainable, traceable and deforestation-free supply chains."[74] As such, it aligns closely with the goals identified by CARB for the sustainability certification requirement in the purpose and rationale document. In that document, CARB identifies mitigation of deforestation risk as well as protection of high biodiversity value land and avoidance of land use change as key drivers behind the sustainability requirement.[75]

The ISCC certification system has been fully recognized by the EU since 2011. As stated by ISCC, "[t]he processes and procedures of ISCC are based on the binding requirements of the RED II."[76] There are two primary certification programs for biofuels established by ISCC: ISCC EU and ISCC Plus. ISCC EU is designed specifically to demonstrate RED II compliance while ISCC Plus is for non-EU markets. Nonetheless, the two frameworks are generally harmonized, and the ISCC EU documents generally serve as system requirements for ISCC Plus.[77] Thus, RED II is the source of the majority of substantive requirements to which the ISCC programs certify.

However, the ISCC certification programs do include ecological and social requirements that go beyond RED II.[78] ISCC notes that it may change its framework to accommodate changes in the legal requirements on which the ISCC is premised,[79] namely changes in the EU RED framework.

Significantly, ISCC requirements (whether ISCC EU or ISCC Plus) apply to the entire supply chain associated with biofuel.[80] This includes farmers, aggregators of crops, traders, and biofuel processors.[81] In the U.S. corn supply chain, this would requires thousands of entities to come into compliance and obtain certification under the ISCC framework.[82] Certifications require renewal on an annual basis.[83]

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[74] *ISCC EU 201 System Basics* at 8 (July 2, 2021), https://www.iscc-system.org/wpcontent/uploads/2022/05/ISCC_EU_201_System_Basics-v4.0.pdf.
[75] ISOR at 4, 32, 67.
[76] *ISCC EU System Basics* at 12.
[77] *ISCC Plus System Basics* at 7. There are some differences in the tracing and accountability requirements that are laid out in the ISCC Plus system documents. Additionally, the demonstration of GHG reduction requirements is voluntary for ISCC Plus, while it is required for ISCC EU in order to demonstrate RED II GHG reduction requirements. ISCC EU System Basics at 8. However, the vast majority of system documents and requirements are shared between the two certification systems.
[78] *ISCC EU System Basics* at 9.
[79] *Id.* at 11.
[80] *Id.* at 16.
[81] *Id.* at 25-29.
[82] There are some opportunities for group certification, but these are still premised on data for each and every part of the supply chain.
[83] *ISCC EU System Basics* at 34.

Consistent with the RED II standards for sustainability, ISCC seeks to address ILUC by excluding from ISCC certification crops grown on land with high carbon stock.[84] ISCC EU 202-1 deals almost exclusively with this requirement, and also applies to ISCC Plus. ISCC also provides a framework for demonstrating that crops present low ILUC risk.[85]

Aside from addressing ILUC issues, the ISCC certification addresses issues related to other aspects of farming that impact CI. For example, ISCC requires significant analysis of the amount of fertilizer applied to fields and the maintenance of records to support the analysis, the maintenance of soil quality indicators, use of agricultural wastes, and calculation of soil organic matter content.[86] Many of the variables tracked by the ISCC are the very variables that most impact the CI of farming.

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[84] *ISCC EU 202-1, Agricultural Biomass Principle 1*, at 7 (Jan. 2024), https://www.iscc-system.org/wp-content/uploads/2024/01/ISCC_EU_202-1_Agricultural-Biomass_ISCC-Principle-1_v4.1_January2024.pdf.
[85] *See ISCC Plus Add-on 202-07, Low ILUC-Risk Feedstock Certification* (July 2023), https://www.iscc-system.org/wp-content/uploads/2023/11/ISCC_PLUS_lowILUC_V1.0_July2023_Final.pdf.
[86] *ISCC EU 202-2 Agricultural Biomass: ISCC Principles 2-6*, at 12-15 (Dec. 1, 2022), https://www.iscc-system.org/wp-content/uploads/2022/08/202_2_Agricultural-Biomass_ISCC-Principles-2-6_v1.1_August_2.pdf.

Environmental Health & Engineering, Inc.

180 Wells Avenue, Suite 200
Newton, MA 02459-3328

TEL 800-825-5343
781-247-4300
FAX 781-247-4305

www.eheinc.com

February 20, 2024

California Air Resources Board
1001 I Street, Sacramento, California 95814

Comments of David MacIntosh[1,2], Brittany Schwartz[1]
[1] Environmental Health & Engineering, Inc., Newton MA
[2] Harvard T.H. Chan School of Public Health, Boston, MA

RE: Comments on 2024 Proposed Low Carbon Fuel Standard Amendments

We at Environmental Health & Engineering, Inc. (EH&E) are a multi-disciplinary team of environmental health scientists and engineers with expertise in measurements, models, data science, life cycle assessment (LCA), and public health. Members of our team conducted a state-of-the-science review of the carbon intensity (CI) for corn ethanol in the United States (U.S.)[1] and a comprehensive assessment of the impacts of corn ethanol fuel blends on tailpipe emissions.[2,3]

We submit this letter to the California Air Resources Board (CARB) in response to the 2024 Proposed Low Carbon Fuel Standard (LCFS) Amendments.[4]

BACKGROUND INFORMATION

The LCFS Regulation was created after the California Global Warming Solutions Act of 2006, with a goal of reducing the CI of the transportation fuel pool used in California. CARB has recently released a draft of its 2024 update to the regulation. Appendix A-1 of the Proposed Regulation Order contains the proposed amendments and was updated on January 2, 2024.

Within these proposed amendments is a requirement[5] that all crop-based and forestry-based feedstocks used for LCFS fuel pathways must maintain continuous third-party sustainability

[1] Scully MJ, Norris GA, Alarcon Falconi TM, MacIntosh DL. 2021a. Carbon intensity of corn ethanol in the United States: state of the science. *Environmental Research Letters*, 16(4), pp.043001.
[2] Kazemiparkouhi F, Alarcon Falconi TM, Macintosh DL and Clark N. 2022. Comprehensive US database and model for ethanol blend effects on regulated tailpipe emissions. *Sci Total Environ*, 812, pp.151426.
[3] Kazemiparkouhi F, Karavalakis G, Alarcon Falconi TM, Macintosh DL and Clark N. (in press). Comprehensive US database and model for ethanol blend effects on air toxics, particle number, and black carbon tailpipe emissions. *Atmospheric Environment: X*.
[4] CARB, Low Carbon Fuel Standard, https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024
[5] Proposed as line (g) under Section 95488.9. Special Circumstances for Fuel Pathway Applications.

certification, beginning on January 1, 2028.[6] Biofuels using feedstocks that fail to obtain the certification will be penalized by being assigned the same total CI score as ultra-low sulfur diesel (ULSD). As we share in this letter, our team has concerns about the potential outcomes of this proposed certification requirement. In particular, the cost of the certification process and CI penalty may result in less ethanol blending in California fuels, which risks the air quality and climate benefits offered by corn starch ethanol.

POTENTIAL OUTCOMES OF THE PROPOSED AMENDMENTS

As mentioned, an element of the proposed amendments would require crop-based feedstocks used for fuel pathways to receive a sustainability certification or face a CI penalty.[7] While we appreciate that CARB recognizes the importance of emissions reductions through sustainable agricultural practices, we are concerned that the certification requirement has not been assessed for impact and has the potential to result in outcomes that reduce ethanol levels in California's fuel.

Predicting the implications of the certification requirement involves studying a complex mix of economic market dynamics, fuel policies, and refinery priorities/capabilities.[8] Based on our review of the proposed amendments and supporting documents, CARB has not conducted an analysis to determine these impacts. In this section, we bring up considerations that reveal that a certification requirement should be preceded by an in-depth study of its regulatory impacts.

The requirements of the sustainability certification process will likely pose a new cost on the feedstock supply chain for biofuels that are an integral component of transportation fuels in California. Raising the cost of a key element of fuel blends could have several impacts. For one, at least a portion of the costs may be passed on to California consumers as increases in the retail price of fuel blends at the pump.

In addition, higher prices of ethanol could reshuffle the gasoline blending dynamic in California. The current 10% ethanol/CARBOB fuel blend is premised on the availability of relatively inexpensive ethanol that also generates CI credits. Higher costs of ethanol might incentivize the markets and fuel producers to reconfigure their refineries and distribute blends that contain more aromatics or alkylates as octane substitutes for ethanol. The upshot is that the certification requirement could disrupt markets or prompt refineries to reconsider their fuel blends, potentially resulting in less ethanol blending.

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[6] CARB. Appendix A-1. Proposed Regulation Order. Proposed Amendments to the Low Carbon Fuel Standard Regulation. p 166. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/lcfs_appa1.pdf
[7] CARB. Appendix A-1. Proposed Regulation Order. Proposed Amendments to the Low Carbon Fuel Standard Regulation. p. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/lcfs_appa1.pdf
[8] CARB. 2023. Appendix C-1: Standardized Regulatory Impact Assessment (SRIA). https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/appc-1.pdf

Changing the blend to reduce ethanol content would have adverse air quality and climate impacts that we discuss next in this letter. By making it more challenging to incorporate ethanol into fuel blends, the proposed certification jeopardizes the air quality, public health, and climate benefits of ethanol. In the sections that follow, we introduce these benefits and other considerations.

ETHANOL FUEL BLENDS AND TAILPIPE EMISSIONS

Two 2022 publications by our team and a 2022 report by the University of California – Riverside (UCR) are among the literature to indicate that increasing ethanol content in fuels decreases emissions of certain air pollutants. The uncertainty around the implications of the proposed certification precludes our team from modeling and comparing the emissions of a specific fuel blend that could hypothetically emerge on the market through the replacement of some ethanol content with a substitute. Instead, in this section we present findings of the general trend that fuel blends with higher ethanol content have lower emissions of particulate matter (PM) and other air pollutants when compared with blends containing less ethanol.

Recent Studies from Our Team

Members of our team led the Kazemiparkouhi et al. (2022a)[9] and Kazemiparkouhi et al. (2022b)[10] studies, which are the first large-scale analyses of data from light-duty vehicle emissions studies to examine real-world impacts of ethanol-blended fuels on air pollutant emissions, including PM, NOx, CO, and THC[11], as well as BTEX (benzene, toluene, ethylbenzene, xylene) and 1,3-butadiene.[12]

In each study, we used similar approaches. We extracted data from a comprehensive set of emissions and market fuel studies conducted in the U.S. Using these data, we (1) estimated the composition of market fuels for different ethanol volumes and (2) developed regression models to estimate the impact of changes in ethanol volumes in market fuels on air pollutant emissions for different engine types and operating conditions. Importantly, our models estimated these changes accounting for not only ethanol volume fraction, but also aromatic volume fraction, 90% volume distillation temperature (T90), and Reid Vapor Pressure (RVP). Further, our models examined the impacts of ethanol fuels on emissions under both cold start and hot stabilized running conditions and for gasoline-direct injection engines (GDI) and port-fuel injection (PFI) engine types. In doing so, our two papers provided important new information about real-world market fuels and their corresponding air pollutant emissions, as highlighted below.

[9] Kazemiparkouhi, F., Alarcon Falconi, T.M., Macintosh, D.L., and Clark, N. 2022a. Comprehensive U.S. database and model for ethanol blend effects on regulated tailpipe emissions. Sci Total Environ, 812, pp.151426.

[10] Kazemiparkouhi, F., Karavalakis, G., Alarcon Falconi, T.M., Macintosh, D.L., and Clark, N. 2022b. Comprehensive US database and model for ethanol blend effects on air toxics, particle number, and black carbon tailpipe emissions. Atmospheric Environment: X, 16, 100185.

[11] Kazemiparkouhi et al., 2022a.

[12] Kazemiparkouhi et al., 2022b.

- Aromatic levels in market fuels decreased by ~7% by volume for each 10% by volume increase in ethanol content, as discussed earlier.
- PM emissions decreased by 15-18% on average for each 10% increase in ethanol content under cold-start conditions.
- Emissions of CO and THC generally decreased with increasing ethanol fuel content under cold running conditions, while NOx emissions did not change.
- Air toxic emissions showed lower BTEX, 1-3 butadiene, black carbon, and particle number emissions with increasing ethanol fuel content.

2022 UCR Study

Additional evidence of this trend comes from a report prepared for CARB by UCR.[13] This study assessed the impact of E15 (splash-blended from E10) on air pollutant emissions for twenty current technology Tier 3 or California LEV-III, SULEV exhaust emissions standards vehicles. The authors found that switching from E10 to E15 reduced PM emissions by 18%, with cold-start emissions being reduced by 17%.

Further, emissions of CO and THC significantly decreased with increasing ethanol fuel content, while NO_x emissions did not change. Air toxic emissions also showed lower ethylbenzene, m/p-xylene, o-xylene, and solid particle number emissions with increasing ethanol fuel content while 1,3-butadiene, benzene, and toluene emissions did not change.

STRENGTHENED NATIONAL AMBIENT AIR QUALITY STANDARDS

The prospect of losing the PM emissions benefit of 10% ethanol blends in light-duty vehicle fuel has implications for the ability of California to comply with the strengthened National Ambient Air Quality Standard (NAAQS) for fine particulate matter, known as $PM_{2.5}$, announced by the U.S. Environmental Protection Agency (EPA) on February 7, 2024.[14]

The updated NAAQS lowers the upper limit on annual average $PM_{2.5}$ concentrations from 12 micrograms per cubic meter (µg/m^3) to 9 µg/m^3. $PM_{2.5}$ is widely recognized as a cause of premature mortality, cardiovascular disease, respiratory disease, asthma exacerbation and other

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[13] Karavalakis G, Durbin TD, Tang T. 2022. Comparison of Exhaust Emissions Between E10 CaRFG and Splash Blended E15. Final Report. Riverside, CA: California Air Resources Board (CARB), Growth Energy Inc./Renewable Fuels Association (RFA), and USCAR.

[14] EPA finalizes stronger standards for harmful soot pollution, significantly increasing health and clean air protections for families, workers, and communities. U.S. Environmental Protection Agency web page. Accessed February 9, 2024.

adverse effects in humans. Nationwide achievement of the new $PM_{2.5}$ NAAQS is estimated to prevent 4.500 premature deaths and yield up to $46 billion in net health benefits in 2032.[15]

Notably, $PM_{2.5}$ concentrations in 29 of the 58 California counties for 2020 – 2022 do not meet the new NAAQS of 9 µg/m^3.[16] These counties are listed in Table 1. Moreover, 23 counties in the state, including 21 of those in Table 1 plus Calaveras and Ventura Counties, are not projected to meet the updated standard by 2032, its first year of enforcement, despite the substantial emissions reductions expected to result from full implementation of existing legislation and incentives.[17,18]

[15] U.S. Environmental Protection Agency. 2024a. Final Regulatory Impact Analysis for the Reconsideration of the National Ambient Air Quality Standards for Particulate Matter. EPA-452/R-24-006. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC.

[16] U.S. Environmental Protection Agency. 2024b. Fine Particle Concentrations for Counties with Monitors Based on Air Quality Data from 2020 - 2022. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC.

[17] U.S. Environmental Protection Agency. 2024b.

[18] U.S. Environmental Protection Agency. 2024c. EPA Projects 52 Counties Would Not Meet the Strengthened Standard in 2032. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC.

Table 1 Design values and reductions in annual average concentrations of fine particulate matter ($PM_{2.5}$) in California counties that do not currently meet the strengthened National Ambient Air Quality Standard (NAAQS) of 9 micrograms per cubic meter (µg/m³).

County	2020 – 2022 Design Value for Annual $PM_{2.5}$ (µg/m³)[a]	$PM_{2.5}$ Reduction Needed to Comply with Strengthened NAAQS (µg/m³)	Percentage Change in $PM_{2.5}$ (%)
Alameda	9.4	0.4	-4.4%
Butte	11.6	2.6	-28.9%
Colusa	10.5	1.5	-16.7%
Contra Costa	10.0	1.0	-11.1%
Fresno	17.5	8.5	-94.4%
Imperial	11.1	2.1	-23.3%
Kern	18.8	9.8	-108.9%
Kings	16.6	7.6	-84.4%
Los Angeles	13.4	4.4	-48.9%
Madera	13.2	4.2	-46.7%
Mendocino	11.1	2.1	-23.3%
Merced	12.3	3.3	-36.7%
Mono	19.5	10.5	-116.7%
Orange	11.2	2.2	-24.4%
Placer	10.9	1.9	-21.1%
Plumas	17.0	8.0	-88.9%
Riverside	13.6	4.6	-51.1%
Sacramento	11.7	2.7	-30.0%
San Bernadino	14.0	5.0	-55.6%
San Diego	10.0	1.0	-11.1%
San Joaquin	12.3	3.3	-36.7%
Santa Clara	10.7	1.7	-18.9%
Shasta	9.3	0.3	-3.3%
Siskiyou	11.6	2.6	-28.9%
Solano	9.4	0.4	-4.4%
Stanislaus	14.3	5.3	-58.9%
Sutter	13.8	4.8	-53.3%
Tehama	9.9	0.9	-10.0%
Tulare	18.4	9.4	-104.4%

[a] U.S. Environmental Protection Agency. 2024b. Fine Particle Concentrations for Counties with Monitors Based on Air Quality Data from 2020 - 2022. Office of Air Quality Planning and Standards, Health and Environmental Impacts Division, Research Triangle Park, NC.

EPA projects that annual emissions of primary $PM_{2.5}$ in these 23 counties will need to decrease by 43 (Ventura) to 2,551 (Los Angeles, Riverside, San Bernadino) tons.[19] The magnitude of the emissions reductions necessary to meet the strengthened NAAQS indicates that CARB should ensure all practical measures are taken to protect existing avoided $PM_{2.5}$ emissions including current ethanol fuel blends. On-road motor vehicles are the third largest source category of $PM_{2.5}$ emissions in the South Coast Basin of California, including Los Angeles, Riverside, and San Bernadino counties, which reinforces the important benefits of current ethanol blends compared

[19] U.S. Environmental Protection Agency. 2024a. Table 2A-14, p. 155-158.

to lower ethanol blends that could be a consequence of the proposed requirement for feedstock certification.[20]

Environmental Justice Communities

The benefits to air quality and public health associated with higher ethanol fuels may be particularly important for Environmental Justice Communities (EJCs). EJCs are predominantly located in urban neighborhoods with high traffic density and congestion; these communities are thus exposed to disproportionately higher concentrations of PM emitted from motor vehicle tailpipes.[21,22,23] For example, in New York, people of color are exposed to more $PM_{2.5}$ from light-duty gasoline vehicles and heavy-duty diesel vehicles than average (+35% and +42%).[24]

This unequal impact is seen on a national level within the Regulatory Impact Analysis for the new PM NAAQs, where EPA found that, on average, "…Asian, Black, Hispanic, less educated, unemployed, uninsured, linguistically isolated, below the poverty line populations live in areas with higher annual average PM2.5 concentrations than the reference population." [25] The strengthened NAAQS is projected to have disproportionately beneficial impacts on EJC,[26] which underscores the importance of maintaining 10% and higher ethanol blends in California over lower ethanol blend concentrations.

Further, vehicle trips within urban EJCs tend to be short in duration and distance, with approximately 50% of all trips in dense urban communities under three miles long.[27,28,29] As a result, a large proportion of urban vehicle operation occurs under cold-start conditions,[30] when

[20] U.S. Environmental Protection Agency. 2024a. Figure 2-27, p. 90.

[21] Bell, M. L., & Ebisu, K. (2012). Environmental inequality in exposures to airborne particulate matter components in the United States. *Environmental Health Perspectives, 120*(12), 1699–1704. https://doi.org/10.1289/ehp.1205201

[22] Clark, L. P., Millet, D. B., & Marshall, J. D. (2014). National patterns in environmental injustice and inequality: Outdoor NO2 air pollution in the United States. *PLoS One*, *9*(4), e94431. https://doi.org/10.1371/journal.pone.0094431

[23] Tian, N., Xue, J., & Barzyk, T. M. (2013). Evaluating socioeconomic and racial differences in traffic-related metrics in the United States using a GIS approach. *J Expo Sci Environ Epidemiol*, *23*(2), 215–222. https://doi.org/10.1038/jes.2012.83

[24] Tessum, C. W., Paolella, D. A., Chambliss, S. E., Apte, J. S., Hill, J. D., & Marshall, J. D. (2021). PM2.5 polluters disproportionately and systemically affect people of color in the United States. *Science Advances*, *7*(18), eabf4491. https://doi.org/10.1126/sciadv.abf4491

[25] U.S. Environmental Protection Agency. 2024a. p. 333.

[26] U.S. Environmental Protection Agency. 2024a. Chapter 6.

[27] de Nazelle, A., Morton, B. J., Jerrett, M., & Crawford-Brown, D. (2010). Short trips: An opportunity for reducing mobile-source emissions? *Transportation Research Part D: Transport and Environment*, *15*(8), 451–457. https://doi.org/10.1016/j.trd.2010.04.012

[28] Reiter, M. S., & Kockelman, K. M. (2016). The problem of cold starts: A closer look at mobile source emissions levels. *Transportation Research Part D: Transport and Environment*, *43*, 123–132. https://doi.org/10.1016/j.trd.2015.12.012

[29] US DOT. (2010). *National Transportation Statistics*. Bureau of Transportation Statistics.

[30] de Nazelle et al. 2010.

PM emissions are highest. Given the evidence that ethanol-blended fuels substantially reduce PM during cold-start conditions,[31] it follows that ethanol-blended fuels may present an effective method to reduce air pollution-related health risks for EJCs.

Additionally, while the market share of gasoline-powered light-duty vehicles is expected to decrease over the next 10 years due to electric vehicles (EVs), they still account for a majority of the vehicles driven by the US population. EVs also have higher upfront costs than gasoline-powered vehicles ($18,000 higher on average)[32] which may limit their market penetration until prices become more comparable.[33] Given the financial barriers to acquiring an EV and the disproportionate exposure to traffic pollution for EJCs,[34] alternatives such as using higher ethanol blends may provide significant benefits to these communities.

ETHANOL SUPPORTS CARB'S GREENHOUSE GAS REDUCTION GOALS

Another reason for concern about the outcomes of the proposed amendments is that reducing ethanol content in fuels goes against CARB's greenhouse gas (GHG) reduction goals.

In addition to lower emissions of key health-relevant pollutants, such as PM and BTEX, and associated benefits to air quality and health, studies have shown that higher ethanol fuel blends also provide significant GHG reductions.

To quantify these GHG reductions, we conducted a state-of-the-science review of the carbon intensity (CI) for corn ethanol in the US, applied objective criteria applicable to the US regulatory context, and derived an evidence-based central CI estimate and credible range as of 2020.[35] We found that assessments of GHG intensity for corn ethanol have decreased by approximately 50% over the prior 30 years and converge on a current central estimate value of approximately 51 grams of carbon dioxide equivalent emission per megajoule (gCO_2e/MJ), which is about 46% lower than the average CI for neat gasoline. This trend is further evidenced by more recent corn starch ethanol results generated by the Argonne National Laboratory's (ANL) Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model (GREET), with a central estimate of 55.6 gCO_2e/MJ in 2021 and 51.3 gCO_2e/MJ in 2022.[36] The decrease in GHG intensity is attributable to updates in modeling systems and input data that reflect market-driven changes that resulted in more efficient corn production and energy consumption at ethanol refineries, as well as market-based analyses of indirect land use change

[31] Kazemiparkouhi et al. 2022a.
[32] J.D. Power E-Vision Intelligence Report, October 2023.
[33] Ibid.
[34] Tessum CW, Paolella DA, Chambliss SE, Apte JS, Hill JD, Marshall JD. 2021. PM2. 5 polluters disproportionately and systemically affect people of color in the United States. Science Advances, 7(18).
[35] Scully et al. 2021.
[36] Argonne National Laboratory. The Greenhouse Gases, Regulated Emissions, and Energy Use in Technologies Model. 2021 and 2022.

(iLUC). Estimates for corn farming and production of ethanol are consistent between the most recent estimates from the CARB, EPA, ANL, and our analysis. The primary difference across the CI estimates for corn ethanol relates to iLUC.

iLUC Estimates

As mentioned, iLUC represents the main discrepancy between various CI estimates for corn starch ethanol. Looking closer, analyses relying on updated models and inputs return lower iLUC impacts than prior work.

The plot in Figure 1 presents current iLUC estimates for corn ethanol in comparison to prior and now superseded estimates from EPA in 2010 and CARB in 2015/2018. The figure, which is based on updates to Figure 1 in Scully et al. 2021, includes iLUC estimates from the most current relevant and applicable modeling efforts in the U.S. (shown in blue) and in Europe (shown in red).[37, 38] For reference, we also include the U.S. Department of Agriculture (USDA), Washington State, and Oregon State studies, which are based on review of primary LUC analyses. Note that the figure does not include a 2022 publication by Lark et al,[39] as this paper has been heavily critiqued and should not be relied on. Flaws of that study have been documented in our response to the paper,[40] critiques by researchers at ANL,[41,42] and a comment by USDA.[43]

We see from Figure 1 that the four commonly relied upon models—GTAP-BIO, FAPRI-CARD, MIRAGE, and GLOBIOM—provide current estimates of iLUC GHG impacts that are considerably lower than the earlier results from EPA and CARB.

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[37] Scully et al. 2021a.

[38] Results from Plevin et al. 2015, the prominent application of GCAM for corn starch ethanol iLUC, are not included because the authors report ranges of iLUC values and later explain that the ranges are not predictions but instead were generated to understand model sensitivity to selected parameters. In that paper, the uncertainty analysis aims to determine the relative influence of individual parameter uncertainty on overall uncertainty, not reduce uncertainty.

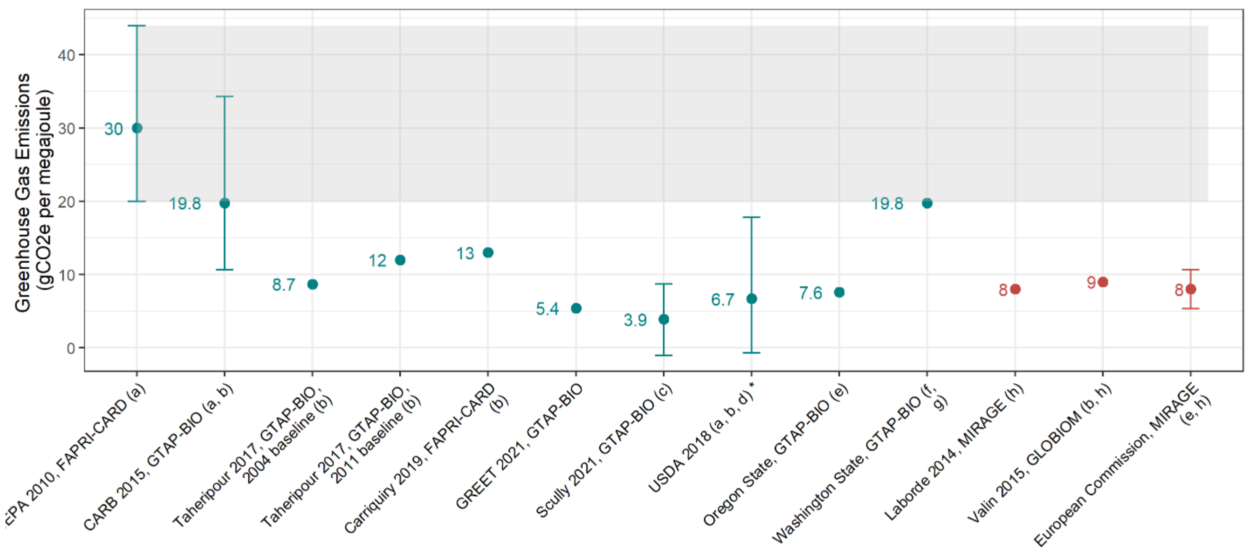
[39] Lark, T.J., Hendricks, N.P., Smith, A., Pates, N., Spawn-Lee, S.A., Bougie, M., Booth, E.G., Kucharik, C.J. and Gibbs, H.K., 2022. Environmental outcomes of the US renewable fuel standard. Proceedings of the National Academy of Sciences, 119(9), p.e2101084119.

[40] Alarcon Falconi et al., 2022.

[41] Taheripour, F., Mueller, S., Kwon, H., Khanna, M., Emery, I., Copenhaver, K., Wang, M. and CropGrower, L.L.C. 2022b. Comments on "Environmental Outcomes of the US Renewable Fuel Standard".

[42] Taheripour, F., Mueller, S., Kwon, H., Khanna, M., Emery, I., Copenhaver, K., Wang, M. and CropGrower, L.L.C., 2022c. Response to comments from Lark et al. regarding Taheripour et al. March 2022 comments on Lark et. al. original PNAS paper.

[43] USDA. 2022. Technical Memorandum: Review of Recent PNAS Publication on GHG Impacts of Corn Ethanol. Available from: https://www.usda.gov/sites/default/files/documents/USDA-OCE-Review-of-Lark-2022-For-Submission.pdf



a Uses older versions of the model
b Indirect and direct land use change
c Partially based on a review of primary land use change analyses
d Based on a review of primary land use change analyses using multiple models
e Policy based on primary land use change analyses
f Proposed policy based on primary land use change analyses
g Based on CARB 2015 analysis
h Adjusted to a 30-year, amortization period
* Includes CARB 2015 LUC as the upper range

Figure 1 Comparison of EPA's iLUC estimates with relevant most recent studies from the U.S. (teal) and Europe (red)

Several publications also recognize this downward trend in iLUC estimates for corn starch ethanol over the last decade.[44, 45, 46, 47] This agreement can be attributed to model and data improvements, including data that reflect the uptake of sustainable farming practices.

COMPARING LAND USE IMPACTS OF STARCHES AND OILS

The discussion of iLUC impacts underscores the importance of prioritizing feedstocks with minimal environmental footprints in biofuel production. In a 2015 report generated for the European Commission, Valin[48] compares the LUC impacts and emissions of starch-based crops

[44] Lee U, Hoyoung K, Wu M, Wang M. 2021. Retrospective analysis of the U.S. corn ethanol industry for 2005-2019: implications for greenhouse gas emission reductions. Biofuels, Bioproducts & Biorefining, 15(5), pp.1318-1331.

[45] Dunn JB, Mueller S, Kwon H-Y and Wang MQ. 2013. Land-use change and greenhouse gas emissions from corn and cellulosic ethanol. Biotechnology for Biofuels, 6(1), pp.1-3.

[46] Taheripour F, Mueller S and Kwon H. 2021a. Appendix A: supplementary information to response to 'How robust are reductions in modeled estimates from GTAP-BIO of the indirect land use change induced by conventional biofuels?' Journal of Cleaner Production., 310, pp.127431.

[47] Carriquiry M, Elobeid A, Dumortier J and Goodrich R. 2019. Incorporating sub-national Brazilian agricultural production and land-use into U.S. biofuel policy evaluation. Applied Economic Perspectives and Policy, 42, pp.497-523.

[48] Valin, H., Peters, D., van den Berg, M., Frank, S., Havlík, P., Forsell, N., Hamelinck, C. N., Leclère, D., & Gusti, M. (2015). The land use change impact of biofuels consumed in the EU: Quantification of area and greenhouse gas impacts (No. JRC95883). European Commission, Joint Research Centre.

to vegetable oils, illustrating that starch crops, like corn, generally demonstrate lower LUC impacts and emissions compared to vegetable oils. For starches as a group, Valin assigns LUC emissions of 29 gCO_2/MJ, while the vegetable oil group is assigned over three times that value: 101 gCO_2/MJ. Looking specifically at corn ethanol, Valin estimates a LUC impact of 14 gCO_2/MJ. Meanwhile, the LUC emissions from palm oil biodiesel are estimated to be 231 gCO_2/MJ.

A 2013 study[49] simulates the direct LUC impact of three palm oil expansion scenarios in Brazil, differentiated by the level of environmental enforcement in the area. Noting that the results are an estimate of direct LUC only (i.e, these do not include iLUC), the authors estimate a direct LUC impact of 14 gCO_2e/MJ for palm oil in a strict enforcement scenario, 60 gCO_2e/MJ with some environmental enforcement, and 84 gCO_2e/MJ given no environmental enforcement.

These findings align with the broader literature, which emphasizes the detrimental environmental costs associated with the expanded use and production of vegetable oils, especially palm oil, including intensive land use requirements, deforestation, and biodiversity loss compared to starch-based biofuels.[50,51,52] However, our initial exploration of the literature on palm oil impacts shows that even recent studies[53] tend to call on older values for the crop's LUC emissions in a biofuel context. This indicates a need for further research to capture and update the LUC of palm oil, as other authors have expressed.[54]

Alternate iLUC Approaches

The European Union Renewable Energy Directive II (EU RED II) framework offers an informative and global perspective on addressing the environmental impacts of biofuel feedstocks. Notably, the EU RED II refrains from quantifying iLUC impacts of biofuel feedstocks due to the complexities in modeling and predicting iLUC. Instead, the EU RED II categorizes feedstocks into low, medium, and high-risk categories based on their potential

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49 Yui, S. and Yeh, S., 2013. Land use change emissions from oil palm expansion in Pará, Brazil depend on proper policy enforcement on deforested lands. Environmental Research Letters, 8(4), p.044031.

50 Koh, L. P., & Wilcove, D. S. (2008). Is oil palm agriculture really destroying tropical biodiversity? Conservation Letters, 1(2), 60–64. https://doi.org/10.1111/j.1755-263X.2008.00011.x

51 Gaveau, D. L. A., Sheil, D., Husnayaen, S., Salim, M. A., Arjasakusuma, S., Ancrenaz, M., Pacheco, P., & Meijaard, E. (2013). Rapid conversions and avoided deforestation: Examining four decades of industrial plantation expansion in Borneo. Scientific Reports, 3(1), Article 3370.

52 Taheripour, F. and Tyner, W.E., 2020. US biofuel production and policy: implications for land use changes in Malaysia and Indonesia. Biotechnology for biofuels, 13(1), pp.1-17.

53 Meijaard, E., Brooks, T.M., Carlson, K.M., Slade, E.M., Garcia-Ulloa, J., Gaveau, D.L., Lee, J.S.H., Santika, T., Juffe-Bignoli, D., Struebig, M.J. and Wich, S.A., 2020. The environmental impacts of palm oil in context. Nature plants, 6(12), pp.1418-1426.

54 Cooper, H.V., Evers, S., Aplin, P., Crout, N., Dahalan, M.P.B. and Sjogersten, S., 2020. Greenhouse gas emissions resulting from conversion of peat swamp forest to oil palm plantation. Nature communications, 11(1), p.407.

environmental impacts.[55] Corn and other starches are typically classified as low or medium risk, while palm oil is considered high risk due to its significant LUC impacts.[56] Other vegetable oils like soybean oil may also receive high-risk categorization under the EU RED II due to similar environmental concerns.[57,58,59]

EU RED II regulation of feedstocks favors low-risk biofuels, applying stricter criteria to those deemed high-risk due to their environmental impacts. Starches, including corn starch, are generally categorized as low or medium risk within this framework.[60] As such, issuing broad California regulatory efforts that capture starches like corn starch may not be the most effective approach to promote sustainable biofuel production practices and to mitigate adverse environmental consequences associated with biofuel feedstocks given their relatively lower environmental effects. Instead, CARB may consider policies that focus on vegetable oil feedstocks and their larger LUC impacts.

Limited Availability of Vegetable Oils

Additionally, the limited availability of recycled vegetable oils can indirectly incentivize the razing of forests for conversion to vegetable oil plantations, especially palm oil plantations, further exacerbating environmental concerns associated with biofuel production. Recycled vegetable oils, derived from used cooking oil and other waste sources, are considered a sustainable feedstock for biofuel production due to their potential to reduce GHG emissions and minimize competition with food crops.[61,62] However, their availability is constrained by factors including collection infrastructure, processing capacity (including pretreatment needs to reduce free fatty acids), and market demand.[63,64] The low availability of recycled vegetable oils may incentivize producers to seek out virgin vegetable oils, contributing to further negative environmental impacts.[65,66] Specifically, the International Council on Clean Transportation

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55 European Union. (2018). Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32018L2001
56 EU Directive 2018/2001
57 EU Directive 2018/2001
58 European Federation for Transport & Environment (2022) Fueling our Crises, November 4, 2022. Soy_Study_TE_2022_final_embargoed_Friday_4_Nov-1.pdf (transportenvironment.org)
59 Carlson, K.M. & Garret, R.D. (2018). Environmental Impacts of Tropical Soybean and Palm Oil Crops. Environmental Science. https://doi.org/10.1093/acrefore/9780199389414.013.234
60 EU Directive 2018/2001
61 Valin et al., 2015
62 Gaveau et al., 2013
63 LMC International/GlobalData. USO Supply Outlook. https://cleanfuels.org/wp-content/uploads/GlobalData_UCO-Supply-Outlook_Sep2023.pdf
64 Banga, S. and Pathak, V.V., 2023. Biodiesel production from waste cooking oil: a comprehensive review on the application of heterogenous catalysts. Energy Nexus, p.100209.
65 Koh & Wilcove, 2008
66 Gaveau et al., 2013

(ICCT) warns that there is potential for waste oil fraud, where virgin palm oil and soy oil are disguised as waste oil.[67] ICCT reports that cases of waste fraud have already been taken to U.S. federal courts.

To mitigate the environmental impacts posed by high-risk feedstocks like palm oil, policymakers can promote more sustainable biofuel feedstocks such as corn starch.[68,69]

EXISTING SUSTAINABILITY PRACTICES

In the earlier section about corn ethanol's support for GHG reduction goals, we mention that the total CI of ethanol has declined due to improvements in modeling estimates and market-driven efficiency in both corn production and energy consumption at ethanol refineries. Here, we discuss the possibilities of carbon reduction strategies and technologies that are currently in use in agriculture and at ethanol plants. These improvements have already reduced the CI of the feedstock and ethanol production stages for various farms and plants and have the potential for further reductions across the industry.

During the summer of 2021, the Renewable Fuels Association (RFA) sent a letter to President Biden committing its members to ambitious carbon emissions targets.[70] Signed by dozens of ethanol producers, the letter sets two goals: 1) reduce ethanol's average CI to about 30gCO_2e/MJ by 2030 (a reduction of around 15g/MJ from the current average RFA presents) and 2) on average, achieve net carbon neutrality for ethanol by 2050.

A February 2022 report prepared by Informed Sustainability Consulting (ISC) for the RFA assesses the feasibility for the ethanol industry to meet its stated goals.[71] The report first establishes a baseline scenario that only considers gradual yield improvements and efficiency advancements. The authors estimate that this business-as-usual scenario would result in a 7.1 gCO_2e/MJ reduction in the ethanol CI between 2020 and 2050, not reaching RFA's targets. Next, ISC analyzes the potential impact, estimated cost, and technology readiness level of 29 individual "emission reduction actions" that can be adopted along the supply chain. The authors then arrange these actions into five viable pathways for ethanol to reach net zero by 2050.

67 ICCT. 2023. U.S. Biofuel Demand and the Potential for Used Cooking Oil from Major Asian Exporting Countries. https://theicct.org/wp-content/uploads/2023/02/US-UCO-potential_fs_final.pdf
68 EU Directive 2018/2001
69 Mongabay. (2011, November 8). Palm oil biofuel from peatlands has big climate impact, finds study. Mongabay Environmental News. https://news.mongabay.com/2011/11/pam-oil-biofuel-from-peatlands-has-big-climate-impact-finds-study/
70 https://d35t1syewk4d42.cloudfront.net/file/1272/RFA-Net-Zero-Commitment-Letter-to-President-Biden-.pdf
71 ISC. 2022. Pathways to Net-Zero Ethanol: Scenarios for Ethanol Producers to Achieve Carbon Neutrality by 2050. https://d35t1syewk4d42.cloudfront.net/file/2146/Pathways%20to%20Net%20Zero%20Ethanol%20Feb%202022.pdf

The ISC report describes a “core pathway” that balances impact, cost, and readiness; the other pathways prioritize a single factor, such as cost. Each pathway contains up to a dozen actions, and in each pathway, ethanol reaches net zero by 2050. The core pathway achieves the majority of its success through carbon capture and sequestration (CCS) at ethanol plants, along with renewable energy use at ethanol plants.[72] Specifically, the authors note that “Implementing CCS can offset more GHG emissions than are emitted by all of a facility’s energy use and non-corn input purchases operations combined.”[73] The core pathway also incorporates actions by corn farmers (e.g., “75% adoption of renewable electricity and 75% increase in reduced tillage practices”[74]), but the authors note that combining the supplier elements of the core pathway totals a reduction of under 1 gCO_2e/MJ.

To understand progress toward emissions goals, RFA issued a survey to its members in March 2023.[75] RFA reports that “nearly all” member producers responded, representing small and large facilities across 12 states.[76] When presented with 10 specific improvements, all plants responded that they have incorporated at least one of these efforts since 2015/2016, and “most facilities adopted more than one of these technologies and practices”. [77] Over half of the respondents have invested in two specific efforts: high-efficiency motors and fermentation efficiencies. Seventy-nine percent of plants indicated they intend to adopt CCS technology. [78] This is promising given the potential of CCS described in the ISC report, as is the result that 34% of plants responded that they already capture carbon from fermentation for utilization in the food and beverage industry.[79] Another encouraging finding is that 77% of plants surveyed feel they are on target to generate net-zero ethanol by 2050. [80]

The outcomes of the survey emphasize that even without the certification in the proposed amendments, many ethanol plants are already working toward reducing their CI and may have a CI below average.

[72] ISC 2022.
[73] Ibid. p. 30.
[74] Ibid. p. 33.
[75] RFA. 2023. The Energy Transition – How RFA Members Are Driving Progress Toward Net-Zero Carbon Emissions. https://d35t1syewk4d42.cloudfront.net/file/2547/The%20Energy%20Transition%20-%20How%20RFA%20Members%20Drive%20Progress%20-%20June%202023.pdf
[76] RFA. 2023. Progress Toward Net-Zero: Survey of RFA Members. Slideshow presentation. https://d35t1syewk4d42.cloudfront.net/file/2548/Energy%20Transition%20Member%20Survey%20FEW%202023%20-%20Tad%20Hepner.pdf
[77] Ibid. Slide 8.
[78] Ibid. Slide 12.
[79] Ibid. Slide 11.
[80] Ibid. Slide 20.

DATA COLLECTION

In its proposed amendments, CARB does not provide much context on the organizations it expects will certify farms for their sustainability practices. We anticipate that groups such as the International Sustainability & Carbon Certification[81] and the Rainforest Alliance[82] will be selected by farms seeking to pursue certification. In order to complete the applications for these two examples and others, farms will need to gather and submit farm-specific data such as fertilizer use. This fertilizer data would allow CARB to conduct CI scoring for fertilizer use on a farm-by-farm basis, instead of applying an industry average. An approach like this that builds toward farm-by-farm scoring for select elements is a way to incentivize sustainable practices at farms without the time and cost burden of a third-party certification.

We encourage CARB to consider reviewing the data inputs required for applications to various certifying organizations with the purpose of identifying which data requests apply to CARB's goals. CARB can then begin considering these key elements on a farm-by-farm basis, keeping the focus of this activity on specific targets rather than the broad scope often applied by sustainability certification organizations.

PROPOSED CI PENALTY

CARB's proposed amendments seek to assign the CI for ULSD to crop-based biofuel pathways that use uncertified feedstocks.[83] The CI value of ULSD is currently 100.45 gCO_2e/MJ and is set to rise to 105.76 gCO_2e/MJ within the proposed amendments.[84] Earlier in this letter, we reported the primary finding of our Scully et al. 2021 paper, which is that the central estimate CI for corn ethanol is around 51 gCO_2e/MJ.[85] At over double this value, the proposed ULSD CI score of 105.76 gCO_2e/MJ is not reasonably near the central estimate CI for corn ethanol. The value seems particularly arbitrary given that ethanol is a substitute for gasoline, not diesel. Further, CARB's pathway analysis already incorporates a LUC contribution to the CI score, so the proposed amendments would unnecessarily double up on this penalty.

If all ethanol with uncertified corn receives the same 105.76 gCO_2e/MJ score, this takes away incentives for other emissions reduction strategies. For example, an ethanol plant that has incorporated technology/efficiency improvements and has even implemented CCS would be given a CI score that is over double the actual average for corn starch ethanol. Yet, as discussed earlier, CCS has incredible potential to offset substantial emissions from ethanol plants. The

[81] International Sustainability & Carbon Certification. ISCC Certification Schemes. https://www.iscc-system.org/certification/iscc-certification-schemes/
[82] Rainforest Alliance. 2020 Certification Program. https://www.rainforest-alliance.org/for-business/2020-certification-program/
[83] CARB LCFS 2024 Proposed Order. p. 167.
[84] CARB LCFS 2024 Proposed Order. Table 7-1, p. 127.
[85] Scully et al. 2021.

automatic assignment of 105.76 gCO_2e/MJ if feedstock is uncertified may discourage plants from investing in other improvements if these investments will not impact their CI score in California.

CONCLUSION

We thank CARB for the opportunity to comment on the 2024 Proposed Low Carbon Fuel Standard Amendments. Within our letter, we have expressed concern about the feedstock certification requirement. We believe that the complex nature of this amendment's possible impacts requires a level of consideration that has not been presented alongside the proposal.

Our letter walks through a scenario where market impacts caused by a certification requirement could perhaps lead to reduced ethanol content in California's fuels. In sharing recent studies by our team and UCR, we highlight the trend that increasing ethanol content reduces emissions of certain air pollutants, including PM. Ethanol's potential to reduce PM emissions from fuels is critical in the context of the strengthened NAAQS released earlier this month, as EPA projects that California will need to reduce emissions in nearly half of its counties to comply.

Ethanol also presents opportunities to lower GHG emissions from California's fuels, given its CI central estimate of 51 gCO_2e/MJ. We caution that reducing ethanol levels in fuels may work against the GHG reduction goals of CARB. While CARB's proposed amendments would assign the same CI score to crop feedstocks of all types if uncertified, our letter shares research that vegetable oils tend to cause more LUC than starches. The EU incorporates this distinction through policy that focuses on reducing LUC from the highest risk category, a strategy that CARB may wish to consider.

We next describe the encouraging finding that there are multiple viable pathways for ethanol to average net zero by 2050, with CCS identified as a notable strategy to reach emissions reduction targets. Survey results show that many plants have already taken steps toward decarbonization.

Finally, we note that the CI score of 105.76 gCO_2e/MJ that would be assigned to fuels with uncertified feedstocks is unreasonable, as the number is derived for an irrelevant fuel and is more than double the actual CI of corn ethanol.

In summary, we invite CARB to analyze the potential ramifications of a certification requirement for crop feedstocks, keeping in mind the air quality and carbon reduction benefits offered by corn ethanol. We look forward to reviewing a revised version of the 2024 Proposed Low Carbon Fuel Standard Amendments.

Tufts University School of Engineering
Department of Civil and Environmental Engineering

February 3, 2022

Docket Number: EPA-HQ-OAR-2021-0324

Comments of Drs. Fatemeh Kazemiparkouhi,[1] David MacIntosh,[2] Helen Suh[3]
[1] Environmental Health & Engineering, Inc., Newton, MA
[2] Environmental Health & Engineering, Inc., Newton, MA and the Harvard T.H. Chan School of Public Health, Boston, MA
[3] Tufts University, Medford, MA

We are writing to comment on issues raised by the proposed RFS annual rule, the Draft Regulatory Impact Analysis (December 2021; EPA-420-D-21-002), and the supporting Health Effects Docket Memo (September 21, 2021; EPA-HQ-OAR-2021-0324-0124), specifically regarding the impact of ethanol-blended fuels on air quality and public health. We provide evidence of the air quality and public health benefits provided by higher ethanol blends, as shown in our recently published study[1] by Kazemiparkouhi et al. (2021), which characterized emissions from light duty vehicles for market-based fuels. Findings from our study demonstrate ethanol-associated reductions in emissions of primary particulate matter (PM), nitrogen oxides (NOx), carbon monoxide (CO), and to a lesser extent total hydrocarbons (THC). Our results provide further evidence of the potential for ethanol-blended fuels to improve air quality and public health, particularly for environmental justice communities. Below we present RFS-pertinent findings from Kazemiparkouhi et al. (2021), followed by their implications for air quality, health, and environmental justice.

Summary of Kazemiparkouhi et al. (2021)

Our paper is the first large-scale analysis of data from light-duty vehicle emissions studies to examine real-world impacts of ethanol-blended fuels on regulated air pollutant emissions, including PM, NOx, CO, and THC. To do so, we extracted data from a comprehensive set of emissions and market fuel studies conducted in the US. Using these data, we (1) estimated composition of market fuels for different ethanol volumes and (2) developed regression models to estimate the impact of changes in ethanol volumes in market fuels on air pollutant emissions for different engine types and operating conditions. Importantly, our models estimated these changes accounting for not only ethanol volume fraction, but also aromatics volume fraction, 90% volume distillation temperature (T90) and Reid Vapor Pressure (RVP). Further, they did so

[1] https://doi.org/10.1016/j.scitotenv.2021.151426

under both cold start and hot stabilized running conditions and for gasoline-direct injection engines (GDI) and port-fuel injection (PFI) engine types. Key highlights from our paper include:

- ***Aromatic levels in market fuels decreased by approximately 7% by volume for each 10% by volume increase in ethanol content*** (Table 1)**.** Our findings of lower aromatic content with increasing ethanol content is consistent with market fuel studies by EPA and others (Eastern Research Group, 2017, Eastern Research Group, 2020, US EPA, 2017). As discussed in EPA's Fuel Trends Report, for example, ethanol volume in market fuels increased by approximately 9.4% between 2006 and 2016, while aromatics over the same time period were found to drop by 5.7% (US EPA, 2017).

  We note that our estimated market fuel properties differ from those used in the recent US EPA Anti-Backsliding Study (ABS), which examined the impacts of changes in vehicle and engine emissions from ethanol-blended fuels on air quality (US EPA, 2020). Contrary to our study, ABS was based on hypothetical fuels that were intended to satisfy experimental considerations rather than mimic real-world fuels. It did not consider published fuel trends; rather, the ABS used inaccurate fuel property adjustment factors in its modeling, reducing aromatics by only 2% (Table 5.3 of ABS 2020), substantially lower than the reductions found in our paper and in fuel survey data (Kazemiparkouhi et al., 2021, US EPA, 2017). As a result, the ABS's findings and their extension to public health impacts are not generalizable to real world conditions.

Table 1. Estimated market fuel properties

Fuel ID	EtOH Vol (%)	T50 (°F)	T90 (°F)	Aromatics Vol (%)	AKI	RVP (psi)
E0	0	219	325	30	87	8.6
E10	10	192	320	22	87	8.6
E15	15	162	316	19	87	8.6
E20	20	165	314	15	87	8.6
E30	30	167	310	8	87	8.6

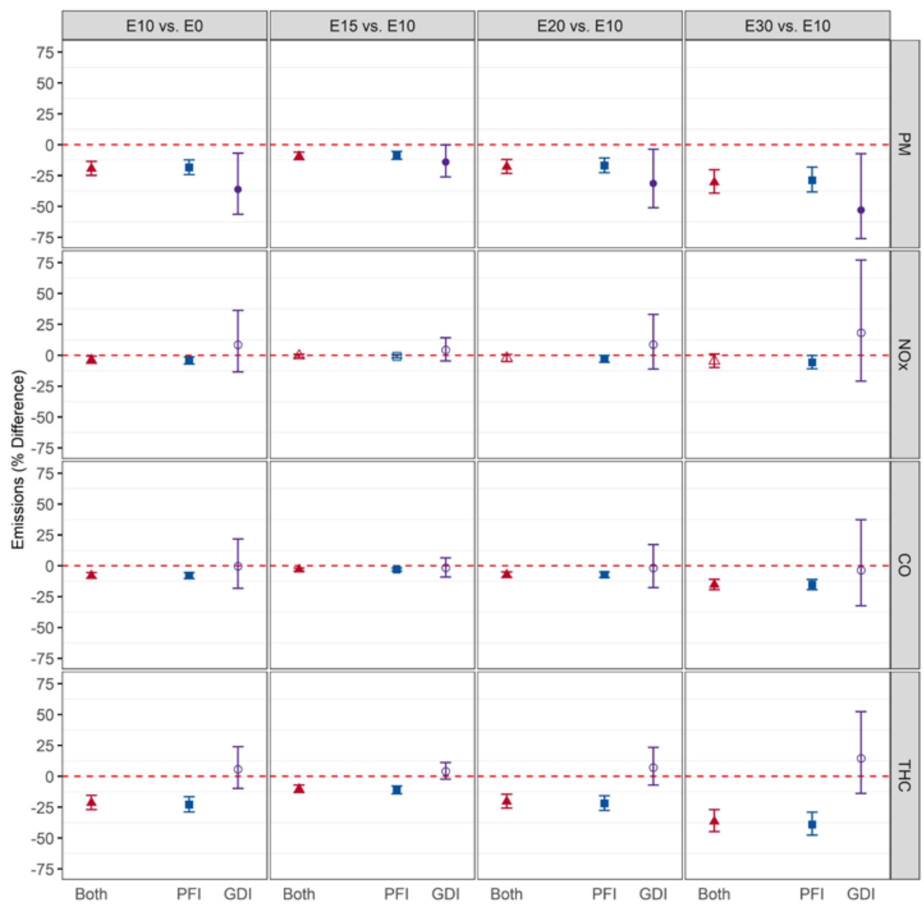
Abbreviations: EtOH = ethanol volume; T50 = 50% volume distillation temperature; T90 = 90% volume distillation temperature; Aromatics=aromatic volume; AKI = Anti-knock Index; RVP = Reid Vapor Pressure.

- ***PM emissions decreased with increasing ethanol content under cold-start conditions.*** Primary PM emissions decreased by 15-19% on average for each 10% increase in ethanol content under cold-start conditions (Figure 1). While statistically significant for both engine types, PM emission reductions were larger for GDI as compared to PFI engines, with 53% and 29% lower PM emissions, respectively, when these engines burned E30 as compared to E10. In contrast, ethanol content in market fuels had no association with PM emissions during hot-running conditions.

  Importantly, our findings are consistent with recent studies that examined the effect of ethanol blending on light duty vehicle PM emissions. Karavalakis et al. (2014), (2015), Yang et al. (2019a), (2019b), Schuchmann and Crawford (2019), for example, assessed the influence of different mid-level ethanol blends – with proper adjustment for aromatics – on the PM emissions from GDI engines and Jimenez and Buckingham (2014) from PFI engines. As in our study, which also adjusted for aromatics, each of these recent studies found higher ethanol blends to emit lower PM as compared to lower or zero ethanol fuels.

Together with these previous studies, our findings support the ability of ethanol-blended fuels to offer important PM emission reduction opportunities. **Cold start PM emissions have consistently been shown to account for a substantial portion of all direct tailpipe PM emissions from motor vehicles**, with data from the EPAct study estimating this portion to equal 42% (Darlington et al., 2016, US EPA, 2013). The cold start contribution to total PM vehicle emissions, together with our findings of emission reductions during cold starts, suggest that a **10% increase in ethanol fuel content from E10 to E20 would reduce total tailpipe PM emissions from motor vehicles by 6-8%.**

Figure 1. Change (%) in cold-start emissions for comparisons of different ethanol-content market fuels[a]



[a] Emissions were predicted from regression models that included ethanol and aromatics volume fraction, T90, and RVP as independent variables

- **NOx, CO and THC emissions were significantly lower for higher ethanol fuels for PFI engines under cold-start conditions**, but showed no association for GDI engines (Figure 1). CO and THC emissions also decreased under hot running conditions for PFI and for CO also for GDI engines (results not shown). [Note that NOx emissions for both PFI and GDI engines were statistically similar for comparisons of all ethanol fuels, as were THC emissions for GDI engines.] These findings add to the scientific evidence demonstrating emission reduction benefits of ethanol fuels for PM and other key motor vehicle-related gaseous pollutants.

Implications for Public Health and Environmental Justice Communities

The estimated reductions in air pollutant emissions, particularly of PM and NOx, indicate that increasing ethanol content offers opportunities to improve air quality and public health. As has been shown in numerous studies, lower PM emissions result in lower ambient PM concentrations and exposures (Kheirbek et al., 2016, Pan et al., 2019), which, in turn, are causally associated with lower risks of total mortality and cardiovascular effects (Laden et al., 2006, Pun et al., 2017, US EPA, 2019, Wang et al., 2020).

The above benefits to air quality and public health associated with higher ethanol fuels may be particularly great for environmental justice (EJ) communities. EJ communities are predominantly located in urban neighborhoods with high traffic density and congestion and are thus exposed to disproportionately higher concentrations of PM emitted from motor vehicle tailpipes (Bell and Ebisu, 2012, Clark et al., 2014, Tian et al., 2013). Further, vehicle trips within urban EJ communities tend to be short in duration and distance, with approximately 50% of all trips in dense urban communities under three miles long (de Nazelle et al., 2010, Reiter and Kockelman, 2016, US DOT, 2010). As a result, a large proportion of urban vehicle trips occur under cold start conditions (de Nazelle et al., 2010), when PM emissions are highest. Given the evidence that ethanol-blended fuels substantially reduce PM, NOx, CO, and THC emissions during cold-start conditions, it follows that ethanol-blended fuels may represent an effective method to reduce PM health risks for EJ communities.

Summary

Findings from Kazemiparkouhi et al. (2021) provide important, new evidence of ethanol-related reductions in vehicular emissions of PM, NOx, CO, and THC based on real-world fuels and cold-start conditions. Given the substantial magnitude of these reductions and their potential to improve air quality and through this public health, our findings warrant careful consideration. Policies that encourage higher concentrations of ethanol in gasoline would provide this additional benefit. These policies are especially needed to protect the health of EJ communities, who experience higher exposures to motor vehicle pollution, likely including emissions from cold starts in particular, and are at greatest risk from their effects.

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Appendix D

California Low Carbon Fuel Standard

MATTHEW BOTILL
CHIEF, INDUSTRIAL STRATEGIES DIVISION

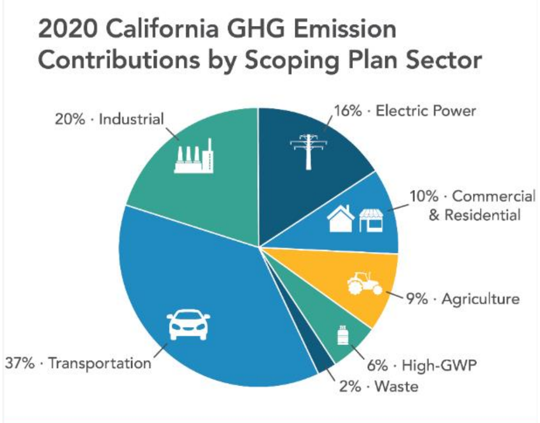
JANUARY 11, 2024

CALIFORNIA
AIR RESOURCES BOARD

California's Climate Policy Framework

GHG Targets & Goals

Legislation & Executive Orders: Total GHGs (AB 32/SB 32/AB 1279) or sector targets (SB 1383/SB 100), etc.

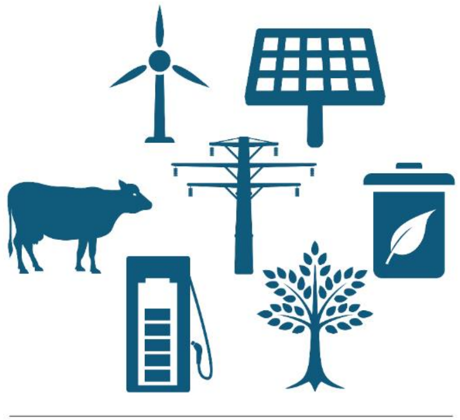


Scoping Plan

Actionable plan across all sectors

Action

Regulations & Incentives: Advanced Clean Cars, climate change investments, etc.



Projects

Examples: Zero-emission trucks, energy infrastructure and renewables, compost facilities, digesters, etc.

The Road
to Zero Emissions

CARB has put a roadmap in place to drastically reduce our dependence on petroleum in the transportation sector by 2045.

AB 32

Requires we cut GHGs.

To reach goals, fuel use must be cut by 94%.

How cuts happen?

Zero emission cars, trucks and fuels.

ACT ACC ACF

CARB rules that make that possible:

Advanced Clean Trucks, Advanced Clean Cars, Advanced Clean Fleets

- ACT: Phases out sale of most fuel-powered trucks by 2035
- ACC: 100% ZEV sales requirement by 2035
- ACF: Requires that trucks in CA be zero emissions by 2045

LCFS

Makes fuel less polluting and encourages production of cleaner alternatives

How it works:

Dirty Fuel	Cleaner Fuel
PAY	EARN

Governor Newsom creates new oversight committee to monitor oil companies

All together, these actions will help us build a cleaner, healthier California for current and future generations.

CARB

Evolution of the LCFS Program - 2009 and 2011 Rulemakings

- First iteration of LCFS adopted in 2009, with revisions in 2011
- Original regulation length: **63 pages**
- First rulemaking established basic framework and included focused on crediting opportunities for the following fuels

Fuel Pathway Crediting

- Renewable Diesel
- Biodiesel
- Ethanol
- Renewable Natural Gas
- Hydrogen
- Electricity

Evolution of the LCFS Program – 2015 Rulemaking

- Cost containment
- Project-based crediting added to recognize emissions reductions in crude oil extraction and refining operations

Fuel Pathway Crediting		Project-based Crediting
• Renewable Diesel • Biodiesel • Ethanol • Renewable Natural Gas • Hydrogen • Electricity	+	• Refinery Investment • Innovative Crude • Renewable Hydrogen for Refineries • Low-Complexity/Low-Energy-Use Refinery

Evolution of the LCFS Program – 2018/2019 Rulemakings

- Compliance targets strengthened/extended to 2030
- Additional crediting opportunities added starting 2019/2020 (ZEV infrastructure, holdback equity spending, third-party verification)

Fuel Pathway Crediting

- Renewable Diesel
- Biodiesel
- Ethanol
- Renewable Natural Gas
- Hydrogen
- Electricity

+

- Alternative Jet Fuel
- Propane
- Electricity (Incremental crediting and Off-road)

Project-based Crediting

- Refinery Investment
- Innovative Crude
- Renewable Hydrogen for Refineries
- Low-Complexity/Low-Energy-Use Refinery

+

- Carbon Capture and Sequestration (CCS)

+

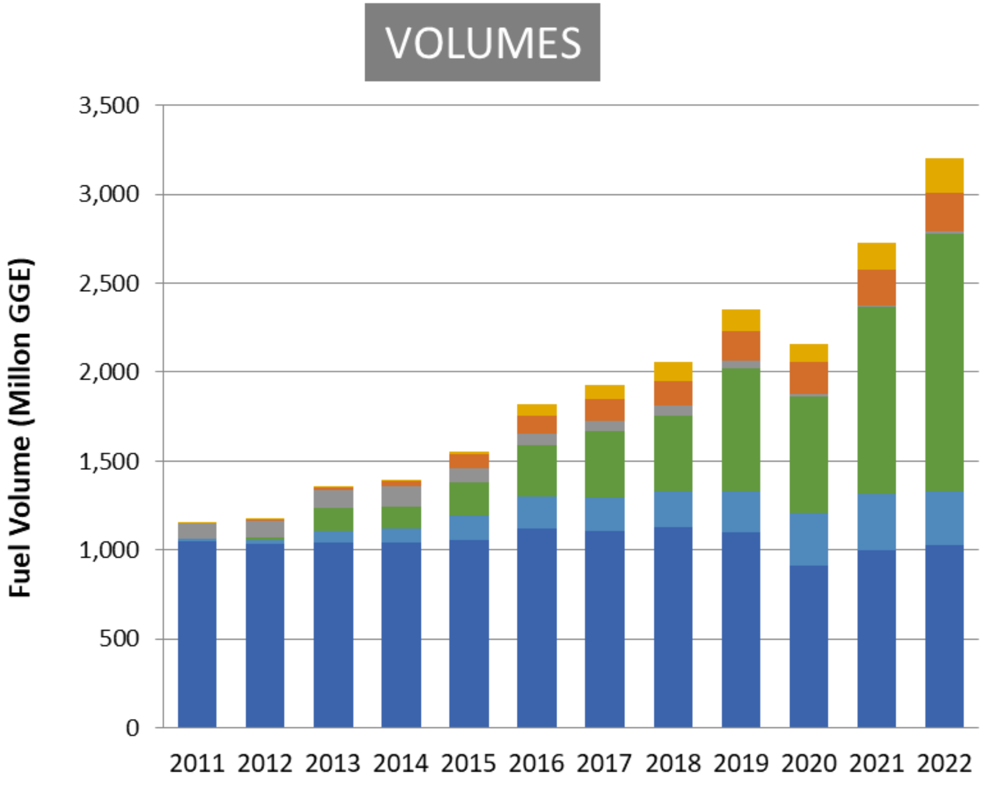
ZEV Infrastructure Crediting

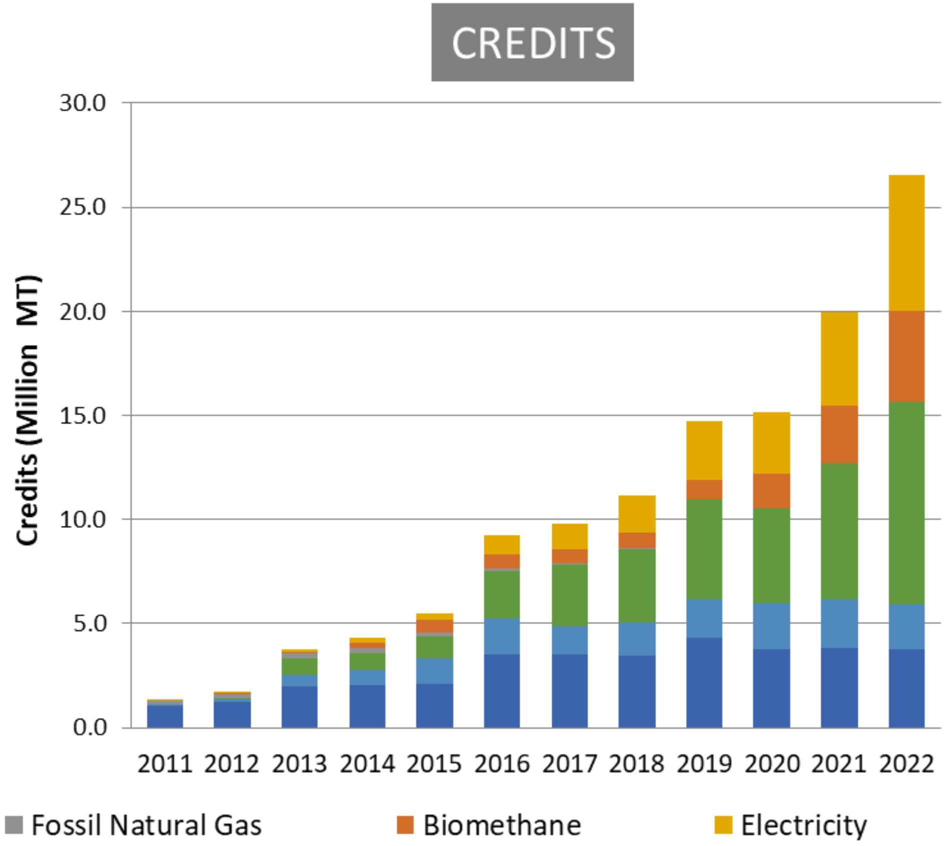
- Hydrogen Refueling Infrastructure (HRI)
- Fast Charging Infrastructure (FCI)

Other Provisions

- Third-party verification
- Holdback equity spending requirements
- Cost containment mechanisms

Growing Alternative Fuel Volumes and Credits





LCFS as an Exportable Policy

- LCFS initiation in CA started with the basic framework and CA successfully created the market structure to incentivize low-carbon fuels.

- Over a decade since initiation, CA LCFS is moving into its next phase

- California has set mid-century carbon neutrality objectives, CA LCFS is being revised to support California climate goals.

- For other jurisdictions: creating the framework and setting initial goals is key to begin moving the market; additional program modifications can follow as needed

California LCFS Regulatory Amendment Proposals

Rulemaking Package Posted

- Initial Statement of Reasons (ISOR) package publicly available on LCFS Rulemaking webpage*
  - Staff Report/ISOR
  - Proposed regulatory text
  - Environmental Impact Analysis
  - Updated Life Cycle Analysis (LCA) modeling tools**
  - Other appendices
- 45-day comment period from Jan 5 – Feb 20, 2024
  - Submit comments through rulemaking docket***

* LCFS Rulemaking Webpage: https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024
** LCA modeling tools: https://ww2.arb.ca.gov/resources/documents/lcfs-life-cycle-analysis-models-and-documentation
*** LCFS Comment Docket: https://www.arb.ca.gov/lispub/comm/iframe_bcsubform.php?listname=lcfs2024&comm_period=A

Robust Public Process

9 PUBLIC WORKSHOPS OVER PAST THREE YEARS

2 COMMUNITY MEETINGS

2 BOARD HEARINGS

OVER 800 COMMENT LETTERS RECEIVED

We Received A Diverse Set of Comments

- Strengthen carbon intensity targets and provide long-term price signals
- Maximize crediting opportunities
- Incentivize development of innovative fuels
- Reduce use of combustion fuels
- Eliminate biomethane from the program
- Continue support for biomethane and prevent stranding assets
- Limit or cap crop-based biofuels
- Expand the use of crop-based biofuel crediting
- Concentrate health and economic benefits in communities burdened by current transportation system
- Provide a mix of low-carbon transportation incentives to communities

Key Concepts for Rulemaking

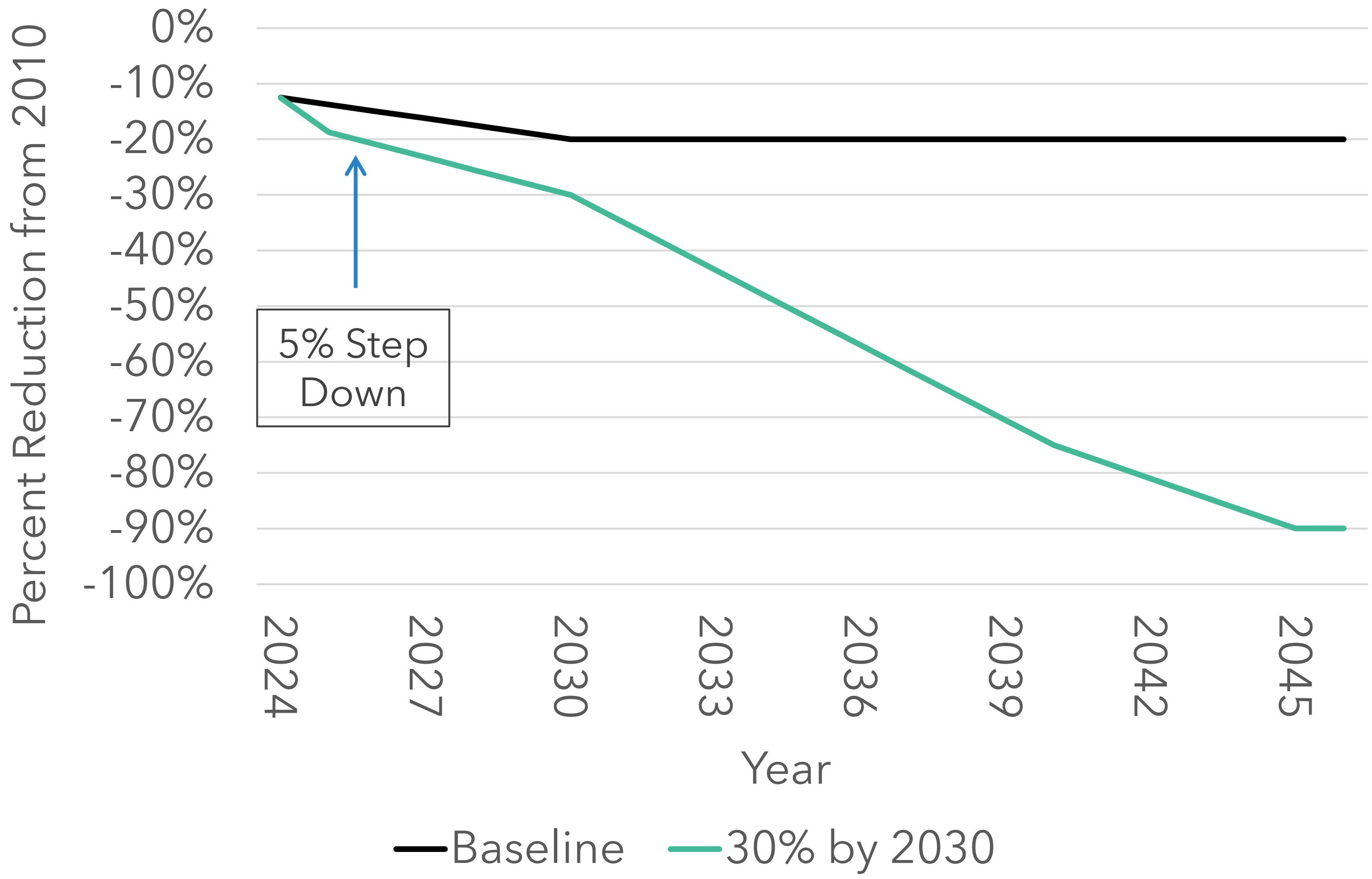
- Increase the stringency of the program to displace fossil fuels
- Strengthen equity provisions to promote investment in disadvantaged, low-income, and rural communities
- Support electric and hydrogen truck refueling
- Increase the use of alternative jet fuel in the State
- Incentivize more production of clean fuels needed in future, such as low-carbon hydrogen
- Support methane emissions reductions and deploy biomethane for best uses across transportation and other sectors
- Consider guardrails on crop-based fuels

Other Considerations

- Light-duty vehicle sector needs
- Federal incentives
- Price-signals for investment
- Air quality benefits
- Transportation costs
- Program administration and streamlining

Strengthen the Annual Carbon Intensity Benchmarks

1. A carbon intensity (CI) reduction of 30% by 2030 and 90% by 2045, compared to 2010 CI baseline
2. A 'step down' in the CI reduction target in 2025 from the current 13.75% to 18.75%



Price Signals for Investment

Table 15: Value Added from LCFS Credit for Low Carbon Fuels under the Proposed Amendments

Fuel	Average CI Value (gCO_2e/ MJ)	2025	2030	2035	2040	2045	Units
*Proposed Amendments Estimated Credit Price**		*$221*	*$76*	*$138*	*$221*	*$105*	$/MT
Corn Ethanol**	55	0.66	0.13	-0.12	-0.77	-0.55	$/gge
Electricity**	64	5.39	1.52	1.54	0.52	-0.37	$/gge
Hydrogen**	-79	7.20	2.25	3.40	4.31	1.38	$/dge
Biodiesel**	40	1.37	0.35	0.28	-0.15	-0.42	$/dge
Renewable Diesel**	44	1.25	0.31	0.20	-0.27	-0.48	$/dge
Landfill NG	45	0.96	0.22	0.08	-0.41	-0.51	$/dge
Dairy NG	-293	11.01	3.68	6.35	9.64	4.26	$/dge

- Modeling 30% by 2030 and 90% by 2045 benchmarks shows increased value of low carbon fuels.
- Auto-Acceleration Mechanism available if program over-performs.

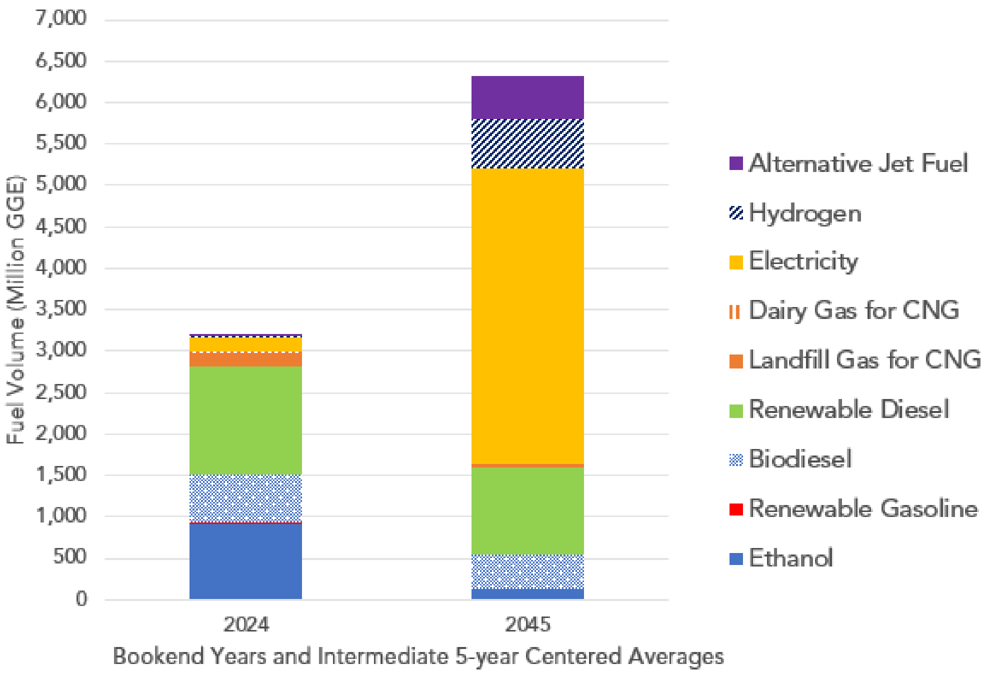
*AAM not modeled in table results

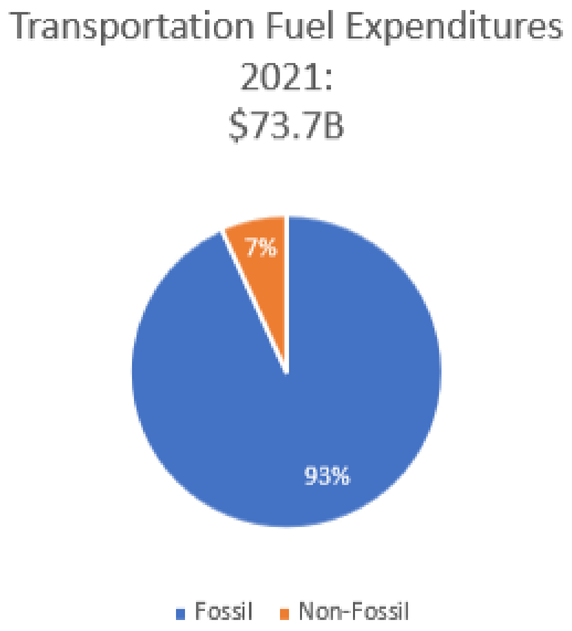
Federal Alignment

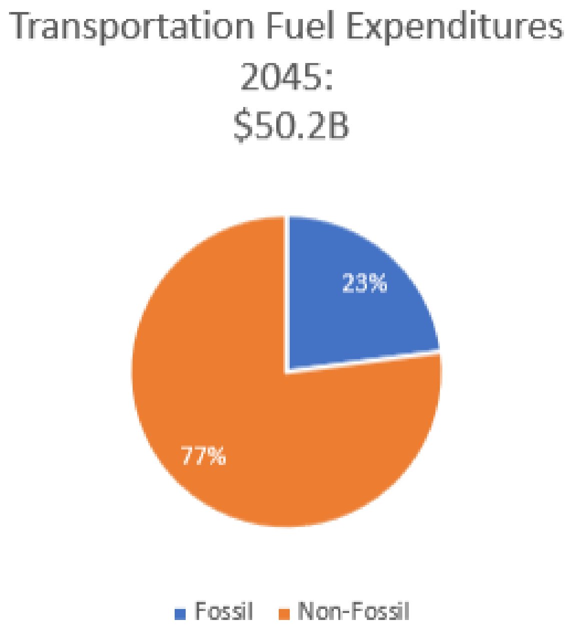
Proposed LCFS Amendments seek to leverage and harmonize with federal investment opportunities

LCFS Proposal		Concurrent Federal Opportunity
Hydrogen book and claim eligibility	....	Hydrogen producers tax credit (45V)
Regulating fossil jet fuel	....	SAF producers tax credit (40B) and Federal SAF Grand Challenge
ZEV infrastructure crediting for medium/heavy-duty vehicles	....	Hydrogen hubs and NEVI charging grants

Transportation Fuel Mix and Costs







Fossil fuel use will continue to decline as low carbon fuels grow

As fossil fuel use is replaced with alternatives CA drivers will save money

Results of AQ/Health Analysis

- Total reduction in criteria pollutant emissions in all air basins from 2024 to 2046
- Total monetized health savings from avoided health outcomes: $5 billion
- Much higher health benefits when tailpipe reductions are included

Other Options Have Drawbacks

- Limits on Decarbonization Options
  - Ending biomethane crediting
  - Limits on biomass diesel
  - No DAC credits

Greater need for fossil diesel, worse health outcomes, more GHG emissions

- More Stringent CI Targets
  - 35% by 2030 with 5% step down in 2025
  - No additional crediting constraints

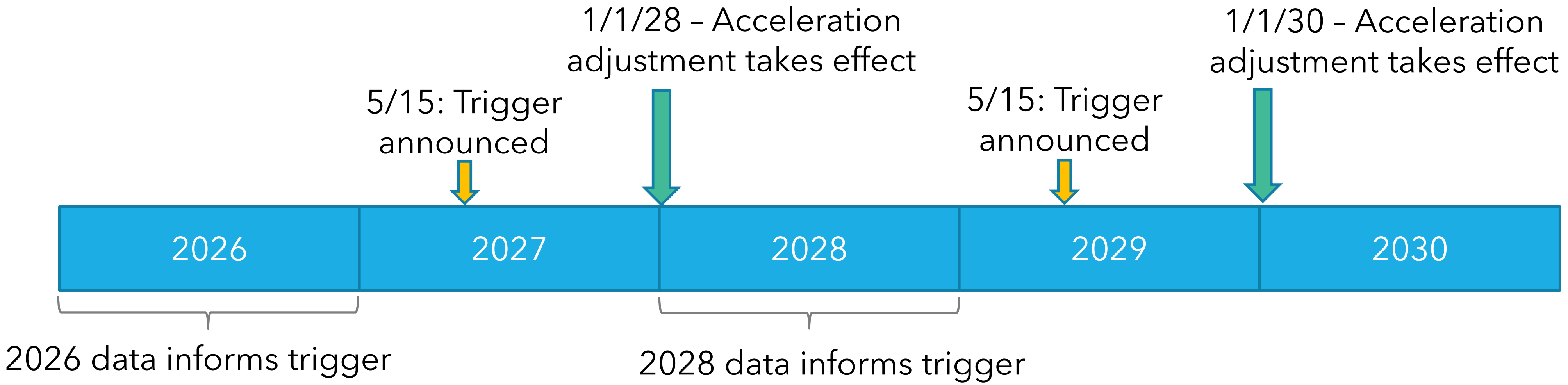
Highest cost scenario

Additional Proposed Regulatory Provisions

- Implement Automatic Acceleration Mechanism
- Eliminate Exemption for Intrastate Fossil Jet Fuel
- Expand Zero Emission Vehicle Infrastructure Crediting
- Apply Biomethane Deliverability Requirements and Phase Out Avoided Methane Pathways
- Add Crop-Based Biofuels Sustainability Criteria
- Improve Equity Provisions

Auto-Acceleration Mechanism

- Advances the upcoming year's CI benchmark, and all subsequent benchmarks by one year, **if triggered**
  - Trigger conditions: annual credit to deficit ratio and credit bank to deficit ratio
  - Can first happen in 2027. If triggered, skips a year.
  - **If triggered in both 2027 and 2029, the 2030 CI benchmark will be the 2032 benchmark (39% CI Reduction)**



Continue and Focus FCI and HRI Crediting

- Propose to extend the light-duty vehicle infrastructure crediting past current end date of 12/31/25
- Also proposing targeted changes to utility-generated holdback credits to accelerate deployment of ZEVs with a focus on equity projects

New Medium- and Heavy-Duty ZEV Infrastructure Crediting

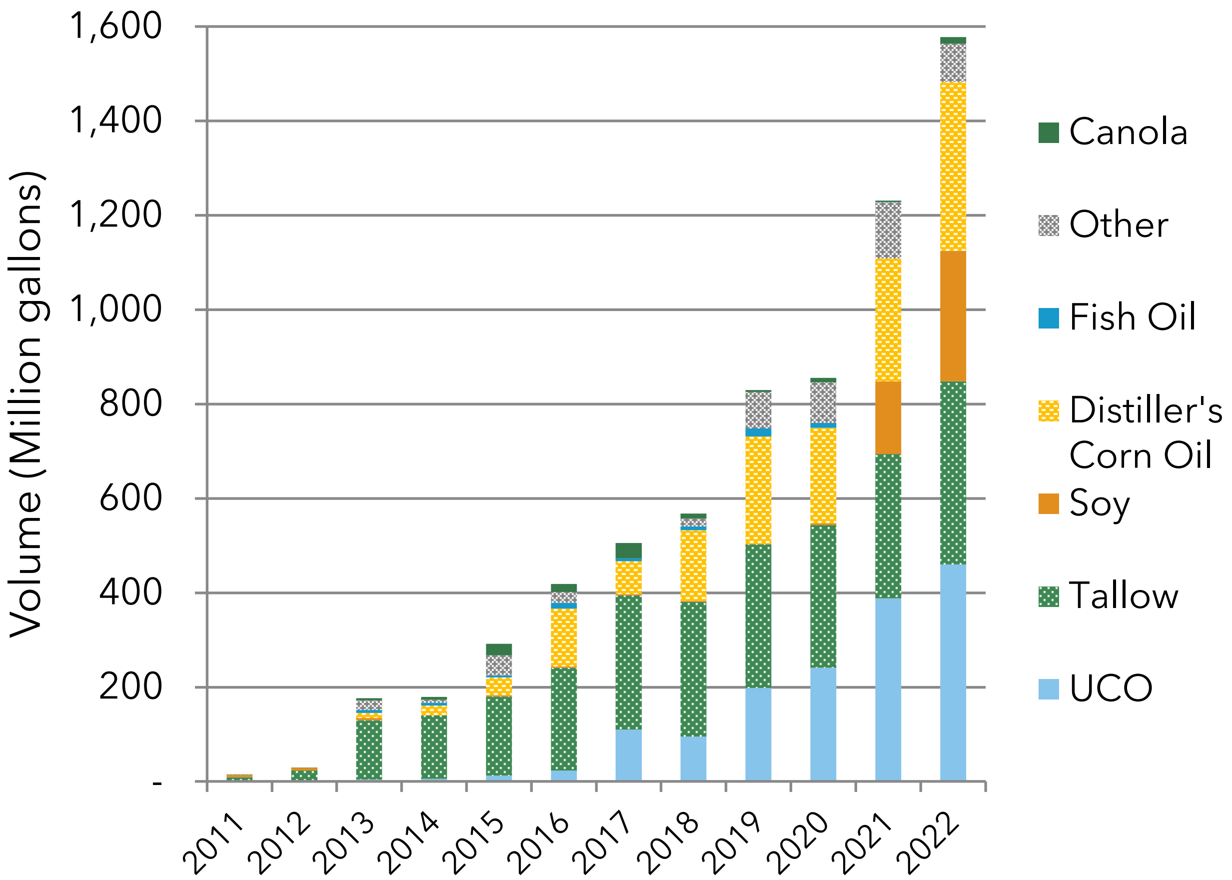
- Refueling infrastructure will be essential to successfully implementing Advanced Clean Fleets (ACF) and Advanced Clean Trucks (ACT)
- Ten years of crediting to support fleet transition to ZEVs, reduce emissions and pollutants in communities heavily impacted by freight travel
- Clean Fuel Reward program to focus on to rebates for new and used medium- and heavy-duty ZE trucks

Biomethane Crediting

- Biomethane supply needs to grow rapidly to support SB 1383 targets and then be deployed to other uses
- 2030 and 2040 are critical milestones for methane reduction and ZEV deployment in California
- Biomethane as a hydrogen feedstock will remain important in LCFS
- Propose continuing biomethane and avoided methane crediting for pathways, with phase out of these pathways if they break ground after 2030

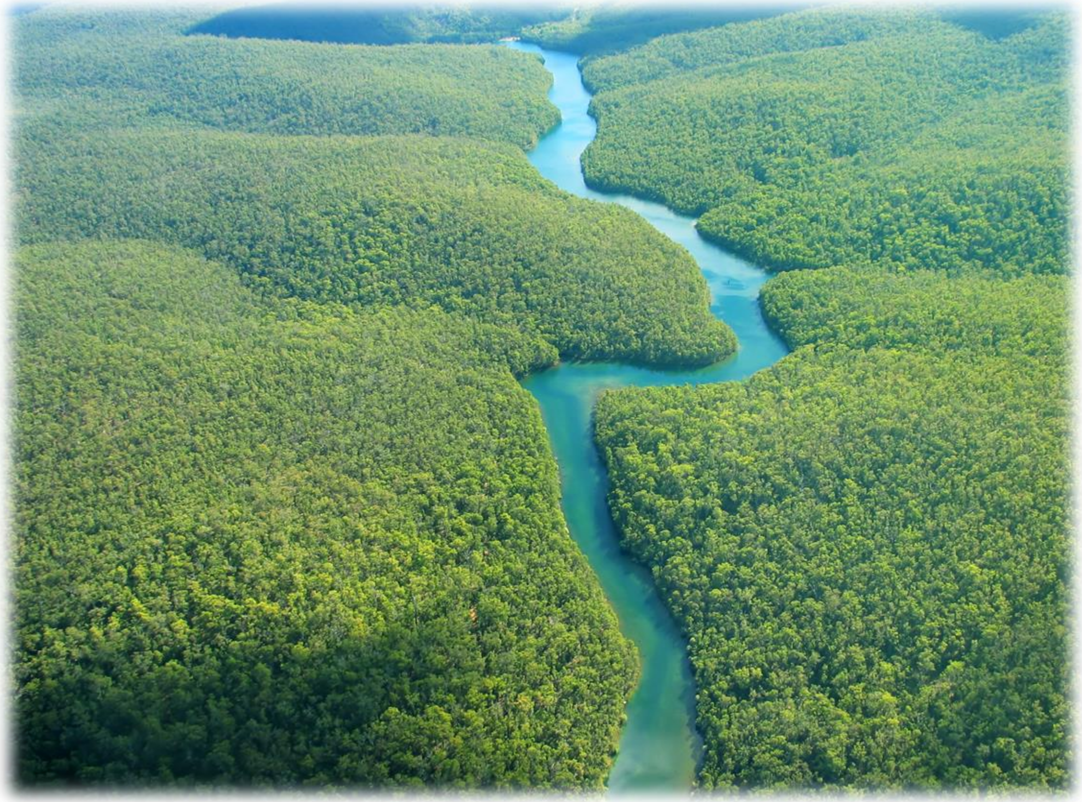
Crop-Based Biofuels Considerations

- Biofuel production must not come at the expense of food production or forests
- Ongoing tracking shows crop-based fuel consumption has historically been steady in the California market but has begun to increase in the last two years
- Other governments have implemented guardrails
- Chair Randolph directed staff to investigate guardrails at the Sept 28, 2023 informational board hearing



Add Crop-Based Biofuels Sustainability Criteria

- Require independent feedstock certification by a certification body approved by the Executive Officer
- Built in a timeline to develop those standards and approval processes by third party certifiers
- Also, propose removing palm-derived fuels from eligibility for credit generation



Streamline Implementation: Pathway Certification

- Credit True-up
  - Mechanism to retroactively provide credits to fuel pathway holders if verified CI is lower than certified CI
- New and updated Tier 1 CI Calculators
  - Broadly applicable to most fuel pathways
  - Will reduce the number of Tier 2 applications
- Verification improvements
  - Clarifying requirements
  - Allowance Option for Less Intensive Verifications

Rulemaking Timeline

January 5, 2024:
45-Day Public Comment Period began

March 21, 2024:
Board consideration and vote on Regulatory Proposal

Late 2024 or early 2025:
LCFS Amendments in Effect

Submit comments into the docket to be considered:

ww2.arb.ca.gov/our-work/programs/low-carbon-fuel-standard

Comment Log Display

Here is the comment you selected to display.

Comment 379 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Don
Last Name	Schinske
Email Address	don@lcfcoalition.com
Affiliation	Low Carbon Fuels Coalition
Subject	UPDATED letter: Low Carbon Fuels Coalition letter
Comment	Updated letter includes additional signers. Thank you!
Attachment	www.arb.ca.gov/lists/com-attach/7062-lcfs2024-BXAFcwFkWWsCcFA1.pdf
Original File Name	UPDATED 240220 LCFC re. ICF Study update.pdf
Date and Time Comment Was Submitted	2024-02-20 20:37:57

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Low Carbon Fuels Coalition

February 20, 2024

The Honorable Liane M. Randolph, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

(Comment submitted electronically)

RE: Recommendation of the Low Carbon Fuels Coalition, with Broad Support from Clean Fuel and Technology Organizations and Companies Requesting that the California Air Resources Board Restore Value to California's Low Carbon Fuel Standard by Recognizing the Full Potential of Electric, Gaseous and Liquid Low Carbon Fuels to Rapidly Decarbonize California While Delivering Criteria Pollutant Emission Reductions

Dear Chair Randolph,

The undersigned organizations and companies are ardent supporters of California's Low Carbon Fuel Standard (LCFS) and sincerely appreciate CARB's diligent and thorough work throughout this rulemaking process in hosting workshops and considering stakeholder feedback to inform the next phase of a historically successful emissions reductions program.

The extraordinary success of the LCFS program in accelerating the growth of a robust clean fuels industry has enabled an accelerated pace of carbon intensity (CI) reduction and a corresponding substantial oversupply of credits. The LCFS credit bank now exceeds 20 million metric tons of CI reduction credits generated in the transportation sector beyond the CI reductions required by the LCFS! But while celebrating this achievement, we also recognize that the profound success of this transformative market-based program has resulted in a precipitous drop in the LCFS credit price which, if unchecked, threatens to trigger a similar drop in clean fuels and technologies investment.

To continue to reap the tremendous greenhouse gas (GHG) and criteria pollutant reduction benefits that the LCFS can deliver, CARB must take aggressive action based on a thorough analysis of the full potential of clean fuels and technologies. Consistent with its history of dedication to the citizens of California, CARB should and consistently does seriously consider concerns raised regarding the possibility of unintended consequences resulting from the transformation to clean transportation. However, CARB should also hold to its history of dedication to empirical evidence, scientific analysis, and public process and not be swayed or intimidated by claims and positions not grounded in evidence and analysis.

The diverse set of companies and stakeholders below support the findings of ICF in two analytical reports commissioned to inform this rulemaking. ICF is the most experienced and respected technical consulting company in this field. Fully informed by the rulemaking record, the latest market information and current LCFS program data, ICF utilized scenario analyses to develop the most empirically based and market informed CI reduction reports for the LCFS rulemaking record:

- *Analyzing Future Low Carbon Fuel Targets in California, Central Case*[1]
- *Analyzing Future Low Carbon Fuel Targets in California, ISOR Case (ISOR Case)*

Deep Technical Engagement

Through this year-long process, we have highly appreciated CARB's willingness to deeply engage at key junctures. This process has included multiple iterative discussions such that ICF and CARB modelers could compare data and methodologies at a granular level thereby enabling ICF and our group to provide the most constructive input possible to the rulemaking record. In order to speak directly to the specifics of the regulatory proposal contained in the proposed regulation and explained in the Initial Statement of Reasons (ISOR), ICF has updated its analysis to fully recognize the policy decisions that are included in the rulemaking proposal. In other words, ICF's attached report does not reflect what the clean fuels industry (including electric, gaseous and liquid fuels as well as LCFS credit-generating projects and infrastructure) has recommended that CARB do in terms of policy decisions. Instead, the attached ISOR Case Report is based solely on what CARB has proposed to do in the LCFS rulemaking proposal.

Key Findings in the ISOR Case and Resulting Policy Recommendations

As previously noted, the LCFS credit bank has reached a historical peak, exceeding 20 million surplus credits. LCFS credit bank growth is continuing to accelerate due in part to the LCFS but now supplemented by Inflation Reduction Act and other federal funding that is more complementary to California's GHG policy structure than in prior years. Indeed, one of the key reasons for ICF's projected LCFS growth curve is the greater policy synergy between California and the federal government. This trend coupled with overperformance has driven LCFS credit to an eight-year low as reported by Aegis Hedging:

> *CARB reported an average California LCFS transfer price of $69.00/t in January 2024, down $4/t, or 5.5%, from December 2023. This marks the lowest transfer price since October 2015. January ICE futures averaged $64.08/t over the course of the month.*[2]

Credit bank growth has accelerated to over 8 million credits per year, and ICF forecasts that the bank will grow to 29-30 million credits by the end of 2024 under current conditions. Further, the ICF analysis indicates that ***the current proposal is insufficient to reverse this trend and will***
370.1 ***only slow credit market growth to about 4 million credits per year***. In order to rebalance the market, both the step down and Automatic Acceleration Mechanism (AAM) should be adjusted in the final rule as described in detail in the attached ICF ISOR Case Report.

---

[1] See Comment of the Low Carbon Fuels Coalition and Supporting Companies and Organizations, September 28, 2023, at https://www.arb.ca.gov/lists/com-attach/27-lcfsupdate2023-VWcGMwQ1VD5RZVJq.pdf

[2] See Aegis Hedging, "AEGIS HEDGING West Coast LCFS Report February 2024 (LCFS Credit & Futures Pricing)," available at https://aegis-hedging.com/insights/aegis-hedging-west-coast-lcfs-report-february-2024-afmgbqerkb43b5btjwbreher#lcfs_credit_pricing (last viewed February 15, 2024).

Based on the ICF analysis, we are writing to strongly encourage CARB to implement three specific adjustments to the LCFS regulatory proposal:

370.2 1.) A Carbon Intensity (CI) reduction target between 41 - 44% for 2030.
370.3 2.) An initial step down of 10.5% to 11.5% in 2025 to achieve a target credit bank equivalent of two to three quarters worth of deficits.
370.4 3.) An Automatic Acceleration Mechanism (AAM) implementation that can be triggered in 2026, with a modification to enact the AAM when the credit bank is more than 2.5 times greater than the quarterly deficits generated in a given year.

370.5 In addition, we urge CARB to maintain the technology neutrality that has enabled the success of the LCFS program.

Increase Initial Step Down for 2025

Based on ICF's analysis of the ISOR, the credit bank will continue to build with the proposed step down of 5%. As stated in ICF's ISOR Case: *"[CARB's] proposed CI step down will slow the bank build by about 50% compared to previous years; however, the credit bank is still likely to grow by nearly 4 million credits by the end of 2025."*

The ICF analysis also shows that a 6.5% step down is necessary to flatten the credit bank build but will not result in a reduction of the credit bank. This analysis indicates that achieving a target credit bank equivalent of 2-3 quarters worth of deficits requires a step down of 10.5% to 11.5% in 2025.

Modify the Automatic Acceleration Mechanism

As stated in the ISOR Case Report:

> *ICF recommends that the Automatic Acceleration Mechanism be considered for implementation as soon as 2026, rather than waiting until 2028. ICF also recommends that the first criteria for the Automatic Acceleration Mechanism be modified such that the mechanism is enacted when the credit bank is more than 2.5 times greater than the quarterly deficits generated in a given year (down from the proposed value of 3 times).*

We recognize that there may be unforeseen market forces that impact the fuel market, as occurred due to the COVID 19 pandemic. Given this reality, we support CARB's proposal to
370.6 establish an AAM that will only trigger a CI reduction when the market metrics pertaining the credit bank size and credit/deficit generation ratio are fulfilled. In the event that credit generation decreases unexpectedly, we note that the AAM will not be triggered.

Maintain Technology Neutrality

Building on successful programs—that have demonstrated environmental and economic benefits—is the lynchpin to continuing to achieve real-world targets. The ICF work shows what is possible if the LCFS remains fuel technology-neutral, driven by updated and sound science, capable of incentivizing real-world investment, and focused on performance-based GHG outcomes. Remaining true to these core concepts will ensure California leads the world in rapid transportation sector decarbonization.

The undersigned Low Carbon Fuels Coalition is a technology neutral trade association representing the entire value chain and types of clean fuels industry stakeholders. The other signatories below represent diverse sectors, technology and service providers, and pathways. We collectively urge CARB to maintain technology-neutrality with the LCFS program, and specifically to avoid provisions that disadvantage particular industries or sectors. That very neutrality has allowed the program to achieve GHG reductions more quickly and cost-effectively than anticipated, as reflected in the greater ambition proposed in this rulemaking.

We stand ready to follow your leadership to address the dire threat of climate change while improving air quality and quality of life for Californians. Additional LCFS ambition will ensure Californians will enjoy the benefits of clean transportation and California continues to lead the world in addressing the climate crisis and improving air quality.

3Degrees American Biogas Council Adelante Consulting Inc. Bayer BTR Energy

CleanFuture Solutions for Sustainability Clean Energy Clean Fuels Alliance America The Coalition for Renewable Natural Gas DG Fuels

gevo Green Plains indigo Life Cycle Associates Low Carbon Fuels Coalition

Neste NXTCLEAN FUELS SHV Energy SCSglobal Services Setting the standard for sustainability SkyNRG

SWTCH Velocys world energy

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Comment 380 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Michael
Last Name	O'Hare
Email Address	ohare@berkeley.edu
Affiliation	UC Berkeley

Subject	Low Carbon Fuel Standards Amendments

Comment

371.1

CARB's plans for assigning carbon intensity to biofuels greatly underestimate the real "carbon intensity" (climate warming effect of specific fuel uses) for all crop-sourced biofuels. The phenomenon of particular importance here, called ILUC for "indirec land use change", has been known and studied at least since 2008; I was the principal investigator of CARB contract research at the University of California when ILUC was incorporated into LCFS estimates. In simplest form, by processes well-known to CARB staff, withdrawing goods from world commodity markets (for example, soybean oil in the US) sets in motion price changes that induce increased production of similar or substitutable goods (for example, palm oil in Indonesia) elsewhere, on land whose conversic to crops (usually from forest or cerrado) releases very large greenhouse gas (GHG) discharges directly attributable to the food-to-biofuel diversion.

The GTAP economic model used by CARB to estimate indirect land use change is seriously and systematically flawed in ways detailed in the "Report on the Economic Basis for GTAP and Use of GTAP Style Models in Biofuel Land Use Modeling" by Steven Berry, Timothy Searchinger, and Anton Yang, from the Yale Tobin Center for Economic Policy. This report has been separately submitted to CARE by its authors. The effect of continuing to use GTAP to estimate biofuel carbon intensity undermines the intent of the LCFS and wil displace real GHG reduction with increased fuel use that actually increases global warming, in addition to causing extremely damagir biodiversity loss and cultural injury, especially in tropical forests.

CARB would better serve the climate policy goals of the LCFS by scoring the actual carbon intensity of biofuels than using GTAP tc estimate land use change effects. I urge CARB to attend carefully to Berry et al's critique and amend the LCFS carbon intensity scoring system accordingly.

Attachment

Original File Name

Date and Time Comment Was Submitted	2024-02-20 20:47:02

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Comment 381 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Mary
Last Name	Elizabeth
Email Address	mebeth@outlook.com
Affiliation	
Subject	LCFS

Comment

372.1 Biofuel have better uses in the soil and I am speaking of manure and woody biomass.
372.2 I live in Stockton where there is a biomass plant, DTE, which is the greatest source of stationary pollution.We live on this planet so when wood pellets from the US are used elsewhere we are contributing to global climate change - money is changing hands and the vulnerable suffer. There is a grey hydrogen plant that want to produce hydrogen from methane at the Port. Not enough requirements for mitigation and hydrogen interferes with the degradation of methane in the atmosphere. Any of these credits have to be phased out as soon as possible. I just received a notice of some organic oils being transported around to become biodiesel: MONTANA RENEWABLES, LLC. Full lifecycle analysis is needed now. Climate Change is now.

372.3 - Eliminate avoided methane crediting for fuel derived from livestock manure.

372.4 - Oppose Proposed LCFS Amendment Loophole to Allow Petroleum Projects with Carbon Capture & Storage Past the 2040 Phase-out.

372.5 - Conduct and incorporate a full life cycle assessment of all air pollution and greenhouse gas (GHG) emissions for all pathways, and their implications for environmental justice communities.

372.6 - Create ZEV multipliers to boost electric school bus and electric public transit bus and rail system deployments.

372.7 - Eliminate credit generation from factory farm gas projects that would have happened anyway due to other programs or investments.

372.8 - Include intrastate jet fuel as a deficit generator and include California's share of the fuel used in interstate and international flights.

372.9 - Allow credits for zero-emission transportation fuels used for ocean-going vessels and simplifying the process for credits for shore power installations serving electrified harbor crafts and fo dispensing green hydrogen.

Attachment	
Original File Name	
Date and Time Comment Was Submitted	2024-02-20 20:36:15

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Comment 382 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name Laura

Last Name Haider

Email Address lauragreen.rosenberger@gmail.com

Affiliation Fresnans Against Fracking

Subject Low carbon Fuel Standard

Comment

373.1 No Subsidies for Fossil Fuel Projects with Carbon Capture: I oppos
the proposed Low Carbon Fuel Standard (LCFS) amendment that would
allow petroleum projects using carbon capture and storage (CCS) to
continue to generate credits beyond the phase-out date of December
31, 2040. Carbon pipelines had leaked.

Attachment

Original File Name

Date and Time Comment Was Submitted 2024-02-20 20:50:32

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Comment 383 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Peter
Last Name	Hawighorst
Email Address	hawighorst@enhancing-sustainability.com
Affiliation	
Subject	Feedback to the proposed Low Carbon Fuel Standard Amendments

Comment

Ladies and Gentlemen,

Thank you for the opportunity to participate in this stakeholder consultation on the planned addition to the LCFS. We very much appreciate this opportunity. We are supporting the additional requirements for low carbon fuels as described in the draft document. In our view, this step is very important and will help t strengthen the program and its credibility in the long term. To further strengthen this initiative, we would like to recommend the following aspects:

374.1 - We think that it is helpful to set out more detailed guidelines for social and environmental criteria for the cultivation of sustainable feedstocks on farm level, e.g. to describe "good agricultural practices" or "best practice" for plant protection product application, working security, social standards, etc. Further, it would be important to have criteria for the long-term maintenance of soil fertility, as this is an essential factor for the long-term maintenance of production capacity and sustainabilit

374.2 - Clearer guidance on the verification process for farms would be beneficial, especially the option for group sampling on farm level to prove compliance with the set out requirements would help farmers to minimize audit efforts.

374.3 - Biodiverse land areas as well as peat and wetlands should be protected as those areas are crucial for preserving biodiversity. They should be "fully" protected if not used for agricultural production in the last years, or at least restrictions on their us should be defined to preserve them.

374.4 - We think that it would be beneficial to cooperate with established certification schemes. The Board can implement a process for the recognition of qualified certification schemes who then cooperate with certification bodies to conduct the verification processes in the future. This set-up would be helpful for the Board, as it ensure a credible verification process for th set out requirements as it helps to:

a) establish a "triangle" between the certification bodies, 374.4 cont. economic operators and the schemes with clear roles and responsibilities ("balance of power"), to ensure a global, transparent and independent verification process, a conflict of interest-free auditing framework provided by the certification schemes and ensuring the transformation of the certification requirements into practical audit documents, checklists and guidelines via the scheme

b) enable a regional and technical multi-stakeholder dialogue

c) enable the scheme to set up a training and qualification progra
for certification bodies, auditors and economic operators

d) support the continuous management and improvement of the certification set-up by the scheme

e) ensure the ability to run the scheme for global supply chains

f) establish and improve credibility via whistleblower tools, companies and grievance mechanisms established and an integrity program which is overseeing and monitoring auditor performance and
economic operators

374.5 We support the stakeholder process and are very grateful for the opportunity to provide feedback on the planned project in this way
we would be delighted if our feedback was taken into account.
Please do not hesitate to contact us if you have any questions.

With best regards
Peter Hawighorst

Attachment

Original File Name

Date and Time Comment Was Submitted	2024-02-20 20:45:28

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Comment 384 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Dan
Last Name	Willis
Email Address	dwillis@sfwater.org
Affiliation	San Francisco Pub Utilities Commission
Subject	SFPUC, SFMTA, SF Airport - LCFS Rulemaking Comments
Comment	Thank you for considering the attached joint comments from the San Francisco Public Utilities Commission, the San Francisco Municipal Transportation Agency, and the San Francisco International Airport
Attachment	www.arb.ca.gov/lists/com-attach/7068-lcfs2024-AHNWNlAhByEGYwlW.pdf
Original File Name	SFPUC_CARB_LCFS_Comments_022024.pdf
Date and Time Comment Was Submitted	2024-02-20 21:17:18

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San Francisco, CA 94103

San Francisco International Airport
P.O. Box 8097 | San Francisco, CA 94128

February 20, 2024

Recommendations to the California Air Resources Board Regarding Low Carbon Fuel Standard Rulemaking

The San Francisco Public Utilities Commission (SFPUC), the San Francisco Municipal Transportation Agency (SFMTA), and the San Francisco International Airport (Airport) (together, the City), offer the following comments on the California Air Resources Board's (CARB) proposed modifications to its Low Carbon Fuel Standard (LCFS) program. A well-designed LCFS program should support local governments and transit agencies in achieving both California's greenhouse gas (GHG) reduction goals[1] and the climate action goals of local governments, especially with respect to reducing emissions via clean transportation.

The City generates LCFS credits in several ways. The SFPUC provides zero-carbon intensity (CI) electricity to its customers through a Lookup Table pathway via "book and claim" accounting.[2] SFMTA receives most of this electric energy to power and run one of the nation's largest fleets of zero-GHG light rail, trolley bus, historic streetcar, and cable car fixed guideway systems. Charging the SFMTA's electric battery buses also generates a small number of credits. The sale of these LCFS credits is an important revenue stream for the SFMTA as it looks to maintain and improve its clean transit network, particularly at a time when the SFMTA and other public transit agencies across California continue to face depressed revenues and other financial impacts due to the pandemic and still-recovering ridership levels. The SFPUC also provides zero-CI energy to the Port of San Francisco to provide shore-side charging to cruise ships, to the Airport for its AirTrain[3] service, and has begun providing EV charging at select City parking facilities.

The SFPUC, SFMTA, and Airport request the following changes and offer the following comments to the proposed amendments prior to their adoption.

375.1 1. The scope of any proposed third-party verification requirements for electricity transactions should be narrowed significantly. CARB should develop a separate and simpler reporting/verification process for electric LCFS providers that recognizes the extensive pre-existing regulation of the electric sector.

375.2 2. The cost of verification for the electric sector for public entities is too high and will deter development of this critical sector of the LCFS program.

[1] 2022 Scoping Plan for Achieving Carbon Neutrality (2022 Scoping Plan).
[2] LCFS Section 95488.8(I).
[3] A fixed guideway system under CARB regulations.

375.3 3. All fixed guideway transit systems should generate LCFS credits considering the fuel efficiency of electric transportation, regardless of when the systems began operations.

375.4 4. Public Transit agencies must retain the discretion to determine how best to use LCFS proceeds from Fixed Guideway Systems to maintain California's public transit system in its time of financial challenges.

375.5 5. Each electric LCFS credit provider should be allowed to use the carbon intensity value of its electric retail seller, as calculated in the California Energy Commission's Power Source Disclosure Program, for purposes of determining the amount of its LCFS credit.

Each of these issues and recommendations are discussed below.

375.1 cont. **1. The scope of any proposed third-party verification requirements for electricity transactions should be narrowed significantly. CARB should develop a separate and simpler reporting/verification process for electric LCFS providers that recognizes the extensive pre-existing regulation of the electric sector.**

The proposed amendments to section 95500 would add a third-party verification requirement for almost all LCFS electricity transactions.[4] The only stated reason for this verification is the rapid growth in electric usage as a component of the LCFS program and corresponding imposition on CARB staff to review.[5] Nowhere does CARB identify any irregularities in electric LCFS reporting.

While some additional verification may be needed for the electric sector, CARB's proposed approach attempts to put a "Square peg in a round hole" by shoehorning electric verification into a review process designed almost exclusively for fossil fuels, fails to recognize the extensive existing regulatory oversight of the electric industry, and could hinder electric energy LCFS usage due to the high cost of LCFS verification.

If CARB believes there is a need for verification of electric energy LCFS usage, CARB should develop a separate and simplified verification process that recognizes the pre-existing regulatory framework that governs the electric sector rather than putting in place an unnecessarily burdensome verification process. This process could be as simple as providing applicable electric bills from the retail service provider, applying the applicable carbon intensity already calculated by CARB, and at most an initial site visit to ensure that metered energy usage is matched to LCFS load. All of this data could be provided and verified without an expensive new verification process.

a. Electric energy used for the LCFS program is already highly regulated, minimizing the need for additional verification.

Unlike biofuels which have a long supply-chain (in some cases as far away as Brazil) or lower CI-fossil fuels such as reformulated gasoline which are manufactured as part of a multi-product

[4] Proposed Section 99500(c)(1)(D).

[5] Proposed Amendments to the Low Carbon Fuel Standard Regulation, Appendix E: Purpose and Rationale. 1/2/24 Update, Page 117.

375.1 cont. refining process, electric energy used for the LCFS program has a far simpler and established delivery path subject to a high level of regulatory oversight.

Verifying the use of electric energy for the LCFS consists of three components – the amount of energy delivered, its carbon intensity, and ensuring that delivered energy is used for LCFS purposes.

Other than self-generation, all electric energy is delivered in California by publicly and privately owned utilities that are required to provide "revenue quality" meter data[6] to their customers and are subject to extensive regulation.

For California's investor-owned utilities, Public Utilities Code Section 770 requires the California Public Utilities Commission (CPUC), among other requirements, to:

- "Ascertain and fix adequate and serviceable standards for the *measurement of quantity*, quality, pressure, or other condition pertaining to the supply of the product, commodity, or service furnished or rendered by any such public utility"[7]
- "*Establish reasonable rules, specifications, and standards to secure the accuracy of all meters and appliances for measurements*. …"[8]; and
- *"Provide for the examination and testing of any and all appliances used for the measurement of any product*, commodity, or service of any such public utility."[9]

As California's investor-owned utilities perform billing services for Community Choice Aggregators (CCAs) and Energy Service Providers (ESPs), LCFS customers receiving service from these entities also receive the same level of verified billing. California's publicly owned electric utilities have adopted similar safeguards to ensure the accuracy of metered energy usage, and have no incentive to misrepresent reported data.

For purposes of collecting necessary taxes and fees, the State Board of Equalization requires that every electric utility in the state:

> Shall keep and maintain adequate and complete records showing... meter readings and other records as may be necessary for the accurate determination of the kilowatt-hours of electrical energy generated, purchased, consumed, or sold in this state.[10]

California's electric retail providers are subject to additional regulations requiring that metered data be accurately reported. This includes retail seller filings to the California Energy Commission for purposes of its Power Source Disclosure (PSD) program which must be either independently verified or attested to by the governing body if a publicly owned utility.[11] Electric utilities reporting to the federal Energy Information Administration, including customer sales,

[6] American National Standard for Electric Meters, Code for Electricity Metering for Accuracy, Section 5.1.2.2 says "the performance of all watthour meters is considered to be acceptable when the percent registration is not less than 98% or more than 102% as determined in Section 5.1.5."
[7] Public Utilities Code Section 770(b), emphasis added.
[8] Public Utilities Code Section 770(d) emphasis added.
[9] Public Utilities Code Section 770(e) emphasis added.
[10] California Code of Regulations, Title 18, Division 2, Chapter 5. Article 1, Regulation 2343(b)(2)
[11] Public Utilities Code Section 398.4 to 398.6.

are subject to civil or criminal penalties for misrepresentation.[12] The California Independent System Operator (ISO) also requires electric retail sellers to meet strict metering requirements.[13]

The second component of LCFS electric energy usage is its carbon intensity. CARB has already addressed this issue through its use of either a standardized state-wide CI for electric energy or use of the Western Renewable Energy Generation Information System (WREGIS) to track the environmental attributes of claimed electric generation under "book and claim" accounting. The California Energy Commission (CEC) has found that WREGIS meets the requirements of Public Utilities Code section 399.21(a)(1), which requires a system "capable of independently verifying that electricity earning the credit is generated by an eligible renewable energy resource and can ensure that renewable energy credits shall not be double counted ..."[14] As explained further below, the CEC's Power Source Disclosure program also meets CARB's requirements for accurately calculating the CI intensity of provided electric energy.

375.1 cont.

The third component of LCFS electric energy usage is to ensure that reported generation is used for LCFS purposes, a component that CARB recognizes is not an issue. Staff's Initial Statement of Reasons (ISOR) notes:

> *There is little change of operation from reporting period to reporting period thus reducing the benefit of annual site visits*. If a verification body conducts a site visit as part of verification services and issues a positive verification statement in year one, *there is no or little risk to the integrity of the LCFS program to allow for less intensive verification services* without a site visit in the annual verifications for the following two years.[15]

b. <u>CARB should not attempt to shoehorn electric usage verification into an inapplicable verification system focused almost exclusively on fossil-fuel usage.</u>

Instead of using the existing verification tools identified above, CARB attempts to shoehorn electric usage verification into an inapplicable verification system focused exclusively on fossil-fuel usage.[16] Other than adding electric LCFS to this verification requirement,[17] this results in numerous confusing, onerous, and in many cases inapplicable requirements upon electric LCFS providers.

As noted above, publicly and privately owned utilities already provide metered energy usage to LCFS providers for which the utility is responsible for ensuring its accuracy and calibration. Extending the verification requirement to electric LCFS providers duplicates this process by making them subject to the requirements of Section § 95491.2, Measurement Accuracy and Data

[12] EIA guidelines on utility reporting, including sales are available at https://www.eia.gov/survey/form/eia_861/instructions.pdf. As noted in the guidelines: "This report is mandatory under Title 15 U.S.C. §772(b)... Title 18 U.S.C. §1001 makes it a criminal offense for any person knowingly and willingly to make to any Agency or Department of the United States any false, fictitious, or fraudulent statements as to any matter within its jurisdiction."

[13] California ISO metering requirements for California's electric system can be found at: https://www.caiso.com/market/Pages/MeteringTelemetry/Default.aspx.

[14] Public Utilities Code Section 399.21. The CEC approved its RPS Eligibility Guidebook in Resolution 13-0430-4.

[15] Purpose and Rationale, p. 119-120, emphasis added.

[16] Section 99500(c)(1)(A), (B), and (C).

[17] Proposed Section 99500(c)(1)(D).

375.1 cont. Provisions.[18] This section now requires electric LCFS credit generators to be responsible for the "calibration" and "accuracy" of the "Measurement devices that provide data used to calculate LCFS credits."[19] In reality, for electric LCFS providers, the only applicable measurement device is the electric meter itself. Generally, this meter is under the control of the electric utility, not the LCFS provider. Any attempt by a LCFS provider, who did not control the meters, to "calibrate" the meter would constitute tampering which is a misdemeanor under California law.[20] This section does not include a waiver provision, only an inapplicable deferral provision.[21]

Paradoxically, this regulation allows up to a 5% error range in measurement accuracy,[22] two and a half times the 2% error range required of electric utility "revenue quality" meters.[23]

Thus, the proposed regulations would now require LCFS electric providers to duplicate the same measurement, calibration, and accuracy requirements that California's publicly and privately owned utilities already provide.

Indeed, in several portions of the regulation it appears that CARB already considers metered utility data alone as sufficient to meet verification requirements. The regulation's definition of "Site-specific Data" and "Site-specific Input" requires that this data "must be measured, metered or otherwise documented, and verifiable." For "grid electricity" this requirement "must be documented by invoices from the utility."[24] Even within the monitoring requirements required of the verification process, it appears that "copies of monthly utility bills" are acceptable as records.[25] As part of "site visits" (discussed further below) it appears verifiers only need to focus on "measurement accuracy requirements" only for those "devices that do not meet criteria for financial transactions"[26] (i.e. a utility's revenue quality meter.)

In addition to creating a largely duplicative process for verifying metering access, the proposed verification requirements would also require "site visits" by the verifiers. As the regulations state:

> At least one lead LCFS verifier.... must...annually visit each facility; and, if different from the fuel production facility, the central records location for which the records supporting an application or report subject to verification are submitted.[27]

In the case of EV charging, each charger counts as a "fuel production facility" potentially requiring site visits to tens if not hundreds of EV charging facilities located throughout a city.

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[18] Appendix A-1: Proposed Regulation Order (Proposed Sections for Amendments).
[19] Section § 95491.2,(c)(1)(G),(H) and (I).
[20] California Penal Code, Section 498.
[21] Section § 95491.2(c)(1)(K).
[22] Ibid.
[23] American National Standard for Electric Meters, Code for Electricity Metering for Accuracy, Section 5.1.2.2 says "the performance of all watthour meters is considered to be acceptable when the percent registration is not less than 98% or more than 102% as determined in Section 5.1.5."
[24] LCFS Regulations Section 95481.
[25] LCFS Section 95491.1(a)(1)E).
[26] LCFS Section 95501(b)(3)(A)(5).
[27] LCFS Section 95501(b)(3).

375.1 cont. For the SFMTA's transit system, this could include numerous site visits along the SFMTA's 71-mile light-rail system and numerous additional site visits for the SFMTA's overhead catenary street bus system. For each site visit, the regulations specify a number of requirements the verifier must carry out as part of the visit, many of which duplicate existing utility meter accuracy requirements.[28]

The site-visit also includes a requirement to:

> Directly observe production equipment, confirming diagrams for processes, piping, and instrumentation; measurement system equipment; and accounting systems for data types determined in the sampling plan to be high risk.[29]

Once again, while such requirements may be appropriate for complex fossil-fuel production facilities such as refineries, these requirements are not needed where the only energy provided is being done through a utility meter.

c. CARB's proposed methods to minimize the reporting burden on electric LCFS providers are insufficient.

In response to concerns described in the section above, CARB staff did state it will work to modify the verification process to attempt to accommodate the unique aspects of electric LCFS providers. Unfortunately, any guidance documents CARB prepares cannot supersede the actual regulatory language, which in the case of verification is exceedingly proscriptive and leaves little flexibility. This process will be exacerbated by the existing qualification process for verifiers which is focused almost exclusively on fossil-fuel usage and is not proposed to be updated to require electric industry expertise.[30]

CARB staff did propose electric LCFS providers have the opportunity to be subject to "less intensive verification" for the two years following a full verification.[31] However, this still requires electric LCFS providers to go through the costly verification process once every three years. Even with this option, electric sector verification costs (as discussed below) will still exceed five billion dollars over the LCFS timeframe studied. There are also additional limitations and conditions on the ability of electric LCFS providers to use this option.[32]

375.6 **d. If CARB proceeds with its existing proposal, at a minimum it should make the following changes and not make the verification requirement applicable until the 2024 reporting year.**

CARB's attempts to minimize verification costs by applying a "less intensive verification" process, while steps in the right direction, are fundamentally flawed in continuing to use a process based on fossil-fueled transactions.

[28] LCFS Section 95501(b)(3)(A)(1) to (6).
[29] LCFS Section 95101(b)(3)(A)(5).
[30] This can be seen by examining CARB's guidance document on the verification process (Low Carbon Fuel Standard Annual Reporting and Verification User Guide Version v 1.5) and CARB's requirements for verifiers (LCFS Regulation Section 95303.) For example, there is no requirement for any electric energy expertise for verifiers.
[31] Proposed Amendments Section 95501(h).
[32] Proposed Amendments Section 95501(h)(1)-(5).

375.6 cont. If CARB nonetheless continues to use the fossil-fuel based verification requirements to verify electric LCFS usage, at a minimum it should consider the following modifications.

- Significantly reduce reporting requirements for public entities, such as public transit agencies. These entities have little or no incentive to misrepresent their reporting. Similar to the CEC's attestation process for the Power Source Disclosure program, this could consist of self-attestation by the public agencies governing board or the use of internal auditing processes.
- Extend the verification process to a longer time-period and eliminate the annual verification requirement.
- After initial verification, only require a subsequent verification if reported LCFS credits increase by more than 25% as a result of a reporting entity adding new Fueling Supply Equipment.
- Exempt smaller LCFS credit generators (perhaps 500 credits or less).

CARB should also clarify that any verification begins no earlier than 2025 for reporting of 2024 transactions. For public agencies with long lead times to set up contracts with new counterparties, it may not be feasible to hire a verification body in time for an August 31, 2024 reporting of 2023 LCFS data.

375.2 cont. **2. <u>The cost of verification for the electric sector is too high and will deter development of this critical sector of the LCFS program.</u>**

As shown above, a significant portion of CARB's proposed verification requirements duplicate existing electric sector regulatory oversight or could be included into a streamlined CARB verification process.

The Initial Statement of Reasons estimates additional verification costs for the electric and hydrogen sectors at $5.5 billion over the LCFS timeframe studied.[33] This estimate is low as it appears to include only the direct costs of verification and not the internal costs that electric LCFS providers will incur in acquiring and contracting for LCFS verifiers and responding to their informational requests.[34]

This latter issue is a particular problem for public agencies that have local hiring and additional workforce requirements in their contracting processes that make it difficult to hire from the relatively small list of approximately 30 CARB-accredited verification bodies.[35] This process will only be exacerbated by the sudden influx of newly-regulated electric entities chasing after this small number of verifiers.

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[33] ISOR, p. 69 estimates incremental verification costs at $5.5 billion, supposedly after adjusting for "less intensive" verification. This figure is not broken down by sector or in cost per MWh. The SRIA, Appendix C, p. 21 estimated incremental verification costs to the electric sector at $5.88 billion.

[34] The SRIA, at p. C-21 shows that every dollar spent on verification by the "Electric power generation, transmission, and distribution" sector (NAICS Code; 2211) results in a dollar being transferred to "Management, Scientific, and Technical Consulting Services" (NAICS Code 5416) incorrectly implying that electric utilities incur no internal cost in meeting the verification standards.

[35] As noted above, one solution to this problem would be to allow public entities to self-attest to the accuracy of their filings, as the CEC does for its Power Source Disclosure program` or use internal auditors for verification.

375.2 cont. The excessive verification costs applied to the electric sector will hinder the development of the LCFS market, both due to the cost and administrative burden of acquiring a verifier. It is critical for CARB to seek to minimize these costs to provide more revenues for incentivizing further electrification efforts.

Despite repeated requests CARB has failed to provide any of the calculations, worksheets, or assumptions that went into developing its cost estimates for verification that would make it possible to determine compliance costs depending upon the size and type of entity.

The only estimate provided by CARB calculated LCFS verification costs for the electric sector of $6/MWh. This estimate is a composite figure for all entities and is not broken down by size or type of electric service (e.g. fixed guideway, forklifts, EVs.)[36] Thus, verification costs for smaller entities are likely significantly understated even taking into account the "less intensive" verification process.

This level of cost could prove a significant deterrent for both small and large LCFS credit providers. For example, the SFPUC recently began generating LCFS credits from a small number of electric vehicle (EV) charging stations for employees at a public health clinic. The SFPUC aims to grow this program offering over time, but it may not be able to establish and scale the program successfully as any amount of third-party verification costs significantly outweigh the credit generation potential for the first several years of the program.

Even for larger credit generators, such as the SFMTA's mass transit system, which generates about 15,000 LCFS credits per year, the costs of verification would be significant. It currently takes about 3 MWh of RPS-eligible power (3.27 MWh) to generate one LCFS credit for SFMTA or about $22/MWh in revenue at a price of $70 to $80 per credit.[37] CARB's estimated compliance cost of $6/MWh would thus constitute almost one third of total LCFS revenues.

375.3 cont.

3. **<u>All fixed guideway transit systems should generate LCFS credits considering the fuel efficiency of electric transportation, regardless of when the systems began operations.</u>**

As discussed in SFPUC/SFMTA and other transit agency letters submitted during the pre-rulemaking phase,[38] the current LCFS regulation section 95486.1 arbitrarily limits the number of credits earned by fixed guideway transit systems that were built before 2011. This distinction – applying the Energy Economy Ratio (EER) multiplier to recognize the efficiency of electric transportation relative to diesel-powered transportation *only* to newer systems – is not made for any other fuel pathway technology in the regulation as proposed. The result is to understate the amount of LCFS credits existing transit systems receive by a factor of at least three times (3.1, 3.3, or 4.6 times depending on the type of system).[39] This multiplier reflects that public transit systems help take drivers off the road and help reduce Vehicle Miles Traveled (VMT).

The current treatment of these older transit systems conflicts with CARB's goals laid out in its 2022 Scoping Plan to significantly reduce VMT. As the 2022 Scoping Plan notes:

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[36] SRIA Appendices Appendix A: Methodology for Estimating Costs.

[37] Based on SFPUC/SFMTA 2022 Q1 to Q3 data and the then current credit price of $70 to $80.

[38] See SFPUC/SFMTA Recommendations Regarding Low Carbon Fuel Standard Rulemaking (November 7, 2023) submitted to CARB as part of its pre-rulemaking request for comments.

[39] LCFS Regulation Table 5. EER Values for Fuels Used in Light- and Medium-Duty, and Heavy-Duty Applications.

375.3 cont.

> Transforming the transportation sector goes beyond phasing out combustion technology and producing cleaner fuels. Managing total demand for transportation energy by reducing the miles people need to drive on a daily basis is also critical as the state aims for a sustainable transportation sector in a carbon neutral economy.[40]

After recognizing that, the 2022 Scoping Plan adds:

> The transit industry…was significantly impacted during the lockdown months and has struggled to recover; ridership only averages two-thirds of pre-pandemic level and service levels also lag behind.[41]

The 2022 Scoping Plan recognizes the importance of adequate funding of public transit, stating as a "Strategic Objective" the need to "Invest in making public transit a viable alternative to driving by increasing affordability, reliability, coverage, service frequency, and consumer experience."[42]

Applying the EER multiplier to all transit would increase revenues available to transit agencies (2025-2046) from $840 million[43] to about $2.5 billion.[44] While providing a critical incremental jolt of revenue to transit agencies, this change would only represent about 2% of the total LCFS market of $120 to $150 billion during this time-period.

For the SFMTA, where most of the fixed guideway systems are pre-2011, including light rail (3.3 multiplier), electric trolleys, cable cars, and street cars (3.1 multiplier), the SFMTA would increase revenues from its fixed guideways to support transit operations from about $1.6 to $4.8 million/year. [45]

There is no engineering justification for this disparate treatment. Instead, it appears to be the results of the delay in the start of the LCFS regulation. Despite CARB Board directives in both 2009 (Resolution 09-31) and 2011 (Resolution 11-39) that staff consider the inclusion of mass transit in the LCFS program, implementation did not occur until 2016.[46] During the rulemaking some parties objected to the inclusion of mass transit contending that it was not included in the 2010 baseline used to set the starting point against which LCFS-eligible reductions would be calculated.

As CARB concluded:

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[40] 2022 Update to AB 32 Scoping Plan (AB 32 Scoping Plan), p. 192. 2022 Scoping Plan Update (ca.gov)
[41] Ibid, p. 192-193.
[42] Ibid, p. 194.
[43] SRIA, p. 66.
[44] This assumes all transit agencies would qualify for a 3.3 multiplier as the vast majority of fixed guideway infrastructure, other than incremental expansions, occurred before 2011. CARB staff can refine this number as necessary.
[45] Assuming early-2023 LCFS credit prices at 2023 service levels.
[46] 2015 LCFS Rulemaking Final Statement of Reasons. https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf

375.3 cont. Early adopters of lower carbon intensity fuels, such as electricity, should not be penalized by excluding them from LCFS credit generating. Instead, they should be incented to continue and expand such applications.[47]

This conclusion is consistent with, and supported by, CARB's statutory requirement to:

> Ensure that entities that have voluntarily reduced their greenhouse gas emissions prior to the implementation of this section receive *appropriate* credit for early voluntary reductions.[48]

However, while recognizing these early voluntary GHG reductions, CARB stopped sort of giving them full credit, stating that;

> The LCFS credit formulas for all electric forklifts and existing electric fixed guideways *do not include credits for fuel displacement, which substantially reduces the number of credits these electrical applications could generate*. In contrast, the LCFS credit formula for new electric fixed guideway system does have the fuel displacement credits. This approach addresses the commenter's concerns related to allowing sources to generate credits without including them in the 2010 baseline.[49]

Public transit should not receive artificially low credit for its early actions to reduce GHG emissions, particularly if it results in reduced public transit levels and increasing VMT.

As there is no difference in fuel efficiency associated with the year in which these transit systems were built, the EER multiplier should apply to older transit systems as well as newer ones to more accurately reflect the quantity of high carbon intensity fuel displaced by their use. In addition, there is ample reason to fully support and encourage clean transit as SFMTA and other transportation agencies across California face considerable financial uncertainty as ridership struggles to recover from pre-pandemic levels. Continuing to support transit agencies financially is necessary to maintain the emissions-reducing benefits that these systems provide.

375.4 cont. **4. Public Transit agencies must retain the discretion to determine how best to use LCFS proceeds from Fixed Guideway Systems to maintain California's public transit system in its time of financial challenges.**

Under the current LCFS regulations, there are no restrictions on the use of LCFS proceeds from Fixed Guideway Systems. As the SFPUC has previously noted to CARB, this exclusion:

> …[R]eflects that the operators of these systems have separate obligations to reduce GHG-emissions. Almost all operators of Fixed Guideway Systems are government agencies…As public agencies, transit operators are not-for-profit, overseen by elected and appointed public officials, and mandated to promote public transit electrification. ...
>
> The existing regulations, however, provide public transit agencies the flexibility to decide how LCFS proceeds should be used to achieve California's GHG-reduction goals,

[47] 2015 LCFS Rulemaking Final Statement of Reasons, page 843.
[48] Health & Safety Code Section 38562(b)(3) (emphasis added).
[49] 2015 LCFS Rulemaking Final Statement of Reasons, page 843 (emphasis added). https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/fsorlcfs.pdf

375.4 cont.

> whether it is investment in vehicles, energy infrastructure, or efforts to increase or sustain ridership comfort and safety, outreach, or other activities. CARB should respect and defer to these public officials regarding the best use of LCFS proceeds…[50]

Under the proposed regulation, it appears that CARB staff has inadvertently eliminated the discretion provided to these public agencies and their governing bodies. Although incorrectly described as "No substantive changes to existing requirements were made,"[51] the proposed regulations would now require that LCFS revenues from Fixed Guideway Systems be used for "transportation electrification" purposes.[52]

In proposing this change CARB lists several subsections of the current regulation[53] that cross-reference a requirement (Section 95491(d)(2)) that LCFS proceeds be used to promote EV development in California. Notably absent from this list is Section 95483(c)(3) which covers Fixed Guideway Systems and specifically contains no cross-reference to this spending requirement.[54]

Somewhat mitigating this incorrect classification is that CARB has expanded the use of LCFS proceeds from a limited use for "EV development" to a broader use for "further transportation electrification efforts."[55]

The SFPUC supports this change provided it allows public transit agencies to broadly use LCFS proceeds in any way that benefits electric transportation, including as recognized in the 2022 Scoping Plan, the "strategic objective" to "Invest in making public transit a viable alternative to driving by increasing affordability, reliability, coverage, service frequency, and consumer experience."[56] This is consistent with the Standardized Regulatory Impact Assessment's (SRIA's) description of the use of LCFS proceeds to meet operating expenses where "the transit agency is the generator of credits, and thus the LCFS credits will represent cost savings to the transit agency and effectively reduce the price of electricity used to power battery-electric buses."[57] Allowing transit operators to retain this discretion and flexibility in spending will be critical as they continue to face on-going financial challenges.

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[50] SFPUC Comments on the CARB Staff's proposed Low Carbon Fuel Standard Guidance 20-03: Electricity Credit Proceeds Spending Requirements (April 14, 2020).

[51] Purpose and Rationale, page 110.

[52] Proposed Amendments Section 95491(e)(5). Uses of Electricity Credit Proceeds.

[53] According to CARB's Purpose and Rationale Document, page 110, "The general annual reporting requirements for electricity credit proceeds cross-referenced by several subsections in 95483 (i.e., subsections 95483(c)(1)(A), 95483(c)(1)(A)6, 95483(c)(1)(B), 95483(c)(2)(C), and 95483(c)(4)) were previously listed as a subsection of 95491(d), which is "Specific Reporting Requirements for Quarterly Fuels Transactions Reports."

[54] Section 95483(c)(3) only requires that paragraphs 3 and 5 of Sections 95491(3) apply to Fixed Guideway Systems. Neither of these paragraphs restrict the use of LCFS proceeds.

[55] Proposed Amendments Section 95491(e)(5). Uses of Electricity Credit Proceeds.

[56] 2022 Scoping Plan, p. 194.

[57] SRIA, p. 57.

375.5 cont. **5.** <u>**Each electric LCFS credit provider should be allowed to use the carbon intensity value of its electric retail seller, as calculated in the California Energy Commission's Power Source Disclosure Program, for purposes of determining the amount of its LCFS credit.**</u>

In its rulemaking CARB proposes to update the carbon intensity of electric energy to ensure that it is accurate and reflects the latest available data.[58]

For electric energy used directly as a transportation fuel or for hydrogen production, electric LCFS providers currently have two main choices for determining carbon intensity.[59] They can either use the single state-wide average as calculated by the CEC[60] or they can use a zero-CI Lookup Table Pathway where they can document that their electric energy is sourced from zero-GHG RPS-eligible renewable resources.[61]

CARB should add a third option to this choice, allowing electric LCFS providers to use the CEC's verified GHG emissions from the Power Source Disclosure reports of the electric retail seller that provides them with electric service. This third option would use the same CEC data used by CARB to determine the state-wide average, but assign it on a more granular level to each electric LCFS provider. It would also allow electric LCFS providers to use their retail seller's Power Source Disclosure reports to document a "low-CI" energy portfolio through the simplified use of CARB's Lookup Table Pathway. Allowing electric LCFS providers to use this data would result in even more accurate reporting of GHG emissions, encourage electric LCFS providers to seek out providers with lower GHG emissions, send better price signals, and avoid distortions in GHG reporting that could influence future investment decisions in LCFS infrastructure.

CARB's last revisions to its LCFS program preceded the CEC's implementation of AB1110 (Chapter 656, Statutes of 2016) effective for calendar year 2020 reporting. AB1110 required the CEC to:

> Adopt a method, in consultation with the California Air Resources Board (CARB), for calculating the GHG emissions intensity corresponding to each purchase of electricity by a retail supplier to serve its consumers; and in doing so; … Rely on the most recent verified greenhouse gas emissions data…[62]

According to Assemblymember Phillip Ting (AB1110's author), his legislative intent was:

> …[T]hat the CEC's approach should be consistent, to the extent practicable, with the approach taken by ARB under its existing programs including the Mandatory Greenhouse Gas reporting requirements, Cap-and-Trade, as well as the CEC's Power Source

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[58] Initial Statement of Reasons, p. 35.

[59] Electric LCFS providers could also use the more lengthy, complex, and difficult process of a Tier 2 Pathway application.

[60] 2024 Update: California Average Grid Electricity Used as a Transportation Fuel in California and Electricity Supplied under the Smart Charging or Smart Electrolysis Provision. https://ww2.arb.ca.gov/resources/documents/lcfs-pathways-requiring-public-comments?utm_medium=email&utm_source=govdelivery

[61] LCFS Section 95488.8(i).

[62] Public Utilities Code Section 398.4(k)(2)(A) and (C).

375.5 cont. Disclosure Program. These programs include protocols for reporting data on GHG emissions and allowing specific adjustments to compliance obligations. By conforming its approach to the ARB programs, the CEC would ensure consistent treatment amongst GHG programs administered by the state.[63]

As implemented by the CEC, the CEC now provides each retail seller of electric energy's carbon intensity in lbs/MWh, through annual Power Source Disclosure reports.[64]

The adopted CEC regulations essentially mirror CARB's Mandatory Reporting Requirements for GHG reporting. This includes: prohibiting the use of unbundled RECs in calculating GHG emissions; ensuring electric energy is claimed only once for GHG-reporting purposes; consistent GHG-reporting of firmed and shaped resources and energy supplied by Asset Controlling Suppliers;[65] and using either MRR-reported GHG emission factors for electric energy acquired from specified sources, or using CARB's default emission factor (941 lbs/MWh) for "unspecified power." These results must in turn be either independently verified according to processes established by the CEC, or, in the case of public entities, attested to their veracity by their governing boards. The CEC retains its authority to review these filings, identify discrepancies and institute enforcement actions for misrepresentation or non-compliance.[66]

As a result of AB1110's implementation, CARB should allow electric LCFS providers to use the corresponding carbon intensity of their individual retail supplier in calculating the amount of their LCFS credits.

CARB has already validated the AB1110 methodology and its use of this CEC data to calculate state-wide electric sector average GHG emissions[67] used for LCFS transportation purposes. Given the importance of electric energy in meeting CARB's LCFS and GHG reduction goals, it makes sense that CARB should use the best, most accurate and granular data for determining electric sector GHG emissions rather than use a single state-wide average that distorts GHG reporting.[68]

The use of the CEC Power Source Disclosure report methodology is consistent with the 2022 Scoping Plan's goal to coordinate with other state initiatives to reduce GHG emissions.[69] This

[63] ASSEMBLY DAILY JOURNAL, 2015–16 REGULAR SESSION, p. 6588 (August 31, 2016).

[64] Modification of Regulations Governing the Power Source Disclosure Program Effective May 4, 2020 (Rulemaking 20-PSDP-01, CEC Document #: TN 232986).

[65] Out-of-state entities such as Bonneville Power Administration (BPA) that operate multiple plants that provide power to California.

[66] Ibid. See also Power Source Disclosure - AB 1110 Implementation Rulemaking Initial Statement of Reasons (Document ID #: 229688, September 6, 2019) and Final Statement of Reasons (Document ID: #232946-2, May 8, 2020) in CEC Docket 16-OIR-5.

[67] Public Utilities Code Section 398.4(k)(2)(B).

[68] CARB has already recognized this need for granularity in the geographic distribution of oil production, having developed a distinct carbon intensity for each of California's 158 oil fields and basins (Proposed Amendments, Appendix F, Table 1: https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/appf.pdf)

[69] For example, the 2022 Scoping Plan "includes careful consideration of, and coordination with, other state agencies, consistent with Governor Gavin Newsom's whole of government approach to tackling climate change"

375.5 cont. includes California's goal of reaching 100% GHG-free energy by 2045. Up to 40% of this energy may come from non-RPS-eligible GHG-free resources[70] and these resources should be counted toward determining the carbon intensity of a retail seller's electric portfolio.

Allowing electric LCFS providers to claim the GHG intensity of their retail seller would provide additional flexibility for them to acquire energy portfolios of lower-CI fossil-fueled energy and non-RPS zero-GHG resources. This flexibility would provide additional incentives for electric LCFS providers to minimize the carbon intensity of their electric energy. It would also incent retail sellers of electric energy to increase their offerings of lower-CI or zero-CI electric portfolios helping California meet its SB100 goals. Even today not all retail sellers provide an energy offering that meets CARB's zero-CI standards.

Third, CARB's use of a single state-wide number for the carbon intensity of electric energy masks significant differences between where in California the electric energy is consumed and who provides the energy.

Table 1 below shows the carbon intensity GHG emission profile for all of California's electric retail sellers that sell over two million (2,000,000) MWh per year as calculated by the CEC. Collectively, these retail sellers represent 86% of California's total retail electric sales.[71]

As can readily be seen in the table, the use of a state-wide average by CARB (456 lbs/MWh in 2021) for determining the amount of LCFS credits that can be claimed by electric LCFS providers masks an actual range of carbon intensity from a low of 0 lbs/MWh to a high of 1,167 lbs/MWh or almost two and a half times the statewide average. Under this "one-size-fits-all" approach, an electric LCFS provider being served by a retail seller with low GHG emissions does not receive any additional credit. Conversely, an electric LCFS provider being served by a retail seller with high-GHG emissions is receiving more LCFS credits than they should receive.

The City's energy providers – CleanPowerSF and Hetch Hetchy Power are both disadvantaged under this approach and do not receive full credit for the zero or low CI energy they provide. CleanPowerSF's "Green" portfolio's GHG emissions are only 82 lbs/MWh, almost two thirds less than the statewide average while its "Super Green" portfolio has GHG emissions of 0 lbs/MWh. Both Hetch Hetchy Power's General and Premium Service also have GHG emissions of 0 lbs/MWh.[72]

Accordingly, CARB should include the carbon intensities of electric retail sellers, as a "Lookup Table Pathway" for electric LCFS providers to use in determining their carbon intensity.

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including SB100 which "provided critical inputs and data points for this plan" and "lays the foundation for even closer coordination among and between state agencies to put the plan into effect." (2022 Scoping Plan, p. 6-7).

[70] SB100 (Chapter 312, Statutes 2018) added Public Utilities Code 454.53 setting a goal of achieving 100% GHG-free energy by 2045 but not changing the existing 60% by 2030 RPS requirement.

[71] This data is available in sortable format from the CEC's website; https://www.energy.ca.gov/sites/default/files/2023-01/2021_Power_Content_Labels_sortable_table-Updated_01-31-2023_ADA.xlsx

[72] 2021 Power Source Disclosure Reports for each entity.

375.7 CARB should also consider replacing its CA-GREET model, used for determining the CI of electric energy used as an input to produce LCFS fuels, with the CEC's state-wide and individual retail seller carbon intensities. It is unclear why CARB has two different methodologies for calculating state-wide GHG emissions, while the use of CA-GREET's state-wide average (without consideration of the actual retail energy supplier) could distort the locational choices of new LCFS fuel producers as only the cost, and not the GHG emissions of their service provider, would influence their investment decisions.

375.8 At a minimum, CARB should allow all zero-GHG resources to be included in the "Lookup Table Pathway" and eligible for "book and claim" accounting if they are tracked through WREGIS. As previously noted, this is consistent with California's requirements to transition to a 100% GHG-free electric sector.

Conclusion

The SFPUC, SFMTA, and Airport thank the Board for considering these recommendations. Please contact the following staff with any questions.

Dan Willis
Utility Specialist, Power Enterprise
San Francisco Public Utilities Commission
dwillis@sfwater.org

James Hendry
Utility Specialist, Power Enterprise
San Francisco Public Utilities Commission
jhendry@sfwater.org

Kathleen Sakelaris
Regulatory Affairs Manager, Government Affairs
San Francisco Municipal Transportation Agency
kathleen.sakelaris@sfmta.com

Courtney Carroux
Net Zero Lead, Sustainability & Environmental Policy
San Francisco International Airport
courtney.carroux@flysfo.com

Table 1: Carbon Intensity of California's Largest Electric Providers[73]

Electric Provider (Rate Option)	Sales (MWh)	GHG Intensity (lbs CO2e /MWh)
Anaheim, City of	2,073,416	**1167**
Constellation NewEnergy, Inc.	7,296,478	**835**
Riverside Public Utilities - General Power Mix	2,082,522	**809**
Calpine Energy Solutions, LLC	4,252,371	**756**
Direct Energy Business, LLC	2,767,084	**729**
Silicon Valley Power - Non-Residential	3,677,200	**650**
LADWP Power Mix	20,619,884	**609**
Southern California Edison	56,106,664	**580**
Clean Power Alliance of Southern California - Lean Power	2,311,125	**566**
Imperial Irrigation District	3,515,689	**565**
East Bay Community Energy - Bright Choice	5,342,524	**564**
San Diego Gas & Electric Company	11,298,590	**504**
Clean Power Alliance of Southern California - Clean Power	5,603,480	**501**
Central Coast Community Energy - 3CE Choice	4,616,178	**494**
Turlock Irrigation District	2,224,430	**493**
Modesto Irrigation District	2,640,606	**473**
SMUD - General Mix	9,504,054	**462**
2021 CA Utility Average and Total Retail Sales	237,870,520	**456**
Shell Energy North America (US), L.P.	5,484,204	**319**
San José Clean Energy - GreenSource	3,660,758	**162**
Sonoma Clean Power Authority - CleanStart	2,193,209	**130**
Pacific Gas and Electric Company - Base Plan	33,085,648	**98**
CleanPowerSF - Green	2,725,268	**82**
Marin Clean Energy - Light Green	5,143,729	**75**
Silicon Valley Clean Energy - Green Start	3,617,472	**18**
Peninsula Clean Energy Authority - ECOplus	3,030,741	**5**
Clean Power Alliance of Southern California - 100% Green Power	2,801,513	**0**

[73] https://www.energy.ca.gov/sites/default/files/2023-01/2021_Power_Content_Labels_sortable_table-Updated_01-31-2023_ADA.xlsx

Comment Log Display

Here is the comment you selected to display.

Comment 385 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Luke
Last Name	Nguyen
Email Address	lnguyen1@idemitsu.com
Affiliation	Idemitsu Apollo Renewable Corporation

Subject	Comments on Proposed LCFS Program Amendments
Comment	Please see our attached comments on CARB's proposed amendments to the Low Carbon Fuel Standard program. Thank you for the opportuni to provide these comments.
Attachment	www.arb.ca.gov/lists/com-attach/7069-lcfs2024-UTgBY1czAjwHaFMn.pdf
Original File Name	Idemitsu Public Comment.pdf
Date and Time Comment Was Submitted	2024-02-20 21:31:41

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

February 20, 2024

California Air Resources Board

1001 I Street

Sacramento, CA 95814

RE: Comments on Proposed LCFS Program Amendments

Dear Chair Randolph and Members of the Board,

On behalf of Idemitsu Apollo Renewable Corporation, we thank you for the opportunity to provide input on the proposed amendments to the California Low Carbon Fuel Standard (LCFS). As a significant contributor of renewable diesel to California markets, we appreciate the collaborative effort to enhance low carbon fuel initiatives in the state.

Idemitsu Apollo Renewable Corporation shares a common goal with the California Air Resources Board to increase the adoption of low carbon fuels, aligning with the state's objectives for greenhouse gas emission reductions. Through strategic business partnerships and investments, we are committed to bringing low carbon renewable diesel to California to support its environmental targets.

However, we have encountered challenges stemming from fluctuations in LCFS credit prices. Despite originally planning a renewable diesel production of 10,000 barrels per day, we have scaled down to 4,000 barrels per day due to the impact of declining credit prices. Consequently, our import volume of renewable diesel has also decreased to less than 50% from our original forecast. Additionally, we have significantly reduced our biodiesel blending program by 75% year on year.

A program high of surplus of credits in the LCFS credit bank has led to downward pressure on LCFS credit prices, making it economically challenging for us to expand operations and invest further in renewable diesel (RD) or sustainable aviation fuel (SAF) projects. To address these concerns and ensure a stable market for future planning, we propose the following amendments for consideration:

376.1 1. Increase the Carbon Intensity (CI) reduction target from the proposed 30% to 35% for 2030.
376.2 2. Consider revising the Automatic Acceleration Mechanism by moving up the start two years earlier, from 2028 to 2026, utilizing 2024 annual data instead of 2026.
376.3 3. Eliminate the exemption for intrastate fossil jet fuel starting in 2025 instead of 2028.
376.4 4. Higher limitations and phaseout measures for forklift crediting.
376.5 5. More aggressive reduction in proposed CI targets with a higher than 5% step-up in reduction in 2025 from the current regulation.

We believe that these amendments will foster a more conducive environment for the growth of low carbon fuels in California, helping achieve the state’s greenhouse gas reduction targets.

Thank you for considering our comments. Idemitsu Apollo Renewable Corporation looks forward to continued collaboration with the California Air Resources Board throughout the rulemaking process.

Sincerely,

Luke Nguyen

Luke Nguyen

Renewables Manager

Idemitsu Apollo Renewable Corporation

Comment Log Display

Here is the comment you selected to display.

Comment 386 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Teresa
Last Name	Bui
Email Address	tbui@pacificenvironment.org
Affiliation	Pacific Environment
Subject	Pacific Environment's Comments on 2024 LCFS Amendments
Comment	Please see attached comments from Pacific Environment's comments o 2024 LCFS Amendments. Thank you for your consideration.
Attachment	www.arb.ca.gov/lists/com-attach/7070-lcfs2024-VCQFZgRaUW4BZFUz.pdf
Original File Name	PE LCFS comment to CARB Feb 2024.pdf
Date and Time Comment Was Submitted	2024-02-20 21:46:04

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

PACIFIC ENVIRONMENT

February 20, 2024

Chair Randolph and Members of the Board
California Air Resources Board
1001 I Street,
Sacramento, California 95814
Via Electronic submittal

Re: Proposed Low Carbon Fuel Standard Amendments

Dear Chair Randolph and Members of the Board:

On behalf of Pacific Environment, thank you to the California Air Resources Board (CARB) for soliciting stakeholder input on the comment on potential changes to the California Low Carbon
377.1 Fuel Standard (LCFS). We greatly appreciate the tremendous amount of work that staff has put into the amendments, including proposing the important step of eliminating the current aviation fuel exemption for intrastate fossil jet fuel from the standard. However, we would like to share our recommendations to align the LCFS program with all of California's other zero-emission transportation laws, regulations, and investments.

Pacific Environment is a 501(c)(3) public-benefit corporation, headquartered in San Francisco, with regional offices in Anchorage, Alaska, and Chongqing, China. Pacific Environment has earned rare permanent consultative status at the International Maritime Organization (IMO), the United Nations' entity that sets international shipping law. At the IMO, Pacific Environment has played a lead role in advocating for a new international regulatory regime (called the "Polar Code") to regulate ship traffic, pollutant emissions, and waste dumping in Arctic waters.

I. <u>Recommendation Area One: Maritime Shipping</u>

377.2 California continues to experience some of the worst air quality in the nation with the South Coast Air Basin and San Joaquin Valley being in extreme nonattainment with the Federal Clean Air Act. Diesel exhausts from ships carrying goods at ports are known to cause severe illnesses from aggravated asthma, lung cancer, heart disease and neurological disorders, and premature death.

While CA's At Berth Regulation will deliver important health and environmental benefits from OGVs at berth, the bulk of air and climate emissions comes from the transiting, maneuvering, and anchoring of these vessels. These emissions remain a threat to public health and the environment, therefore CARB must explore all opportunities to achieve additional emission reductions from OGVs, including through the LCFS program.

473 Pine Street, Third Floor ▪ San Francisco, CA 94104
p. 415.399.8850 ▪ www.pacificenvironment.org

To align the LCFS to support these new maritime regulations and help further decarbonize California maritime operations, we urge the following:

377.3 **A. Strike Ocean-going vessels from exemption under § 95482 (d) to allow for credits for zero-emission transportation fuels used for OGV ships**

The revision of the LCFS program presents an important opportunity to support marine vessels as the transition to zero-emission fuels begins against the backdrop of the IMO's adoption of an updated GHG strategy last July 2023 and other regional initiatives in the EU to regulate international shipping's OGV emissions. Allowing credit generation and creating a new revenue stream for the maritime industry lowers key financial barriers commonly cited as the largest concern for industry stakeholders when making vessel and fuel orders.

According to 95482(d), the LCFS does not apply to transportation fuel used Ocean-going vessels, as defined in CCR, title 17, section 93118.5(d). CARB does have the authority to regulate and incentivize fuels: in 2007 CARB passed the world's first sulfur emissions cap on maritime fuels. This regulation successfully reduced sulfur emissions from ships in California by over 90%. The United Nations eventually adopted a global version of this regulation in 2020. We urge CARB to update the LCFS to allow for credits for zero emission transportation fuels used for ships such as liquid fuels derived from green hydrogen. Financial incentives are now needed to accelerate the zero-emission market, transition to land-side fueling, and help save lives, our ocean, and our climate.

Adopting a ruling allowing for credit generation for OGVs within California's regulated waters would incentivize installation and bunkering of zero emission fuels such as green hydrogen and fuels derived from green hydrogen and create an important market signal and incentive for maritime industry decarbonization. Crediting opt-in entities without obligation could avoid legal challenges to regulation of international maritime activities while signaling the importance of OGV emissions close to California's shores and communities. We urge CARB to expand the opt-in ability to include OGVs leaving or entering California waters.

In addition, credits for zero- and near-zero emission marine fuels such as hydrogen-derived, green methanol and ammonia would help stimulate the growth and uptake of next-generation marine fuels and provide an important revenue source to offset the green fuel price differential in early adoption years.

Recent trends show that an increasing share of new vessel orders are built with dual fuel capabilities allowing for flexibility at ports and across a greater patchwork of fuel and sustainability regulations when it comes to marine fuel choices. But these dual-fuel capable vessels are under no obligation or incentive to utilize zero-emission fuels despite their capability. Industry leaders have highlighted the need for fuel transition support as a key step for industry decarbonization. CARB can create incentives through the use of LCFS credit generation to encourage zero-emission fuel uptake and usage at California ports and near overburdened portside communities. The momentum to transition to sustainable marine fuels is there and the LCFS revision could bring it to California shores and communities.

B. Shorepower for harbor craft

377.4 Harbor craft vessels such as tugboats and ferries are a major driver of air pollution at seaports, and in Los Angeles, Long Beach, and Oakland, these vessels are **one of the top three drivers of cancer risk to frontline communities** due to their diesel PM emissions**.** While CARB's Commercial Harbor Craft rule mandate zero-emission ferries, the rule require the cleanest certified engine (Tier 3 or 4) with a diesel particulate filter for all other regulated vessels. In these categories, there are opportunities to send a strong signal to move towards zero-emissions beyond the cleaner but still diesel engine standards in the rule.

We encourage CARB to update language and LCFS materials available to more explicitly show commercial harbor craft (CHC) is eligible under the electric and hydrogen offroad transportation category. As CHC regulations come into effect, LCFS credit generation can play an important role in transitioning fleets and new vessels onto new fueling pathways and infrastructure. Currently the exception to the exception language does not make it clear CHC infrastructure qualifies for credits.

II. Recommendation Area Three: Cleaning California Oil Imports to Do No Harm

Pacific Environment offers the following comments on the revised **Oil Production Greenhouse Gas Emission Estimator (OPGEE) Model** and data inputs released Feb. 21, 2023:

377.5 1. CARB should accelerate the adoption of the more robust Version 3.0b of the OPGEE model released Feb. 21, 2023.

377.6 2. CARB should implement a **rapid review/update process** to update CARB reporting from OPGEE data/modeling to reflect field specific contemporary peer review literature as it becomes available.
   - **a.** "Climate justice delayed is climate justice denied." Accurate and current data of the emissions is critical to understanding the nature and extent of the climate challenge. In 1954 oil companies knew that what they were doing had an adverse impact on the climate.[1] Their failure to disclose the nature and extent of their knowledge of those impacts is an indictment of their self interest in preserving profits despite horrific impacts on people and the environment. **CARB has a responsibility to use timely, accurate data.**
   - b. CARB should strive to "level the playing field" among oil producers and accelerate the reporting of field specific clean energy resources to encourage energy developers to strive for lower life cycle emissions.

377.7 3. CARB should support OPGEE model **data updates** to **reflect the unique challenges of Arctic oil and gas development** highlighted in the peer review literature, including:
   - a. Exploration & Development (§6.1 to §6.2.2.3)
     - i. CARB should allocate the GHG emissions estimates associated with **unsuccessful exploration activities** at the field level. If the emissions

[1] https://www.desmog.com/2024/01/30/fossil-fuel-industry-sponsored-climate-science-1954-keeling-api-wspa/

377.7 cont.

estimate from unsuccessful exploration activities cannot be directly assigned to a producing field, the CARB should assign those emissions to regional or national oil producing provinces. For example, Shell conducted and abandoned exploration activities in Alaska's Chukchi Sea. The emissions associated with those activities could be assigned to Alaska's North Slope, Alaska as a whole, or the U.S.

ii. CARB should task the OPGEE team with conducting a peer review literature for **Alaska North Slope land use impacts related to tundra disturbances and acceleration of melting permafrost and associated methane/biogenic carbon emissions**.

iii. CARB should task the OPGEE team to review **field drilling and development data for Alaska's North Slope field data** in OPGEE data tables to verify:

1. that the drilling energy consumption estimates reflect the **high level of energy consumption** required to drill through typically **thick permafrost strata**.
2. that the **well completion activities** associated with working in **thick permafrost** are reflected in the emissions estimates.
3. that the **field development emissions** data adequately include the **risk of gas leakage around inadequately completed and monitored wells** [CD-1 Pad, Alpine Field, Alaska North Slope, March 4, 2022]
4. that the **hydraulic fracturing energy consumption and associated emissions** estimates reflect the **higher level of energy consumption required in the typically lower temperature North Slope oil producing strata near thick permafrost strata,** especially for viscous and heavy oil prospects that are being developed at shallower depths.
5. that the **energy expenditures and GHG emissions** that arise from the **extraordinary surface use activities necessary to protect the fragile tundra ecosystem, e.g., snow/ice roads**, are adequately reflected in emissions estimates.
6. that the GHG emissions associated with **surface disturbances of highly thermally sensitive tundra which leave trails in the tundra which accumulate surface water which in turn absorb heat during the increasingly warming climate and accelerate the thermal degradation of permafrost which in turn releases high concentrations of methane** are adequately reflected.

b. Production (§6.4 through §6.53)

i. CARB should task the OPGEE team with reviewing the data associated with the use of **miscible injectant** (CH_4, CO_2 mixture) for **enhanced oil recovery** on Alaska's North Slope to verify that the data adequately accounts for **CH_4 and CO_2 leakages.**

ii. CARB should task the OPGEE team with reviewing the data associated with the use of **polymer flooding** for **enhanced oil recovery of viscous and heavy oils** on Alaska's North Slope to verify that the data adequately accounts for the life cycle emissions of those activities to produce viscous and heavy oils.

377.7 cont.

c. Fuel Cycle & Embodied Emissions (§7)

   i. CARB should task the OPGEE team with reviewing and verifying the **assumptions underlying the co-production credit for prospective LNG exports from Alaska**, i.e., the "natural gas displaces coal" vs. "natural gas could be substantially displaced by renewables." Verify the estimates for the **magnitude and direction of the savings/cost of natural gas vs. coal** supply chains, especially considering the energy intensive LNG supply chain associated with Alaska's North Slope natural gas, either an 800-mile pipeline + LNG or arctic ice breaking LNG tankers. We note that commentary research on coal v. natural gas supply chains suggests that any LNG advantage evaporates with more rigorous analysis.[2] Adding an 800-mile pipeline clearly disadvantages that supply chain compared to a local coal supply.

   ii. CARB should task the OPGEE team with reviewing and verifying the OPGEE model and field specific data to ascertain the extent to which GHG emissions associated with the **long energy intensive supply chain for mobilization, transport and storage** of **equipment and materials** associated with Alaska's North Slope are taken into account. In addition, subsequent GHG emissions associated with landfilling and recycling materials from Alaska's North Slope – including the emissions associated with **dismantlement, removal and restoration fossil fuel lease obligations** – should be included in the embodied emissions accounting or a separate category.

d. Venting, Global Warming Potential & Fugitive Emissions (§8, §9.1, §10.2.3.1)

   i. CARB should task the OPGEE team with reviewing and incorporating contemporary flaring emissions data **by field** instead of **country** to more accurately reflect highly variable CH4 emissions. See for example the date within OCI+ (Oil Climate Index + Gas)[3].

   ii. CARB should **adopt the 20-year Global Warming Potential (GWP) for CH4** as the default and require OPGEE to adopt the 20-year GWP for CH4.

377.8

4. CARB should require the OPGEE team to **divest itself of funding sources that create the appearance of conflict of interest,** e.g., Aramco and Chevron.

377.9

5. CARB should avoid the trap of only updating the data in the OPGEE model when ALL fields have ALL data input fields updated with field-specific data as this will create a perverse incentive for dirty oil producers to refrain from reporting field-specific data while cleaner oils fail to get credit for cleaner field-specific data – skewing comparisons between fields as well as underestimating aggregate emissions.

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[2] See for example the working paper of Robert Warren Howarth, "The Greenhouse Gas Footprint of Liquefied Natural Gas (LNG) Exported from the United States," Department of Ecology & Evolutionary Biology, Cornell University, Ithaca, NY 14853 USA. In review at a peer-reviewed journal; Submitted October 24, 2023; Revised January 13, 2024; Subject to further revision before publication as a peer-reviewed article.

[3] See the OCI+ methodology page, which includes a description of the flaring emissions data developed by a team that includes members from the Colorado School of Mines. https://ociplus.rmi.org/methodology#opgee

377.10 6. CARB should **independently audit and verify data provided by the field operators** to ensure reliable reporting of the data that drives emissions estimates.

Thank you for your consideration of these comments. We would welcome the opportunity to discuss them with respective staff, and we look forward to continued participation and discussion to further strengthen the LCFS.

Sincerely,

Teresa Bui

Teresa Bui
Climate Policy Director
Pacific Environment

Kay Brown

Kay Brown
Arctic Policy Director
Pacific Environment
907.529.6970
kbrown@pacificenviroonment.org

CC: Steve Cliff
Members of the Board

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Comment 387 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	John
Last Name	O'Donnell
Email Address	john@rondo.com
Affiliation	Rondo Energy
Subject	Rondo Energy Comments
Comment	Attached
Attachment	www.arb.ca.gov/lists/com-attach/7071-lcfs2024-UyFSO1M8V2AKYwZZ.pdf
Original File Name	Rondo LCFS Feb 2024 Comment Letter-final.pdf
Date and Time Comment Was Submitted	2024-02-20 21:55:29

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Rondo Energy, Inc.
rondo.com

Liane Randolph, Chair
Board Members
California Air Resources Board

February 20, 2024

Via electronic submittal: LCFS Comment Docket

Re: Rondo Energy, Inc. Comments on the January 1, 2024 Formal Regulatory Amendment Package

Rondo Energy, Inc. (Rondo) appreciates this opportunity to submit comments regarding the regulatory package released last month to the LCFS regulation. Rondo supports CARB's ongoing efforts to continue to lower the carbon intensity of the state's fuel supply using the latest information and the lowest-cost, lowest-risk pathways to achieve California's climate, environmental, and economic goals. Rondo submitted previous comments to earlier LCFS workshops and incorporates them by reference here.[1,2,3,4,5]

About Rondo

Rondo is a California-based company delivering zero-carbon energy for industrial processes and power generation, including for traditional and renewable transportation fuels and feedstock production[6]. The Rondo technology allows for the replacement of fossil fuel combustion with renewable industrial heat, thus achieving significant criteria and greenhouse gas emissions with a single capital project. The 2022 Scoping Plan Update calls out the need to replace traditional combustion technology, and Rondo is proud to be on the front edge of this transition especially in the 'hard-to-decarbonize' industrial sector.

Historically, it has been difficult to curb refining, biofuel facility and feedstock extraction combustion emissions because of a lack of clean, cost-effective sources of industrial heat. The emergence of indirect industrial electrification technologies, including the Rondo Heat Battery, or RHB, now provides an immediately feasible, cost-effective, and equitable way to decarbonize the numerous and diverse industries that collectively make up a significant portion of both California's economy and its GHG emissions.

Rondo's approach to decarbonization – harvesting intermittent and curtailed renewable power, and putting it to work eliminating combustion - aligns with the broader electrification strategy of the state. The technology is being deployed around the world today. It is time to align California policy to enable more projects here in our home state.

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1 https://www.arb.ca.gov/lists/com-attach/51-lcfs-wkshp-oct20-ws-U2EGMAExB2UBN1Jh.pdf
2 https://www.arb.ca.gov/lists/com-attach/77-lcfs-wkshp-aug18-ws-BzVTZ1dmA2kFMggx.pdf
3 https://www.arb.ca.gov/lists/com-attach/151-lcfs-wkshp-dec21-ws-ATNWYlFgBWcBNwA3.pdf
4 https://www.arb.ca.gov/lists/com-attach/36-lcfs-wkshp-nov22-ws-UGJTZ1xsVDVXYAI3.pdf
5 https://www.arb.ca.gov/lispub/comm2/iframe_bccomdisp.php?listname=lcfs-wkshp-feb23-ws&comment_num=49&virt_num=41
6 https://rondo.com

Comments

378.1 ***Comment #1: Rondo is supportive of CARB's efforts to stabilize the LCFS market.***

Rondo's indirect electrification technology can meaningfully enable LCFS credits today and can be more impactful with some addition regulatory changes. The LCFS creates a long-term, reliable economic value proposition for Rondo's customers to decarbonize, and as a result Rondo is actively engaged in decarbonizing California transportation fuels. A Rondo Heat Battery project, with its associated large solar and wind projects, is essentially pre-paying for 40 years of process heat energy. Near-term price support with long-term assurance is therefore critical to funding decarbonization today.

Rondo supports the regulatory amendments aimed at restoring equilibrium in the credit marketplace, and believes that interventions that strengthen the price signal in the near-term are particularly important. Extended periods of low prices reduce market confidence in the mechanism, which jeopardizes the ability for decarbonization projects to get financed and built. Stabilizing the credit-deficit balance will unlock projects set to deploy over the next 1-3 years – a particularly critical window in California's efforts to reach its decarbonization goals.

378.2 ***Comment #2: Support for Project-based crediting.***

The regulatory package makes a clear statement that project-based crediting should be retained in the LCFS program through the next decade. We are supportive of this statement as it provides the invenstment community the positive signal new projects need. Rondo also suggests that for very large capital infrastructure projects, such as new renewable energy fields, that these credit generating opportunities should continue as long as they are reducing the carbon intensity of California fuels. This is the approach already proposed for Carbon Capture and Storage projects.

378.3 ***Comment #3: Support for expanded Indirect Accounting Mechanisms for liquid fuel production.***

Much thought has gone into the treatment of electricity as an input in the EV and hydrogen fuel pathways, including allowing the indirect account of Low-CI electricity over the grid with quarterly matching to adjust the CI calculations for feedstock electricity. Renewable electricity is becoming a larger and larger portion of grid power in numerous areas of the country. Electrifying the process energy used to produce liquid fuels is a major opportunity to lower the CI of those fuels. When natural gas is replaced by electricity for process heat, the total CI of the electricity becomes salient for the CI calculation of the finished fuel.

At the moment, the accounting means for book and claim Low-CI electricityprovided for in the regulation apply only to the production of hydrogen as a fuel. As clean electricity can meaningfully reduce the CI of liquid fuels, these accounting methods should be extended to the production of liquid fuels. This matters because energy storage systems such as Rondo's selectively charge during periods of low-carbon, low-price power in a time-matched manner with wind and/or solar generation. Under the regulation at present, the only means of incorporating renewable electricity to lower CI calculations is to build generation and distribution facilities which interconnect at the fuel production facility behind the meter to a local renewable generator – unlike for hydrogen. Adding the same indirect accounting for book and claim flexibility would significantly expand the electrification of fuel production and reduce the carbon intensity for liquid fuels. There is sufficient renwable power, especially in the Midwest where the majority of biofuels are produced, such that there are daily curtailments of wind energy happening. This zero-carbon energy could charge a Rondo Heat Battery without impacting peak periods of the grid. At the same time that indirect book and claim Low-CI electricity accounting is expanded, the stringency of this accounting should be increased across all credit generating pathways to require hourly time matching of renewable electricity generation to the electricity consumption. This will create true grid emissions reductions from the growing electrification of vehicles, biofuels and H2.

This selective use of allowing book and claim Low-CI electricity consumption is placing unnecessary limits on the LCFS program's ambition. As the staff revisit some of the concepts presented in these amendments in the coming months, we recommend that this issue be at the forfront of those discussions. All credit generation pathways should be able to use hourly time matched Low-CI book and claim accounting, with strong deliverability requirements, to support electrification and lower the carbon intensity of California fuels.

Conclusion

The technology is ready to lower industrial carbon intensity when making California fuels. The electrification policy can be expanded beyond vehicles while the transition is happening. We also note that there are several bills pending today in the California Legislature that recognize state policy is falling behind where industry is leading[7]. During this important update to the LCFS regulation, it is critical to look ahead at the possibilities of all technologies solutions, and how to not limit their use.

There are myriad benefits to generating industrial heat and the use of thermal batteries with renewable energy instead of fossil fuels[8,9]. In addition to the significant GHG emissions reductions, eliminating combustion for thermal loads has direct local air quality benefits in the state's most impacted communities. The strength and stability of the LCFS are at the heart of this transition.

Thank you for the opportunity to provide these comments. We look forward to continued discussions.

Sincerely,

/s/

John O'Donnell
CEO, Rondo Energy, Inc.

[7] SB 993, SB 1018, AB 2083
[8] https://energyinnovation.org/publication/thermal-batteries-decarbonizing-u-s-industry-while-supporting-a-high-renewables-grid-2/
[9] https://www.renewablethermal.org/tes-assessment-press-release/

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Comment 388 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Phoebe
Last Name	Seaton
Email Address	pseaton@leadershipcounsel.org
Affiliation	Leadership Counsel
Subject	CORRECTED - Community, EJ, Environmental Justice Response to ISOR and Staff Proposal Comm
Comment	Please accept these comments as the corrected comments of approximately 35 Environmental Justice, Community-Base, Environmental and Labor organizations. I submitted an outdated letter earlier this evening (at approximately 5 p.m.) in error. Thank you so much, - Phoebe
Attachment	www.arb.ca.gov/lists/com-attach/7072-lcfs2024-BmVTOl0uVHUBYglq.pdf
Original File Name	CORRECTED - Community-Based, EJ, and Environemntal Advocate Response to Staff Proposal.pdf

Date and Time Comment Was Submitted	2024-02-20 21:56:41

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

February 21, 2024

Liane M. Randolph, Chair
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

Submitted via CARB's online Comment Submittal Form

Re: Environmental Justice, Environmental, and Community-Based Advocate Response to Proposed LCFS Amendments and Initial Statement of Reasons

Dear Chair Randolph and members of the Board,

The undersigned organizations believe there is a significant opportunity to reform the Low Carbon Fuel Standard (LCFS) so that it propels California's progress in the fight against the climate and air pollution crises in a manner that delivers economic and environmental justice.

The Staff Proposal Maintains and Exacerbates Several Problems with the LCFS

379.1 1. **In contrast to California's groundbreaking regulations designed to accelerate zero emissions transportation options, the LCFS continues to favor combustion-based biofuels and biogas that contribute to pollution.**

Over 75% of credits in the program flow towards biofuels and biogas (falsely characterized as "carbon negative") flooding the credit market with fuels that end up combusted, while dampening the LCFS's ability to support zero-emissions transportation, even as critical regulations like the Advanced Clean Trucks and Advanced Clean Fleets rule are poised to come into effect.

379.2 **2. These combustion-based fuels do not deliver meaningful greenhouse gas reductions in California's transportation system.**

Lipid-based fuels already required for compliance with the Federal Renewable Fuel Standard are
merely shuffled into the California market while increasing demand for supply-constrained
feedstocks and finite land. Meanwhile, increasingly extravagant claims of avoided methane allow
379.3 the LCFS to function as a more lucrative, less regulated offset program, even as CARB ignores
the Legislature's mandate in Senate Bill 1383 to adopt regulations and directly reduce methane
from manure management at industrial livestock operations in the State. Moreover, these fuel
pathways provide no additive emissions benefits (the reductions are not additional), because their
digesters were demonstrably funded through state grant programs, the Aliso Canyon Mitigation
Agreement, and the Federal Renewable Fuel Standard.

3. Beyond failing to align with California's climate and air quality objectives, these
379.4 **combustion-based fuel pathways exacerbate social and environmental injustice.**

Increasing lipid-fuel consumption extends pollution burdens in oil refinery communities where
these fuels are produced. It also drives deforestation as more land is converted to crop production,
and it requires either the intensification of agriculture (i.e. greater pesticide and fertilizer use)
and/or reduced food consumption amongst those who are already food insecure. Livestock
operations benefitting from lucrative credits for their supposed methane reductions are
379.5 incentivized to maintain or even intensify their polluting management practices that foul the air
and drinking water of local communities. Smaller and more sustainable farms that manage
manure through practices that largely avoid methane creation cannot convert those beneficial
practices into revenue through the LCFS, perversely creating a competitive advantage for massive
livestock operations. Furthermore, "carbon negative" factory farm gas facilitates and even
379.6 encourages the polluting production of dirty hydrogen at refineries. It bears noting that CARB
379.7 ignored the data-backed concerns raised by people living near industrial dairies and refineries
utilizing factory farm gas credits to produce carbon negative hydrogen from fossil fuel in their
"environmental justice" section.

379.8 **4. The costs of these ineffective subsidies are borne by drivers in California dependent on gasoline and diesel.**

The Standardized Regulatory Impact Assessment (SRIA) discloses that the LCFS program's overwhelming subsidies for combustion-based biofuels are costs actually borne by drivers of diesel- and gasoline-powered vehicles. Over time, this cost at the pump increases from an average of $0.37 per gallon through 2030 to an astronomical $1.15 per gallon between 2031 and 2045 in 2021 values (the inflation adjusted pass through costs would be even higher). This cost will be increasingly imposed on low-income Californians least able to self-finance a transition to zero-emissions vehicles. While the ISOR claims that the SRIA overstated the correlation between credit prices and pass-through costs and attempts to obscure increased costs to gas and diesel consumers with decreased costs to electric vehicle drivers, there is no denying people and communities that are and will remain dependent on gasoline and diesel will pay at the pump for massive revenues primarily destined for investors in and producers of biogas and biofuels.

379.9 5. **The proposed policy changes further lock Californians into subsidizing biogas for decades to come.**

The staff proposal allows for biogas-based natural gas and hydrogen to generate credits and enjoy avoided methane crediting for up to 30 years and biogas-based electricity to generate credits and enjoy avoided methane crediting beyond in perpetuity. This demonstrates that CARB has no intention of phasing out avoided methane crediting and, furthermore, signals to investors that they will be able to rely on revenues associated with avoided methane crediting for decades. This, in turn, will lead CARB to maintain subsidies for biogas production to guard against "stranded assets," one of CARB's justifications for maintaining subsidies for biogas. Unfortunately, the staff proposal threatens to sustain CARB's commitment to ensuring adequate return on investment for investors above their role of supporting a transition to clean transportation fuel and a sustainable agricultural sector.

6. **CARB Staff's Proposal Passes Regressive Costs onto Drivers for Dubious Benefit**

379.10

The staff proposal fails to include amendments to address the root causes of the supply glut from Inappropriate credits. Nor do they address the program's lopsided support for polluting fuels over end-to-end zero emission pathways. Instead, as best we can tell, CARB staff's proposed fix to the problem of collapsing credit prices is simply to ramp up demand by increasing the program's overall stringency.

379.11 Absorbing the glut of inappropriate credits in the program with higher carbon intensity targets will increase the credit price, and in doing so will pass greater costs onto California drivers without commensurate climate benefit. Their money will disproportionately fund fuels that academics and environmental organizations have shown have questionable and even adverse climate impacts. And they will continue to fund fuels championed by the oil industry and
379.12 industrial agribusiness, while disregarding the unequivocal opposition of environmental justice communities.

This would make the LCFS a more regressive and less credible climate policy. As other states and the Federal government consider taking up the policy, we urge you as Board members to avoid allowing the LCFS to go down this path.

A Real Solution

Our coalition of climate, environmental justice, animal welfare, public health, and transit advocates believes there is a better path to reforming the LCFS. We urge Board members to direct staff to make the following critical amendments to the Program:

1. **Restrict the over-generation of credits from polluting fuels.** This will shrink the supply of credits and re-balance compliance away from combustion-based biofuels toward zero-emissions pathways with the greatest transformational potential for the State's goals while also addressing severe environmental injustices embedded in the current program. This reform can be done by:

379.13 - **Eliminating avoided methane crediting upon the adoption of the updated regulations.** Livestock operators have profited for more than a decade from exaggerated claims of "negative" emissions based on the assumption that they are free to dump methane into the atmosphere. That assumption must be eliminated starting upon adoption of the amendments, consistent with CARB's mandatory legal duty to adopt, and clear regulatory authority to implement, regulations to address livestock manure methane emissions.
379.14 - **Capping the unrestricted use of lipid-based biofuels.** A cap is the most prudent path to avoid inappropriate re-shuffling of feedstocks into California and reduce the severe, irreversible risks of deforestation or global hunger that increase non-linearly with growing consumption of crop-based biofuels.
379.15 - **Prohibiting credits for Carbon Capture and Storage or Direct Air Capture projects that utilize enhanced oil recovery.** The Legislature and Governor have made clear with the passage of SB 1314 that enhanced oil recovery has no role to play in meeting California's carbon neutrality goals. Accordingly, such projects should not generate LCFS credits.
- **Eliminating credits for Direct Air Capture (DAC).** The LCFS is a program to reduce
379.16 the carbon intensity of transportation fuels in California. A DAC facility in Louisiana has no apparent bearing on the carbon intensity of California's fuels, yet the CARB staff proposal would allow such projects to generate credits. Further, any project that aims to reduce atmospheric carbon by capturing carbon in the ambient air will fail to achieve net emissions reductions if those reductions are offset by further pollution from fossil fuels in California, the effective impact of including such projects in the LCFS.
379.17 - **Ensuring credits derived from livestock manure include all GHGs from producing manure-based fuels.** CARB's current implementation of the LCFS improperly ignores the greenhouse gas emissions from the production of manure and the handling of manure digestate, a practice which over-values the carbon intensity of manure-based fuels and leads to excessive credit generation.

2. **Enhance LCFS Support for Zero-Emission Pathways with the greatest environmental justice benefits.** With credit prices stabilized by restricting supply of inappropriate credits, the program can focus on elevating its support for key priorities that deliver maximal climate, air
379.18 pollution, and economic justice co-benefits. The LCFS should be focused primarily - if not exclusively - on supporting the transition to electrification of the transportation sector. To that end, critical policy interventions that should complement policies to eliminate harmful credits for combustion fuels include:

379.19 - **Adopt a credit multiplier for zero-emission mass transit vehicles, including school and transit buses.** The Scoping Plan calls for a massive reduction in vehicle-miles-traveled to meet State goals. The LCFS' current methodology undervalues zero-emission mass transit vehicles' contributions to reducing the carbon-intensity of California transportation fuels by ignoring their ability to help shift more Californians out of dirtier single-occupancy vehicles.
379.20 - **Allow full credit-generation for fixed-guideway systems** (e.g., light rail and trolley buses). Functioning, zero-emission transit agencies are vital for the mobility of low-income Californians and for reaching climate targets. Currently, the LCFS imposes a

unique penalty on transit agencies by reducing their ability to generate credits for vehicles on fixed guideway systems installed before 2011.

379.21 3. **Expand and Expedite Rules Making Aviation Fuels Deficit Generators**. CARB should expedite the transition of aviation fuel to a deficit generating fuel. Additionally, California's share of fuel from interstate and international flights should be included in the LCFS.

379.22 4. **Direct CARB staff to initiate a rulemaking to directly regulate methane emissions from manure management to achieve the methane reductions required by Senate Bill 1383.** It is inappropriate for California drivers to continue footing the bill for methane mitigation when CARB has a legal duty to mandate methane reductions from livestock operations.

Taken together, our suite of recommendations would not only move the LCFS in a more progressive direction, but better align the program with CARB and the State's own air quality standards and stated goals of advancing zero emission transportation while centering the voices of the communities and workers at the frontlines of the energy transition.

We urge Board Members to direct staff to make these critical changes, and we look forward to working with you to craft a stronger, more equitable LCFS program.

Sincerely,

Christine Ball-Blakely
Animal Legal Defense Fund

Faraz Rizvi
Asian Pacific Environmental Network

Jack Lucero Fleck
350 Bay Area

Raquel Mason
California Environmental Justice Alliance

Gracyna Mohabir
California Environmental Voters

Christina Scaringe
Center for Biological Diversity

Dan Ress
Center on Race, Poverty and The Environment

Janet Cox
Climate Action California

Defensores del Valle Central Para el Aire y Agua Limpio

Sasan Saadat
Earthjustice

James Wang
Eco-Sustainability Pro, Director

Sandra Celedon
Fresno Building Health Communities

Alan Weiner
350 Conejo / San Fernando Valley

Tyler Lobdell
Food and Water Watch

Román Partida-López
The Greenlining Institute

Daniel Chandler
350 Humboldt Steering Committee

Marven Norman
Center for Community Action and Environmental Justice

Dashel Murawski
Center for Food Safety

Kevin Hamilton
Central California Asthma Collaborative

Nayamin Martinez
Central California Environmental Justice Network

Catherine Garoupe White
CVAQ

Suzanne Hume
Clean Earth4Kids

Jennifer Clary
Clean Water Action

Jasmin Ansar
The Climate Center

Amelia Keyes
Communities for a Better Environment

Alan Weiner
350 Conejo / San Fernando Valley

Phoebe Seaton
Leadership Counsel for Justice and Accountability

David Weiskopf
NextGen California

Andrea Vidaurre
People's Collective for Environmental Justice

Matt Baker
Planning and Conservation League

Antonio Diaz
PUEBLO

Joel Ervice
Regional Asthma Management & Prevention

Will Brieger
350 Sacramento

Emily Brandt
San Joaquin Valley Democratic Club

Pauline Seales
Santa Cruz Climate Action Network

Christian Ramirez
SEIU USWW

Jason John
Sierra Club California

Jeremy Martin
Union of Concerned Scientists

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Comment 389 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Shannon
Last Name	Broome
Email Address	sbroome@huntonak.com
Affiliation	Hunton Andrews Kurth
Subject	Comments of Highly Innovative Fuels USA
Comment	Please find attached the comments of Highly Innovative Fuels USA o the proposed amendments to the LCFS. Please contact me with any questions regarding these comments. Shannon S. Broome
Attachment	www.arb.ca.gov/lists/com-attach/7073-lcfs2024-BTdXYVRnWT4GLVJi.pdf
Original File Name	2024-02-20 As Filed HIF USA Comments on CARB LCFS Proposed Amendments.pdf
Date and Time Comment Was Submitted	2024-02-20 22:02:55

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Comments of HIF USA
on
California Air Resources Board
Proposed Low Carbon Fuel Standard Amendments

February 20, 2024

Highly Innovative Fuels USA (HIF USA) appreciates the opportunity to offer these comments on the California Air Resources Board (CARB or the Board) Proposed Amendments to the Low Carbon Fuel Standard (LCFS) regulation.

A subsidiary of HIF Global, HIF USA is a global eFuels company focused on harnessing renewable energy sources to achieve fuel sector decarbonization. HIF USA is currently developing a large-scale commercially viable facility for generating low-carbon eFuels that can be used in a number of transportation applications and has submitted an LCFS pathway for its process that is currently awaiting CARB approval. HIF USA's focus on eFuel development fully aligns with CARB's mission in the LCFS program to encourage private sector innovation to develop a diverse supply of low-carbon transportation fuels in California. This is why HIF USA has been an active participant supporting CARB's 2022 Scoping Plan update process and, more recently, the LCFS update process.

380.1

I. LCFS Incentives for Low CI Methanol

HIF USA provided testimony to the Board during the September 28, 2023 hearing on the LCFS program amendments, emphasizing one specific way that CARB could incentivize the proliferation of innovative carbon-neutral fuels in California: by amending the LCFS regulations (specifically Section 95482) to ensure that low-carbon intensity (CI) methanol (also referred to as "green methanol") is made eligible for LCFS crediting as an opt-in fuel, when sold for use in marine and other specialty transportation applications such as direct methanol fuel cells. HIF USA writes to reiterate this request as CARB considers how to craft a final rule that will create optimal incentives for a variety of low-carbon transportation fuels in California.

HIF USA's process involves using low-CI electricity to power a process known as electrolysis. This process produces "green hydrogen" by breaking water molecules into hydrogen and oxygen. The hydrogen is then combined with CO_2 captured from biogenic or industrial sources to produce green methanol in a reactor through a process called synthesis. Further processing will produce other carbon-neutral eFuels that could be used for different purposes, such as eGasoline for road transport, Sustainable Aviation Fuel for air transport, and liquefied petroleum gas (LPG). HIF USA is currently in the front-end engineering and design phase for an eFuels facility in Texas that will produce carbon-neutral drop-in fuels, such as green methanol, for sale in the California transportation fuels market. As noted above, HIF USA has submitted to CARB a request for LCFS pathway approval so that its process may generate credits under the program.

Amending the LCFS regulations to identify green methanol as an opt-in fuel would create an important incentive for low-CI fuels in hard-to-decarbonize sectors such as marine transportation. Currently the LCFS regulations do not identify green methanol as an opt-in fuel, and they provide that transportation fuel used in most ocean-going vessels is exempt from regulation, meaning that there is no opportunity for low-CI methanol created via HIF USA's process to generate LCFS credits. CARB could amend the LCFS regulations to incentivize the production and sale of this fuel in California by specifying (1) that opt-in entities can obtain LCFS credits for low-CI methanol volumes sold for use in marine applications, and/or (2) that the aforementioned LCFS exemption does not apply to methanol provided as a transportation fuel for ocean-going vessels.

380.1 cont

In a presentation during an LCFS workshop held in July 2022, CARB staff indicated that it was considering the inclusion of methanol as an opt-in fuel for "novel applications," including "commercial harbor craft" under Tier 2 EER-adjusted pathways. Yet, the proposed regulations issued in these proceedings do not include this proposed change. We encourage CARB to pick this up again and specify in the forthcoming proposed rule that opt-in entities can obtain credits for low-CI methanol provided as a transportation fuel in marine and other specialty applications. To create as comprehensive an incentive possible for green methanol, we request that CARB allow any such fuel used in ocean-going vessels in California to qualify as an LCFS opt-in fuel.

According to the Methanol Institute, as compared to conventional fuels, green methanol cuts carbon dioxide emissions by up to 95%, reduces nitrogen oxide emissions by up to 80%, and completely eliminates sulfur oxide and particulate matter emissions.[1] Further, as explained by the Methanol Institute, the large-scale integration of low-carbon and net carbon neutral fuels, such as green methanol, at an accelerated rate in marine applications will be fundamental to achieving international targets for GHG reductions in the marine sector.[2]

Demand for methanol as a marine transportation fuel has grown steadily in recent years, as major shipping companies have built out their ship fleets capable of running on methanol. Allowing low-CI methanol to generate LCFS credits will further stimulate demand by making this fuel more readily available and cost-effective, ultimately incentivizing shipping companies to grow their ship fleets able to use green methanol and reducing emissions from the marine transportation sector.[3]

380.2

II. Proposed Regulatory Text for Book-And-Claim Accounting for Low-CI Electricity

In the text of its proposed regulatory amendments, CARB appears to have proposed a change to 17 C.C.R. § 95488.8(i)(1)(A) that could potentially restrict the ability of eFuels proponents to use book-and-claim accounting (and specifically, Renewable Energy Certificates (RECs)) to claim the emission benefits of low-CI electricity used for hydrogen production through electrolysis used in the production of a transportation fuel. Because this potentially significant change is not explicitly addressed in the Initial Statement of Reasons (ISOR) that CARB issued with the proposed regulatory amendments, HIF USA presumes that it was inadvertent. We thus request clarification that CARB

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[1] *See* Methanol Institute, "Renewable Methanol," https://www.methanol.org/renewable/.

[2] *See* Methanol Institute, "Components in Measuring GHG Intensity of Marine Fuels," https://www.methanol.org/marine/.

[3] Incentivizing the use of green methanol in California's marine transportation sector is also consistent with emission reduction initiatives of several of the major California ports. For instance, the Ports of Los Angeles and Long Beach recently announced efforts to establish a trans-Pacific green shipping corridor between California and Asia to accelerate emissions reductions on one of the world's busiest container shipping routes. *See* Port of Los Angeles, "Ports of Los Angeles, Long Beach, and Shanghai Unveil Implementation Plan Outline for first Trans-Pacific Green Shipping Corridor," https://www.portoflosangeles.org/references/2023-news-releases/news_092223_green_shipping_corridor. Providing LCFS incentives for green methanol used in ocean-going vessels will significantly support this effort.

did not intend to eliminate the use of book-and-claim accounting for low-CI electricity used for hydrogen production through electrolysis and that CARB not finalize the language as proposed.

Specifically, HIF USA is concerned with the proposed amendments to 17 C.C.R. § 95488.8(i)(1)(A) reflected in Appendix A-1:Proposed Regulation Order as follows:

(i) *Indirect Accounting for ~~Renewable or~~ Low-CI Electricity ~~and~~, Biomethane, and Low-CI Hydrogen*.

380.2 cont (1) *Book-and-Claim Accounting for ~~Renewable or~~ Low-CI Electricity Supplied as a Transportation Fuel, Direct Air Capture projects, or Used to Produce Hydrogen as a transportation fuel*. Reporting entities may use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel ~~or,~~ for hydrogen production ~~through electrolysis~~ and processing for ~~transportation purposes (including~~ hydrogen ~~that is~~ used ~~in the production of~~ as a transportation fuel~~)~~,, or for direct air capture projects, provided the conditions set forth below are met:

(A) ~~Reporting entities may report low-CI~~ For electricity used as a transportation fuel ~~or as an input to hydrogen production delivered through~~, the ~~grid without regard to physical traceability if it meets all requirements of this subarticle. The~~ low-CI electricity must be supplied to the grid within a California Balancing Authority . . . [4]

Based upon this markup to the existing regulatory text, CARB appears to propose to strike the provisions in 17 C.C.R. § 95488.8(i)(1) that currently allow eFuels producers to use indirect accounting for low-CI electricity supplied for hydrogen production through electrolysis. The ISOR is silent with respect to any specific intent to eliminate such accounting, however. In fact, CARB's ISOR reflects an intent to *expand* book-and-claim accounting to "support . . . low-CI hydrogen production," specifically by allowing fuel producers to use indirectly match power produced under dedicated power purchase agreements (PPAs) with power used for "both process electricity as well as for hydrogen production" in the context of hydrogen used as a transportation fuel.[5]

As CARB makes no mention in the ISOR of an intent to curb the use of book-and-claim accounting (including via RECs) for low-CI electricity used for electrolysis, HIF USA presumes the above-referenced strikeouts are inadvertent errors and not intended to be part of the proposed action. We request that CARB confirm this point in the FSOR and make the appropriate corrections. Specifically, HIF USA requests that CARB adopt a modified version of its proposed text that would preserve the use of RECs to book-and-claim low-CI electricity used to produce hydrogen through electrolysis, such as the following:

(i) *Indirect Accounting for ~~Renewable or~~ Low-CI Electricity ~~and~~, Biomethane, and Low-CI Hydrogen*.

[4] *See* CARB, Appendix A-1: Proposed Regulation Order (Proposed Sections for Amendments) (Updated 1/2/2024) at 148-149, https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024.

[5] CARB, Staff Report: Initial Statement of Reasons (Dec. 19, 2024) at 34, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf.

380.2 cont

(1) *Book-and-Claim Accounting for ~~Renewable or~~ Low-CI Electricity Supplied as a Transportation Fuel, Direct Air Capture projects, or Used to Produce Hydrogen ~~as a transportation fuel~~*. Reporting entities may use indirect accounting mechanisms for low-CI electricity supplied as a transportation fuel ~~or,~~ for hydrogen production ~~through electrolysis~~ and processing for transportation purposes (including hydrogen that is used in the production of as a transportation fuel), or for direct air capture projects, provided the conditions set forth below are met:

(A) ~~Reporting entities may report low-CI~~ For electricity used as a transportation fuel or as an input to hydrogen production ~~delivered through~~, the ~~grid without regard to physical traceability if it meets all requirements of this subarticle. The~~ low-CI electricity must be supplied to the grid within a California Balancing Authority . . .

HIF USA requests that CARB make conforming changes throughout its proposal to ensure the broadest possible use of indirect accounting for low-CI electricity used in the hydrogen production process. To the extent this proposed change was not inadvertent, HIF USA requests that CARB not adopt it or if it intends to proceed, CARB should provide another comment period and discuss the technical and policy bases for such a change to allow for adequate public comment opportunity on such an important issue, given the current preamble language that indicates the opposite intent.

III. Conclusion

HIF USA recognizes, as CARB does, that this is a critical moment in history to address global climate change. We see this challenge as an opportunity, one that can be accelerated through the key incentives provided in the LCFS program. We look forward to working with CARB staff on our LCFS pathway application that will facilitate bringing innovative fuels to California, including green methanol.

If you have any questions or would like to discuss these comments, please contact Shannon S. Broome, Hunton Andrews Kurth LLP (sbroome@huntonak.com) or (415) 818-2275.

Comment Log Display

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Comment 390 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name Matthew

Last Name Sheets

Email Address msheets@landstewardshipproject.org

Affiliation

Subject Land Stewardship Project Public Comment to CARB

Comment

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Hello,

Please find our public comment attached. We appreciate the
opportunity to offer comment and I would be happy to answer any
clarifying questions you have.


Best,
Matthew Sheets
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Attachment www.arb.ca.gov/lists/com-attach/7075-lcfs2024-Uz8FcFQlUFwLfQB1.pdf

Original File Name LSP Public Comment to CARB Feb 2024.pdf

Date and Time Comment Was Submitted	2024-02-20 22:10:53

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LAND STEWARDSHIP PROJECT

LEWISTON OFFICE
180 East Main St, Box 130
Lewiston, MN 55952
507-523-3366

MINNEAPOLIS OFFICE
821 East 35th St, #200
Minneapolis, MN 55407
612-722-6377

MONTEVIDEO OFFICE
117 South 1st St
Montevideo, MN 56265
320-269-2105

February 20, 2024

Governor Newsom and Members of the California Air Resources Board (CARB),

The Land Stewardship Project, on behalf of our members, submits these comments sharing our concern about the current state of California's Low Carbon Fuel Standard (LCFS) and requests that you amend the current program to address the environmental injustices embedded in the program and that are having direct negative impacts on our members, and on the communities that we represent.

The Land Stewardship Project is a grassroots, member-driven, nonprofit organization that works with farmers and rural communities in Minnesota, Wisconsin, and Iowa. For over four decades, the Land Stewardship Project has organized thousands of small and mid-sized farmers, rural residents, and others to build a just and sustainable farm and food system, as well as healthy communities. Currently, our membership includes approximately 1,500 small and mid-sized farmers and an additional 3,000 households.

We work with our members and communities every day to build an agricultural system in which small and mid-sized farms and farming families can thrive, our air and water is clean, our soil is healthy, rural communities can prosper, and our climate is stable and resilient.

For 42 years, our members have worked together to advance a vision for agriculture and rural communities in the upper mid-west that has included “fighting the worst” that this current agricultural system is giving us and “promoting the best” that we know our system of agriculture and rural areas can be. Small and mid-sized farms and rural communities cannot thrive, or even survive, in an environment where the agricultural sector becomes increasingly consolidated. This consolidation includes large-scale feedlots that threaten our air, water, soil, climate, wildlife, farm economy, local rural economies, human health, and more.

During our history, LSP members, local community groups, and their neighbors have successfully prevented over 40 large-scale feedlots from being built or expanding. We have worked together to protect our shared air, water, land, climate, and communities from the harmful effects factory farms. From the gasses that it produces and the water pollution that it creates, to the good farmers and farm families that are pushed off the land because they cannot compete with operations that use massive economies of scale to produce near endless quantities of cheap produce.

We have also worked together to bolster and support farmers and farming methods that sustain the health of the land, air, water, climate, and communities. The Land Stewardship Project has directly trained over 1000 beginning farmers on sustainable farming practices, won tens of millions of dollars from state and federal governments for investments in programs that build soil health, create regional food systems, created tax incentive programs that make it easier for beginnign farmers to gain access to land, and passed moratoriums on farm foreclosures when the farm economy experiences major downturns.

The Land Stewardship Project has a deep familiarity with building an agricultural system that is good for our planet and our communities in a way that works.

That is why the Land Stewardship Project and our members in rural areas are concerned about the injustice we see happening in our communities stemming from the current way the California LCFS rules are being implemented. Right now, our members are seeing multiple large projects being built proposed or proposed near them to capture methane, or factory farm gas, from industrial farms in their area. These proposals are being brought forward by both big oil and big agriculture corporations with little to no regard for the wishes of or the effects it will have on the community surrounding the sites. In many cases, these proposals are being snuck into communities as quietly as possible and are being proposed in a way that avoids any sort of public environmental review process. Many are brought forward at the behest of large industrial farms in the area, who already hold a large amount of control in the community and local economy, for the sole purpose of further enriching the owners of these industrial farms.

Because large industrial agriculture is able to take part in the LCFS program, the program has become the nation's largest and most lucrative pollution trading scheme for factory farm biogas, perpetuating harmful practices rather than serving its environmental objectives. It is driving the construction of more factory farms and factory farm biogas projects in states far from California, causing severe harm to air, water, public health, rural economies, and overall quality of life in communities where Land Stewardship Project members live, raise their families, recreate, grow food, and grow old in. Communities that are centers for the dairy farming industry have been particularly effected due to dairy manure being the feedstock of choice for many factory farm gas projects in the Upper Midwest. This is having disastrous effects on an already suffering industry and the communities that rely on that industry.

As an organization that works with farmers across the Upper Midwest to help them advocate for their interests, we are in regular communication with dairy farmers and dairy farm families, and are listening to what they care about, what they are proud of, what is working on their operation, what isn't working for them, what they are hopeful about and what they are concerned about. And the concern that we have heard about the most is about the consolidation of their industry that is being driven by large dairy operations. Operations of the size and scale of the ones that the current LCFS funds almost exclusively.

The dairy industry and the rural communities that are connected to that industry in the Upper Midwest are in a fragile state due to this ongoing consolidation. Minnesota is a prime example of this fragility. Since the late 1970's, Minnesota has not seen any meaningful change in the number of dairy cattle that are farmed in our state. What has changed drastically is the number of dairy farms and farming families.

In the late 1970's, there were about 40,000 dairy farms and dairy farm families in Minnesota, earlier this year that number dropped below 2,000. The dairy farmers and farm families that remain are regularly dealing with drastic price swings that dip the sales price that they receive for their milk to between seventy five and fifty percent of what it costs to produce. Farmers are saying that there is no way for them to compete with the large operations, like the ones that receive the bulk of the funds from trading carbon credits under the current LCFS program, when they can use their massive economies of scale to periodically dump large quantities of cheap to produce milk on the market. Driving down the collective price per hundredweight that all dairy farmers receive.

The main beneficiary of this consolidation has been Riverview Dairy, Minnesota's largest dairy farm operator. Riverview themselves owns over a third of all of the cow that are currently producing milk in

Minnesota. This same opperation has recieved the most amount of money from the current LCFS program.

The fact that the state of California is maintaining a system that funnels millions of dollars to these large dairy operations like Riverview seems particularly unjust when the rest of the economic picture is laid out. These are massive corporations that already have an economic leg up over their competition. But they way the current LCFS program works helping their wallets get even larger by helping their operations secure an additional two revenue streams that they have exclusive access to. On top of making money from the milk they produce, the large dairy farms are currently able to sell the methane itself to natural gas companies to be used for energy and turn around and sell the carbon offset credits they accrue through the LCFS program and make money there. This effectively makes the primary source of revenue for a dairy farm large enough to participate in the program funding from energy production, and making the revenue gained from milk production into a byproduct. This energy-based revenue is something that the vast majority of farmers in the Upper Midwest are locked out of due to the unachievable upfront costs, but these farmers will still have to compete with milk that is being sold and priced as a byproduct, not a commodity.

In summary, it is because of the Land Stewardship Projects deep familiarity with what it really takes to have a truly sustainable system of agriculture, the experiences of our membership in rural areas, and the effects that the projects receiving funds from the California LCFS are having on rural communities and the dairy economy in particular that we ask you to amend your current LCFS program by:

381.1 1. Eliminating "avoided methane crediting" in 2024.
381.2 2. Addressing inaccuracies in the Life Cycle Assessment that ignore associated up and downstream greenhouse gas emissions from factory farm gas production.
381.3 3. Removing the 10-year "grace period" for factory farm gas producers.
381.4 4. Stopping double counting by allowing factory farm gas projects paid for and claimed by other programs to sell LCFS credits as well.

Sincerely,

Matthew Sheets

Policy Organizer with the Land Stewardship Project

On Behalf of the Land Stewardship Project Animal Agriculture Steering Committee

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Comment 391 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Nicole
Last Name	Rice
Email Address	nicolerice@ca-rta.org
Affiliation	CA Renewable Transportation Alliance
Subject	CRTA Comment Letter on Proposed Amendments to LCFS
Comment	We appreciate this opportunity to submit these comments on the Proposed Amendments to the Low Carbon Fuel Standards program. Thank you for your consideration of our position.
Attachment	www.arb.ca.gov/lists/com-attach/7076-lcfs2024-BmUCdlwpWWsFXFc7.pdf
Original File Name	CRTA_LCFS Comment Letter_Final - Feb 20 24.pdf
Date and Time Comment Was Submitted	2024-02-20 22:16:47

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SUBMITTED VIA ELECTRONIC FILING

February 20, 2024

The Honorable Liane Randolph
Chair, California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: CRTA Comments in Response to the Low Carbon Fuel Standard Proposed Amendments

Dear Chair Randolph,

The California Renewable Transportation Alliance (CRTA) appreciates the opportunity to provide these comments to you and the California Air Resource Board (CARB) on the *Proposed Amendments to the Low Carbon Fuel Standard Regulation*[1].

CRTA is a diverse coalition of renewable fuel producers, fleet operators, engine manufacturers, consumers, and utilities who, in partnership with the state, advance innovative, cost-effective solutions to decarbonize California's transportation sector and reduce the state's dependence on petroleum products.

The Low Carbon Fuel Standard (LCFS) is a successful program that has been nationally recognized as an effective mechanism for decarbonizing transportation fuel, reducing California's dependence on fossil fuel, and incentivizing the abatement of methane emissions from dairy operations. Today, there are at least 12 states nationally that have either adopted LCFS programs or are having conversations to establish similar programs. And, just last week, the New Mexico Legislature joined California, Washington state and Oregon in adopting a clean fuel standard program that will likely be signed by Governor Michelle Lujan Grisham soon.

The LCFS must remain fuel-neutral, driven by science-based analysis, focused on performance-based greenhouse gas (GHG) outcomes and able to incentivize real-world investments to accomplish the ambitious climate mitigation goals set forth in the *2022 Scoping Plan for Achieving Carbon Neutrality* within the allotted timeframe.

CRTA believes the proposed amendments related to the treatment of biomethane under the LCFS strike the right balance. The proposed language enables renewable natural gas (RNG) to provide significant emission reductions in the near-term while remaining a source of energy to power zero-emission platforms like electricity and hydrogen into the future.

[1] "Appendix A-1; Proposed Regulation Order; Proposed Amendments to the Low Carbon Fuel Standard Regulation." California Air Resources Board. Updated January 2, 2024.

Embracing this type of "balanced approach" to transportation decarbonization has been a hallmark of CRTA and we applaud its application in this context and encourage its adoption in other conversations. It is with this perspective in mind that we offer the comments below on the following provisions of the proposed amendments:

382.1 **1. Increased Stringency of the Carbon Intensity (CI) Curve and Mid-Term Target**

As you know, credit prices have been on the decline since the talks on the LCFS modifications began last year. In 2018, the average LCFS credit value was approximately $170. Most recently, however, the credit price hit an all-time low of $55 per metric ton of carbon dioxide. This decrease in value is mostly due to the imbalance between credit supply and demand due to the abundance of renewable diesel (RD) in the market.

The seriousness of this situation, and the need for a quick, corrective response, is captured in a new report by the University of California Davis, Policy Institute for Energy, Environment, and the Economy.[2] In this pre-publication document, entitled *Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking*,[3] the authors' emphasize that "[d]eployment of renewable diesel (RD) production capacity in the U.S. has greatly exceeded even very recent projections, and the majority of the production continues to flow to California. Current evidence indicates that this trend of rapid RD capacity growth is likely to continue through the mid-2020's, creating a massive pool of relatively low-cost biofuel (given incentives beyond the LCFS) produced with an established technology that could enter California's market. Under these conditions, it is unlikely that the proposed LCFS amendments will achieve their goal of stabilizing the credit market and supporting significantly higher credit prices."

CRTA supports increased stringency of the CI targets. It is necessary to restore the balance between credit supply and demand, thereby increasing prices and incentivizing project development. Given that staff already plans to reevaluate the proposed carbon intensity benchmarks, we urge them to consider these points for discussion at the upcoming April 2024 LCFS workshop:

Increased Stringency
While we see the 2030 midterm target of 30 percent a move in the right direction, we encourage staff to be bolder and adopt a target closer to 41-44 percent by 2030. ICF has performed extensive modeling of the market and has identified the need for an even deeper CI adjustment to maintain a healthy credit marketplace that will ensure that long-term investments are built.

382.2 "Step-Down"
We support the adoption of an immediate 10.5-11.5 percent "Step-Down" of the CI target in 2025 to quickly stabilize the carbon market.

[2] Murphy, C., & Ro, J. (2024). Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking. *UC Davis: Policy Institute for Energy, Environment, and the Economy*. http://dx.doi.org/10.7922/G25719BV Retrieved from https://escholarship.org/uc/item/5wf035p8

[3] This report was published online Friday, February 16, 2024.

382.3 Automatic Accelerator

We strongly support the incorporation of the Automatic Accelerator Mechanism (AAM) concept and making it available for activation as early as 2026. This will allow CARB to maintain market stability in the outyears, thus providing greater certainty for long-term investments.

382.4 **2. Avoided Methane Crediting & Book and Claim Provisions**

CRTA initially commented in 2022 that both the Avoided Methane Accounting and "Book & Claim" provisions in the LCFS, as originally designed, are effective tools to maintain the RNG supply envisioned under the 2022 Scoping Plan Update and to achieve the required reductions of Senate Bill 1383. That said, we support the approach taken by CARB staff in the proposed amendments related to these two provisions. It is a balanced approach that enables RNG to continue providing achievable emission reductions for existing and emerging technologies, resulting in better air quality today and into the future.

The effective and abundant capture of methane today is critical to limiting the planet's warming to 1.5 degrees Celsius, thus preserving the health of our planet and its inhabitants. Methane is a potent GHG and short-lived climate pollutant that accelerates climate change if left unabated. It accounts for almost 30 percent of the rise in global temperatures in the post-industrial era and is 80 percent more potent than carbon dioxide over a 20-year period.

LCFS has proven to be a key driver for the effective capture and reuse of otherwise unabated methane emissions, particularly from dairy operations. It does this by converting raw methane into RNG for use in transportation and other industry sectors. The use of RNG not only helps to decarbonize internal combustion engines like low NOx natural gas trucks and buses, it also can be used to power and decarbonize battery-electric and hydrogen-based platforms.

Therefore, CRTA strongly supports CARB staff's recommendation to continue its application of avoided methane accounting and the program's use of "book and claim" deliverability for RNG projects developed on or before December 31, 2029 that support the transportation sector. By doing so, it restores project planning predictability for investors thereby avoiding stranded assets and incentivizing continued low carbon fuel production. Maintaining strong RNG pathways in the short term maintains its availability for use in other industry sectors as envisioned in the 2022 Scoping Plan Update. We also support CARB staff's recommendations to provide additional time for RNG-supported hydrogen pathways to boost production of this versatile fuel and capitalize on initial funding for infrastructure and production.

382.5 **3. A Full Credit True-up should be inclusive of the Temporary Pathway Period**

New dairy digester projects must apply to CARB staff for pathways to generate LCFS credits. Assuming that there are no major problems with the application, it still takes up to 27 months to receive a provisionally certified LCFS pathway from CARB, which is primarily the result of processing timelines. Consequently, the developer must bear the financial burden during this process delay, which becomes a major impediment to project development.

CRTA therefore supports CARB's proposed amendments that include a "Credit True Up" after Annual Verification. However, the credit true up concept should also cover the temporary pathway period that can take up to 27 months to certify a project. This would help alleviate the pressure for CARB to process LCFS applications in a shorter time period.

382.6 **4. "Less Intensive Verification" Provision -** Section § 95501

CRTA appreciates the inclusion of the "Less Intensive Verification" concept found in Section 955011(h). However, we urge staff to make it applicable to all quarterly fuel transaction reports (QFTR) identified in Section 95500(c)(1) and not just to electricity transactions, as provided in Section 95500(c)(1)(E). A verification site visit for a QFTR primarily consists of a visit to an entity's headquarters or other location of central data management and reviewing of electronic records. As the recent pandemic demonstrated successfully, these visits can easily be done virtually. Allowing for less intensive verifications for QFTRs is consistent with the flexibility provided under the Regulation for the Mandatory Reporting of Greenhouse Gas Emissions[4] and still allows for a full verification if the project-specific details suggest it.

We look forward to continued conversations with you and the Board on the LCFS amendments. Feel free to contact me at nicolerice@ca-rta.org if you have any questions regarding our position.

Respectfully,

Nicole Rice

Nicole Rice, President
California Renewable Transportation Alliance

cc: CARB Board Members
Ms. Hazel Miranda, Chief of Staff and Policy Advisor to Chair Randolph, CARB
Mr. Matt Botill, Division Chief, Industrial Strategies Division, CARB
Ms. Lauren Sanchez, Senior Advisor for Climate, Office of the Governor
Mr. Grant Mack, Deputy Legislative Secretary, Office of the Governor

[4] California Code of Regulations, Title 17, Section 95130(a)(1)

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Comment 392 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Sasan
Last Name	Saadat
Email Address	ssaadat@earthjustice.org
Affiliation	Earthjustice
Subject	Comments on Proposed Amendments to the LCFS
Comment	Earthjustice comments on the proposed amendments to the LCFS attached.
Attachment	www.arb.ca.gov/lists/com-attach/7077-lcfs2024-Wz4BZgd0BCNVOwJo.pdf
Original File Name	Earthjustice- LCFS ISOR Comments Feb 20 2024 (1).pdf
Date and Time Comment Was Submitted	2024-02-20 22:25:04

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EARTHJUSTICE

February 20, 2024

Matthew Botill, Chief, Industrial Strategies Division
Jordan Ramalingam, Policy Manager, Low Carbon Fuel Standard
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Via Electronic Submittal

RE: Earthjustice Comments on the Low Carbon Fuel Standard Staff Report: Initial Statement of Reasons

Dear Mr. Botill and Mr. Ramalingam,

Thank you for considering Earthjustice's comments on the California Air Resources Board (CARB) Staff Proposal for amending the Low Carbon Fuel Standard (LCFS) Regulation as set forth in the December 2023 Initial Statement of Reasons (Staff Proposal or ISOR). Our core recommendations include the following:

383.1 1. Set a cap on all lipid-based biofuels;
383.2 2. End avoided methane crediting for new pathways;
383.3 3. End the practice of allowing compressed natural gas ("CNG") companies to greenwash fossil methane through the purchase of unbundled biomethane credits;
383.4 4. Eliminate flawed carbon accounting practices that lead to lavish subsidies for dirty hydrogen and undermine green hydrogen production; and
383.5 5. Enhance credit generation potential for zero-emissions transit and charging Infrastructure.

We provide discussion in support of these recommendations below and in Appendix A to these comments, which contains a presentation with related graphics and analysis. We further note that we have not received public records responsive to Earthjustice's January 30, 2024 Public Records Act Request for certain data supporting Staff's analysis. Our request is included as Appendix B to these comments. Once we receive these comments, we will likely provide supplemental comments as we believe they are necessary to fully comment on Staff's proposal.

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INTRODUCTION

Earthjustice appreciates the opportunity to provide comments on the Staff Proposal for amendments to the LCFS. California—and CARB in particular—have helped catalyze a new global consensus that cleaning up the transportation system can only be accomplished through a rapid and equitable transition to zero-emissions. In this rulemaking, a critical window is open for CARB to reform the LCFS in a way that leverages its billions in annual funding to support achievement of California's zero emissions goals (including CARB's own ZEV regulations) and federal air quality requirements. These billions are insulated from the current cuts to the State budget and should not be squandered on combustion fuels.

383.6 We are therefore alarmed that, unless major modifications are made, the Staff Proposal would further entrench LCFS subsidies for combustion fuel pathways that exacerbate climate and environmental injustices. The Proposal's combustion focus is a significant aberration from CARB's clear and full-throated mission to achieve health-based air quality standards by accelerating the transition from combustion to zero-emissions—a mission that the California Energy Commission (CEC), the California Public Utilities Commission (CPUC), the California Legislature, and Governor Newsom have joined.[1] We are not aware of any environmental or environmental justice organization that endorses continued LCFS subsidies for combustion fuels, paid for by California drivers. Instead, combustion fuel subsidies are most prominently championed by out-of-state combustion fuel producers, multi-national agribusiness corporations, commodities traders and financiers, and even oil and gas companies.

383.7 Fortunately, as Earthjustice, our partners, and multiple academic experts have explained, reigning in subsidies to outdated, combustion pathways is not only necessary and workable, but can also stabilize LCFS credit prices to support an equitable ZEV transition and protect against runaway increases in gas prices.

We urge CARB to modernize this program now. Major changes are needed in this rulemaking to ensure the LCFS supports rather than thwarts attainment of California's climate, air quality, and equity goals. Delaying the necessary and implementable changes that we summarize above and detail below would cast doubt on CARB's commitment to these core goals and its role as a global climate and environmental justice leader.

[1] These state actions include but are not limited to the following: CARB's regulatory actions on mobile sources are focused on eliminating air pollution and advancing the transition to zero emissions, including Advanced Clean Cars (ACC) II, Advanced Clean Fleets, and Advanced Clean Trucks; CARB's Mobile Source Strategy, which identifies even faster electrification needed to meet attainment; CPUC's denial of utilities' requests to purchase natural gas trucks, recognizing that "California's express policy is to meet [the State's GHG reduction] goal through widespread transportation electrification;" CPUC's eliminating gas line subsidies for methane refueling stations; CEC's 2022-2023 Investment Plan Update for the Clean Transportation Program allocating 95% of its investment toward ZEVs; The State Legislature's clear intent in Senate Bill ("SB") 350 has been to achieve rapid decarbonization through widespread transportation electrification, and; Executive Order N-79-20 calls for an end to the sale of internal combustion engine vehicles by 2035, and that by 2045, all vehicles on the road are zero-emission everywhere feasible.

DISCUSSION AND RECOMMENDATIONS

1. Set a Cap on All Lipid-Based Fuel Pathways.

Lipid-Based Biofuels

383.1 **Summary of Problem:** An unconstrained subsidy on combustion-based fuels increasingly sourced from food crops is driving both record-levels of unsustainable consumption and the glut of credits, depressing the credit price. Staff's previous efforts to constrain fuels that increase pressure on global deforestation are no longer effective.

Earthjustice Recommendation: Cap the generation of credits from all lipid-based fuel pathways to no higher than 2022 levels.

Why Staff Proposal Is Inadequate:

Staff does not propose any limits on lipid-based fuels, including virgin crop oils.

The two newly proposed measures will not solve the problem. Staff's chain of custody certification proposal does nothing to stave off the glut of lipids in the program. Staff's proposed exclusion of palm-oil-derived fuels is also unhelpful because these oils have never generated credits under the LCFS.

a. Crop-Based Fuels are Surging in the LCFS, Despite LUC Factors.

Staff state that crop-based and high-risk feedstocks are disincentivized and that the LCFS has "historically come from waste feedstocks."[2] Staff point to the Regulation's Land Use Change (LUC) factor for this outcome. However, the LUC factor was based on analyses conducted over a decade ago and under volumes significantly lower than are seen even today, let alone the
383.8 volumes expected in the near future. For example, the analyses underlying the LUC values assumed as input values of roughly 0.8 billion gallons of soy biodiesel.[3] But biomass-based diesel volumes (i.e. renewable diesel (RD) and biodiesel (BD)) are already well over 1 billion gallons as of the end of 2022.[4]

In fact, crop-based feedstocks have surged since 2020. As shown in Figure 1, CARB's February 2023 workshop presentation acknowledged the unprecedented use of crop-based oils in the program, primarily driven by soy, suggesting financial or other barriers have been overcome that make using these feedstocks viable, even under increasingly stringent carbon intensity (CI) benchmarks.[5] Since then, the rate of increase has only grown. In the second quarter of 2023, RD

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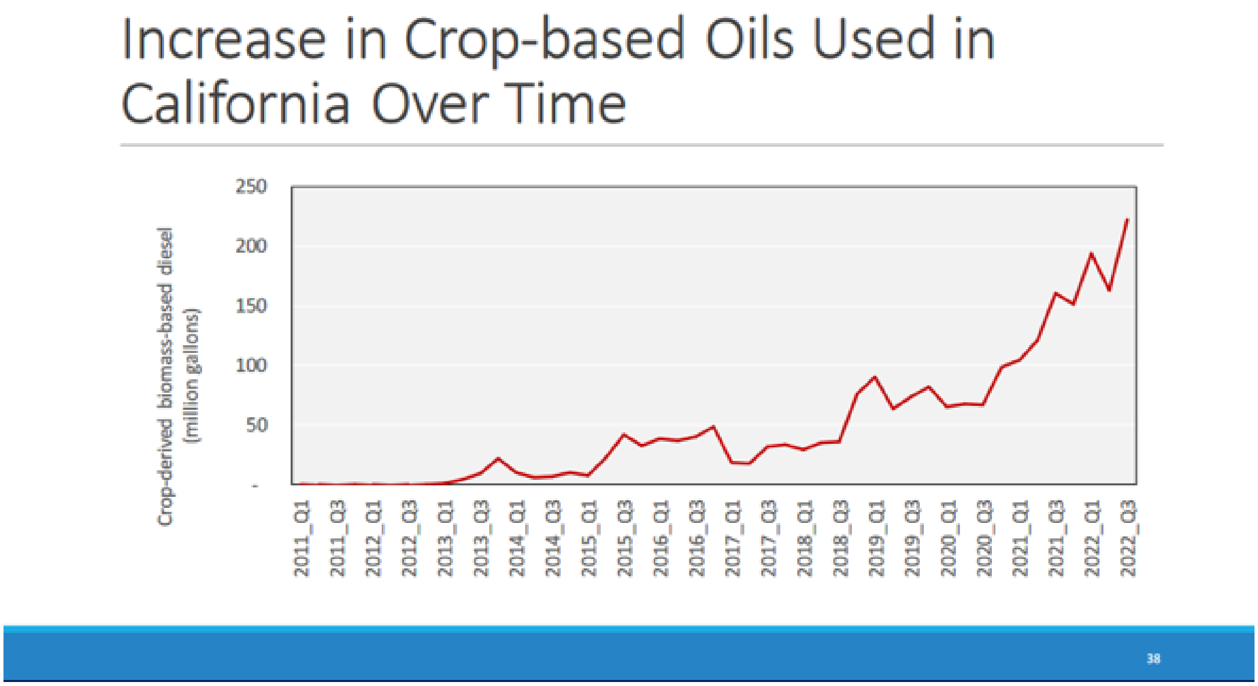
[2] CARB, ISOR at 32, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf.
[3] CARB, Detailed Analysis for Indirect Land Use Change (2015) at I-8, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/iluc_assessment/iluc_analysis.pdf.
[4] CARB, LCFS Data Dashboard (Accessed Feb. 20, 2024) https://ww2.arb.ca.gov/resources/documents/lcfs-data-dashboard.
[5] CARB, LCFS – Public Workshop: Potential Regulation Amendment Concepts (Feb 22, 2023) at 38, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/lcfs_meetings/LCFSpresentation_02222023.pdf.

volumes grew an alarming 18.9% in a single quarter.[6] In the third quarter, volumes climbed another 10.5%.[7] Clearly, what LCFS aimed to achieve solely through the LUC factors is no longer working.

Figure 1: Staff February 2023 Workshop Slide Showing Crop-Based Oil Surge



Land use change is an inherently dynamic phenomenon that cannot be adequately captured by a fixed value. While LUC adders may have helped deter virgin feedstocks in the past, the booming volumes require a more direct intervention. Numerous global pressures, like
383.9 population growth, governance regimes, debt or trade pressures on exporting countries, and climate- or pest-driven crop failures, can all increase the risks of land conversion.[8] These static emissions factors do not reflect the reality that "costing" in ILUC factors will not necessarily affect the carbon stock of the land that is or is not spared, and studies have found that bioenergy consumption taxes (analogous to how the ILUC adder attempts to make crop fuels less desirable

[6] Stillwater Associates, Flash Report: 2Q2023 LCFS Data Show More than 1.5 Million MT Net Credit (Nov. 3 2023), https://stillwaterassociates.com/flash-report-2q2023-lcfs-data-show-more-than-1-5-million-mt-net-credit/.

[7] Stillwater Associates, Flash Report: 3Q2023 LCFS Data Show More than 2.2 Million MT Net Credits, https://stillwaterassociates.com/flash-report-board-meeting-carb-staff-update-on-2023-lcfs-amendment-process-2/.

[8] *See, e.g.*, Dynamis of Land use, Land Cover Change Trend and Its Drivers in Jimma Geneti District, Western Ethiopia (Dec. 2020), https://www.sciencedirect.com/science/article/abs/pii/S0264837719317971; Ilan Stavi et al., Food Security Among Dryland Pastoralists and Agropastoralists: The Climate, Land-use change, and Population Dynamics Nexus (Apr. 2021) https://journals.sagepub.com/doi/abs/10.1177/20530196211007512;

in the LCFS than waste fuels) "fails to steer [land use change] decisions towards low-[emission factor] areas and cannot prevent the conversion of higher-carbon land." The study authors conclude that "this finding implies climate policy sequencing: first, global [land use] regulation needs to be in place, and only then should large-scale bioenergy be considered."[9] There is no such global land use regulation that safeguards against land conversion. On the contrary, most recent satellite data shows a clear trend of increasing deforestation and land conversion alongside rising soybean consumption in the biofuel sector.[10]

b. Unconstrained Biofuels Subsidies Pose Severe Social and Ecological Harms that Do Not Align with California's Vision for Clean Transportation.

We appreciate that Staff's acknowledgement that a "rapid increase in oil crop demand for biofuel production could potentially add pressure to convert forested land or other land types into
383.10 biofuel crop production."[11] Based on the research we have cited throughout the rulemaking process, the risks of harm from biofuels – both social and ecological – is already evident.[12] Most of the land suitable for agriculture is already in use for food production. Diverting crops from food to fuel instead increases the crop prices, resulting in some combination of these detrimental ecosystem, climate, and public health outcomes:

1. New land is diverted from forest or other native vegetation to agriculture;
2. Practices on existing cropland must intensify to increase yield (i.e., through additional use of petroleum-based fertilizer, pesticides, and diesel-fueled equipment); and/or
3. Demand for the crop must be reduced.

[9] Leon Merfort et al., Bioenergy-induced Land-Use-Change Emissions with Sectorally Fragmented Policies (June 2023), https://www.nature.com/articles/s41558-023-01697-2.
[10] *See* Yu Feng et al., Doubling of annual forest carbon loss over the tropics during the early twenty-first century (Feb. 2022), https://www.nature.com/articles/s41893-022-00854-3, *and* Xiao-Peng Song et al., Massive soybean expansion in South America since 2000 and implications for conservation, https://www.nature.com/articles/s41893-021-00729-z.
[11] ISOR Staff Report, page 32, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf.
[12] *See, e.g.*, Tyler J. Lark et al., Environmental Outcomes of the US Renewable Fuel Standard (Feb. 14, 2022), https://doi.org/10.1073/pnas.2101084119; Horst Fehrenback et al., Carbon Opportunity Costs of Biofuels in Germany – An Extended Perspective on the Greenhouse Gas Balance Including Foregone Carbon Storage (Oct. 2022), https://doi.org/10.3389/fclim.2022.941386; Samuel G. Evans et al., Greenhouse Gas Mitigation on Marginal Land: A Quantitative Review of the Relative Benefits of Forest Recovery versus Biofuel Production (Jan. 12, 2015), https://doi.org/10.1021/es502374f; Yu Feng et al., Doubling of Annual Forest Carbon Loss Over the Tropics During the Early Twenty-First Century (May 2022) https://doi.org/10.1038/s41893-022- 00854-3; Sophie Jane Tudge et al., The Impacts of Biofuel Crops on Local Biodiversity: A Global Synthesis (Jan. 19, 2021), https://doi.org/10.1007/s10531-021-02232-5; Transport Environment, Fueling our Crises – How Soy Biofuels are Pushing the Amazon Closer to the Tipping Point (Nov. 4, 2022), https://www.transportenvironment.org/discover/how-soy-biofuels-are-pushingthe-amazon-closer-to-the-tipping-point/.

The first two possibilities significantly increase greenhouse gas (GHG) emissions, destroy surrounding habitats, imperil biodiversity, and pollute the air and water.[13] The land use change model in the LCFS assumes instead that the higher prices will lead to the third option – reduced demand.[14] **Reduced demand due to higher crop prices means the poorest people would eat less and be pushed into hunger.** To examine the emissions effects of theoretically foreclosing this grim outcome, researchers fixed consumption in the GTAP model to control against any increase in food insecurity. They found that the impact on deforestation doubled, and land use change emissions increased by 41 percent, or an additional 10 gCO2e/MJ to the ILUC value for ethanol not currently accounted for by CARB.[15]

383.11 The unacceptable and potentially irreversible harms posed by increasing biofuel consumption to fragile forest ecosystems, the climate, biodiversity, and indigenous communities far outweigh the marginal emissions benefits that these fuels may theoretically offer over fossil fuels, even if one assumed those incremental reductions could be assured.

383.12 In addition to dramatically increasing pressure on land conversion, agricultural intensification, and global food prices, the surge of soybean oil has been self-defeating for all the intended beneficiaries of the LCFS. Record-high crop fuel volumes translate to record-low LCFS credit prices. As a recent article in Argus Media (a trade press tracking biofuel commodities) notes: "Prices have groaned under the weight of new credits generated in excess of obligations that have doubled since the workshops began, to more than 18mn t — nearly enough to satisfy all the deficits generated in the 2021 compliance year. These credits do not expire."[16]

Recent analysis by the University of California Davis shows that there is no end in sight to the surge of lipid biofuels into the California market. Even in a period of low credit prices, renewable diesel has increased so rapidly in recent years that consumption of lipid biofuels already exceeds the maximum volumes projected by some experts and exceeded the volumes that other experts expected to see in the late 2020s.[17] After evaluating recent trends, the University of California researchers found that "the upper bound on aggregate consumption [of lipid biofuels] may be the global supply of lipids, which is more than sufficient to fully displace all diesel and jet fuel consumption within the near term."[18] New information on the availability of renewable diesel suggests that the ISOR's proposed CI targets and automatic acceleration

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[13] *See, e.g.*, Tyler J. Lark et al., Environmental Outcomes of the US Renewable Fuel Standard (Feb. 14, 2022), https://doi.org/10.1073/pnas.2101084119.
[14] CARB, Low Carbon Fuel Standard Public Workshop (July 7, 2022) at slide 34, https://ww2.arb.ca.gov/sites/default/files/2022-07/LCFSWorkshop_Presentation.pdf.
[15] Thomas Hertel et al., Effects of US Maize Ethanol on Global Land Use and Greenhouse Gas Emissions: Estimating Market-Mediated Responses BioScience (Mar. 2010), https://doi.org/10.1525/bio.2010.60.3.8.
[16] Argus Media, "California sets sights on tougher LCFS"(Dec. 20, 2023), https://www.argusmedia.com/en/news/2520844-california-sets-sights-on-tougher-lcfs.
[17] Colin Murphy and Jin Wook Ro, Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking (Feb. 2024) ("Murphy and Ro") at pdf p. 5, https://escholarship.org/uc/item/5wf035p8.
[18] *Id.* at pdf p. 8.

mechanism are "unlikely to bring credit and supply demand into approximate balance before 2030" and meaningful upward pressure on LCFS credit prices is unlikely as long as there is a supply of inexpensive credits from renewable diesel.[19] Ultimately, a "cap on fuels from crop or lipid feedstocks . . . offers the best option for quickly arresting the growth in RD [renewable
383.1 ctd. diesel] markets" because other potentially effective solutions would require years to develop, "by which point significant environmental harm and damage to California's progress toward climate goals will have been irrevocably done."[20]

c. Staff's Proposed Biofuels Measures Would Be Ineffective and Administratively Unrealistic.

383.13 Staff's proposal to require crop fuels to trace the chain of custody of their fuels and receive sustainability certifications appears to be in response to the Board's direction to Staff at the September 2023 Board meeting. However, this ineffective solution does not address the fundamental problem of surging soybean oil into the program. It also presents a host of administrative challenges that are not addressed in the ISOR.

i. Neither Third-Party Certification Nor a Prohibition on Palm Oil Will Mitigate the Climate, Ecosystem, and Societal Harms of the Surge of Soy-Based Diesel in the LCFS.

383.14 The proposed feedstock sustainability certification fails to address the threats that surging demands for lipid biofuels pose to the climate, tropical forests, and food prices because oils that can meet the proposed requirements are fungible on the global market with oils from food crops grown on recently deforested land. As observed by researchers at the University of California Davis, feedstock sustainability certifications "are incapable of mitigating indirect risks like ILUC, which are driven by aggregate demand within a given market, which in the case of vegetable oils, is effectively global."[21] Nor would the proposed certification requirement succeed in stabilizing the credit price because "[t]here is ample potential supply of crop-based vegetable oil that would meet proposed sustainability criteria."[22] The proposed certification would merely direct that feedstock to biofuel production, forcing the current consumers of that oil to find other oil supplies, which have historically included unsustainable alternatives that require conversion of additional land into cultivated use.[23] As the author of the UC Davis study summarizes it: "[t]he problem isn't the oil we use, the problem is what comes into the market to replace the oil we use." [24]

383.15 Moreover, neither CARB's current indirect land use change (ILUC) factors nor the proposed certification standard account for the reality that waste- or residue-derived biofuels still pose significant risks of emissions increases through shuffling. CARB's assumption that ILUC

[19] *Id.* at pdf p. 12–13.
[20] *Id.* at pdf p. 19.
[21] *Id.* at pdf p. 16.
[22] *Id.*
[23] *Id.*
[24] Colin Murphy, (Feb. 19, 2024), https://x.com/scianalysis/status/1759673855847829880?s=20.

factors for waste- and residue-derived fuels have zero or very small indirect emissions is outdated.[25] Used cooking oils and animal fats can divert these products from other non-human consumption ends like livestock feed or consumer products, which then end up needing additional oils to substitute.[26] Therefore, the LCFS must incorporate a cap on all lipid-based
383.1 ctd biofuels, and not just crop-based biofuels or virgin oils.

The exclusion of palm oil is also a diversion from real solutions. The program, per Staff, has not had palm oil reported in the program, likely owing to the current LUC factor of 71.4. The
383.14 ctd greater risk is that soy and palm are near-perfect substitutes. New studies have pointed this out, including one that shows that the United States' increased consumption of soy biofuels has indirectly increased demand for palm oil to substitute in cooking.[27] As long as demand for soy consumption continues to surge in California, this will almost certainly equate to greater consumption of palm oil elsewhere. Excluding palm oil in the program, therefore, does not address the real issue. Given the substitution effect, we question whether soy should be given
383.16 such a favorable LUC factor, over 40 g CO2e/MJ lower than palm oil.

ii. Third-Party Certification Is Costly, Burdensome, and Unlikely to Yield Results.

The ISOR does not provide sufficient detail on how certification will comply with the proposed amendments (including, e.g., which certification bodies would be eligible, what metrics they would be required to assess, and how CARB will verify the work of certifiers). Such a
383.17 scheme cannot ensure that the risks outlined above and Board members' concerns would be addressed.

It is impossible to make confident determinations about the precise practices that generated a given feedstock based just on the properties of the final fuel delivered or even its place of origin. For a certification body to be confident that the feedstock was generated in a manner that did not pose direct or indirect land use impacts, it would effectively need to audit the entire supply chain for each fuel delivery, which would come at enormous cost given the global extent and remote reaches of the biofuel supply chain. Relying on auditors to inspect their clients is not a robust oversight framework and would ultimately require audits of the certification bodies themselves by Staff. Based on the information available in the ISOR, it does not appear that CARB has estimated or accounted for the potential costs and logistical challenges that conducting global supply chain audits would require, including any pass-through costs to Californians. Given that State employees require Governor's approval for non-California travel,

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[25] CARB, ISOR – Proposed Re-Adoption of the LCFS (Dec. 2014) at II-12, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2015/lcfs2015/lcfs15isor.pdf.
[26] Jane O'Malley, Stephanie Searle, and Nikita Pavlenko, "Indirect Emissions from Waste and Residue Feedstocks: 10 Case Studies from the United States" (Washington, D.C.: ICCT, 2021), https://theicct.org/publication/indirect-emissions-from-waste-and-residue-feedstocks-10-case-studies-from-theunited-states/.
[27] Fabio Gaetano Santeramo and Stephanie Searle, "Linking Soy Oil Demand from the US Renewable Fuel Standard to Palm Oil Expansion through an Analysis on Vegetable Oil Price Elasticities," Energy Policy 127 (April 1, 2019) at 19-23, https://doi.org/10.1016/j.enpol.2018.11.054.

and the costs to travel internationally, make this type of oversight unlikely to occur, or far less likely to be imposed on foreign-imported feedstocks than those sourced domestically.[28]

383.18 In addition, the ISOR's proposed certification system would create a powerful incentive to pass off conventional biofuels as waste- and residue-based fuels. Skyrocketing global imports of used cooking oil (including recent pathways approved by the LCFS for California to import Used Cooking Oil from Southeast Asia and Oceania) have been beleaguered by widespread incidence of fraud. Several EU member states have launched national and criminal investigations into fraudulently labeled used cooking oil in their biofuel markets. Germany and Ireland launched such investigations in 2023, and the Netherlands' ongoing criminal investigation has identified that a third of the biodiesel reported as used cooking oil could be virgin oils.[29] Ironically, CARB has only proposed to add certification criteria to virgin crop oils and not to used cooking oil or other waste fuels, the one segment where certification could be a helpful transparency tool.

383.1 ctd A cap covering all lipid-based fuels is the only way to ensure that waste fuels and used cooking oils do not become a backdoor for the land-use driving effects of crop fuels to persist.

d. The Staff Proposal Includes Overstated or Illusory GHG and Air Quality Benefits from Biofuels.

As noted above, CARB has not yet provided stakeholders with the spreadsheets underlying the modeling that supports their conclusions and Earthjustice has not yet received responsive documents to our Public Records Act request attached as Appendix B to these comments. But even without the underlying tables, there are seriously questionable assumptions
383.19 that more biofuels will deliver significant GHG and PM/NOx reductions that depart significantly from past LCFS analyses, are counter to how other regulations are evaluated, and dismiss CARB's own research.

i. Staff Ignores CARB's Own Research on the Air Quality Impacts of Biofuels.

Staff bases the estimated air quality impacts of biofuels on outdated data. In previous rulemakings, CARB asserted the following:

- BD has higher NOx emissions than fossil diesel.
- 383.20 RD has lower NOx emissions than fossil diesel.
- RD NOx reductions "offset" the BD NOx increases at BD concentrations of 20% or less.
- BD and RD have lower PM emissions than fossil diesel.
- These findings were from older engines but assumed to apply to newer engines that now dominate the roadways (called New Technology Diesel Engines, or NTDE).

[28] https://leginfo.legislature.ca.gov/faces/codes_displaySection.xhtml?sectionNum=11032.&lawCode=GOV.

[29] Transport & Environment, Biofuels: From Unsustainable Crops to Dubious Waste? (Dec. 2023) at 20-21, https://www.transportenvironment.org/wp-content/uploads/2023/12/202312_TE_biofuels_update_report_clean-1-1.pdf.

In 2021, CARB posted a study specifically looking at the impact of biofuels on NTDEs. That study found:

- BD NOx has higher emissions than fossil diesel.
- RD NOx has similar emissions to fossil diesel.
- RD cannot offset BD NOx impacts.
- BD and RD have similar PM emissions as fossil diesel.

However, Staff ignore their own 2021 findings in the 2023 LCFS ISOR, stating PM and NOx "emissions test data for renewable diesel in NTDEs were not available," and "staff conservatively assumed use of renewable diesel in NTDEs results in no change in NOx emissions relative to conventional diesel."[30] Neither of these statements is true. Data *are* available and a *conservative* approach would be to protect public health. It is inexplicable that CARB ignored its own, more recent research which measures precisely the question it claims to lack data for. CARB must amend this analysis to fix these egregious errors.

Additionally, the 2021 results were obtained even while using biofuels that do not meet ADF requirements for biofuels.[31] **Using a compliant fuel would likely lead to even higher NOx emissions**. Indeed, Earthjustice strongly advises using a soy-based biofuel in future testing.

ii. Staff's Proposal Double Counts Biofuel Benefits.

Staff's analysis should evaluate the impacts of the specific regulation, separate from the
383.21 benefits of federal mandates or other State regulations that would occur with or without implementation of the current proposal. Inclusion of these benefits improperly overstates the impacts of the proposal and should be avoided. Past LCFS analyses adhere to this construct. In 2018, for example, Staff included an adjustment to the GHG and air quality benefits to "eliminate double counting of emission reductions that are more appropriately attributed to other State and federal programs such as Advanced Clean Cars and Renewable Fuel Standard."[32] However, the ISOR attributes 100% of the PM/NOx and GHG reductions associated with renewable diesel to the LCFS, even though much of these reductions are driven by federal mandates. Staff clearly detailed the methodology for attributing the incremental benefits of the LCFS and those to other programs in Appendix F of the 2018 ISOR and do not provide an explanation for changing the approach in the most recent ISOR.[33] Correcting this apparent

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[30] CARB, Low Carbon Fuel Standard 2023 Amendments – Appendix B (Sept. 8, 2023) at B-9.

[31] In particular, the cetane number of the fuel tested was much higher than allowed in the ADF regulation (see Table A.8 in the ADF Regulation). This is significant because higher cetane fuels generally have faster combustion and lower levels of NOx emissions.

[32] CARB, LCFS Initial Statement of Reasons (Mar. 6, 2018) at IV-2 https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/isor.pdf?_ga=2.105822022.451461435.1708363833-1354554675.1652381457.

[33] That is, the RFS requires renewable diesel to have GHG lifecycle emissions at least 50% below the lifecycle emissions of fossil diesel, and CARB's cost-benefit analysis for proposed LCFS amendments has previously taken credit only for emissions reductions from renewable diesel that go beyond the federal mandate.

oversite would significantly lower the purported benefits of relying on lipid biofuels. Other recently approved CARB regulations include methodologies detailing how Staff accounted for other initiatives in place.[34]

iii. Upstream Benefits Should Not Be Attributed to the LCFS.

383.22 The ISOR attributes GHG and PM/NOx reductions associated with reductions in upstream crude oil production in California to the LCFS. This is a significant departure from CARB's analysis in the 2018 amendment process that is not explained. The new assumption that the LCFS is responsible for declining oil production in California is vastly overreaching, as there is no evidence that the LCFS has a significant impact on production. A wide range of State policies are driving down oil consumption in California, and California's consumption and production are not even linearly connected because oil production is driven by global trends rather than State consumption alone. As shown in Figure 2, the 2022 Scoping Plan notes that crude production in California has been on the decline since 1986 – more than two decades prior to the start of the LCFS.[35] For these reasons, CARB appropriately excluded upstream GHG and PM/NOx benefits from its cost-benefit analysis in the 2018 rulemaking.[36] The ISOR does not offer a clear discussion for why this change in approach is suddenly justified nor does it offer evidence for the LCFS's role in declining domestic production.

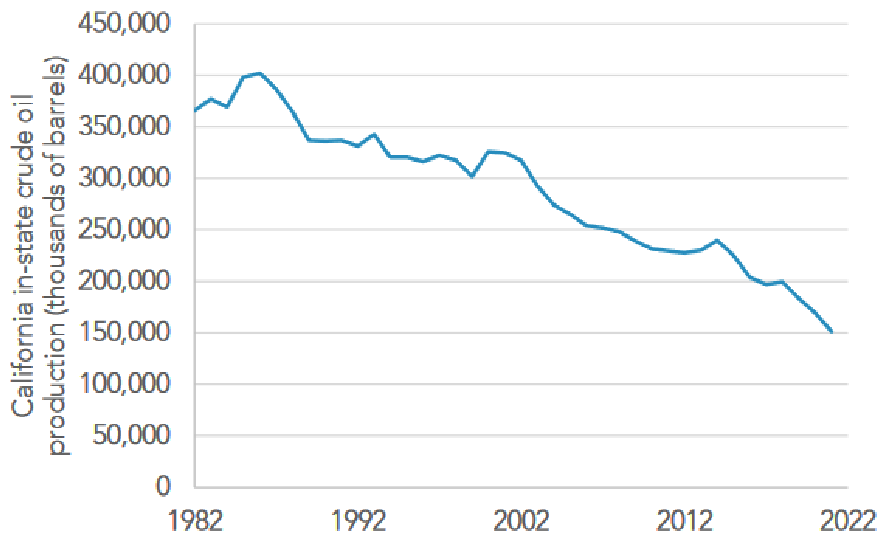
CARB, Attachment F – Updates to the Methodologies for Estimating Potential GHG and Criteria Pollutant Emissions Changes Due to the Proposed Amendments (2018) at F-14, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/15dayattf2.pdf

[34] *See*, *e.g.*, ACC II ISOR Staff Report Chapter X.A.2, where Staff describe how they accounted for the ZEV technology fractions in the California baseline fleet based on new nationwide ZEV sales projections presented in the U.S. EPA Final Rule to Revise Existing National GHG Emissions Standards for Passenger Cars and Light Trucks Through Model Year 2026. Staff evaluated the benefits of the proposed regulation (ACC II) that were in addition to federal requirements.

[35] CARB, 2022 Scoping Plan for Achieving Carbon Neutrality (Scoping Plan) at 103, https://ww2.arb.ca.gov/sites/default/files/2023-04/2022-sp.pdf.

[36] CARB, Attachment F – Updates to the Methodologies for Estimating Potential GHG and Criteria Pollutant Emissions Changes Due to the Proposed Amendments (2018) at F-14, https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/15dayattf2.pdf.

Figure 2: 2022 Scoping Plan Graph of California In-State Crude Oil Production[37]



iv. Corrected Modeling Would Eliminate the Illusory Benefits of Unrestricted Biofuels.

In rejecting a cap on lipid-based fuels contemplated in both Alternative 1 and the
Comprehensive EJ Scenario, CARB argues that restricting those fuels will not achieve the
greenhouse gas or air quality benefits secured under their proposed scenario, which allows
383.23 unrestricted growth in biofuels. But correcting for the aforementioned modeling errors and
relying on up-to-date research on air emissions would likely eliminate the presumed air and
climate advantages portrayed under Staff's proposed scenario. For example, relying on the same
conservative methodology that CARB used in 2018 potentially negates all the climate benefits
Staff estimated from rejecting the cap on virgin oils in Alternative 1.

Alarmingly, the ISOR invokes illusory public health benefits of using renewable diesel to
justify rejecting a commonsense measure—capping lipid biofuels—that would deliver real air
quality benefits by refocusing the LCFS' benefits on zero-emissions technologies instead of
combustion technologies. Unfortunately, Staff's use of the California Transportation Supply
(CATS) model does not allow for electric vehicle (EV) deployment to be dynamically modeled,
383.24 so the benefits of electrification pathways are fixed under all scenarios. But it is unrealistic to
assume that re-focusing the LCFS's subsidy towards electrification pathways would have no
impact on the breadth or immediacy of EV deployment. Researchers at Stanford found that
capping lipid biofuels— as well as eliminating avoided methane credits—would unleash an
additional $19 billion from the LCFS to electrification pathways, and it is reasonable to assume
that such a large infusion of funding will propel deployment of electric cars and trucks beyond

[37] CARB, 2022 Scoping Plan (Dec. 2022) at 103.

current levels.[38] These zero-emission vehicles deliver *real* air quality benefits, yet that additional benefit is traded against illusory reductions that rely on faulty assumptions.

2. End Avoided Methane Crediting for New Pathways.

Avoided Methane Crediting

383.25 **Summary of Problem:** Avoided methane crediting extravagantly rewards an unregulated industry with accounting that distorts the LCFS program, undermines transportation goals, and worsens environmental injustices for frontline communities.

Earthjustice Recommendations:

- New project avoided methane credit phase out in 2025, and

- Existing project avoided methane credit phase out at the end of their current crediting period.

Why Staff Proposal Is Inadequate:

Staff propose to allow the market distortions and harms caused by avoided methane crediting to continue for decades.

Specifically, Staff propose:

- New project avoided methane credit phase out in 2040 (2045 for hydrogen). Projects that break ground after 2030 are also guaranteed 10 years of avoided methane crediting, or 15 years for hydrogen pathways.

- Existing project avoided methane credit phase out in 2060. No restrictions on avoided methane crediting for projects initiated by 2030 (regardless of date of certification). These projects can receive up to three renewals for 10-year crediting periods.

These timelines will perpetuate pollution harms and undermine the program's support for ZEVs and green hydrogen.

a. Avoided Methane Subsidies Conflict with State Climate Policies and Laws.

383.26 Awarding avoided methane credits relies on an assumption that is unjustified on its face— the assumption that, absent the LCFS, livestock operators would be free to vent their methane into the atmosphere. The fact that California is required to achieve economy-wide carbon-neutrality generally, and reduce emissions of short-lived climate pollutants (SLCPs) 40% by 2030 in particular, makes this assumption unreasonable. There is simply no realistic scenario in which the State would allow this controllable fugitive methane to persist while meeting statutory obligations.

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[38] Michael Wara et al., Simulating an "EJ Scenario" for the Low Carbon Fuel Standard Rule Update using the ARB CATS Model (May 31, 2023), https://ww2.arb.ca.gov/sites/default/files/2023-05/Stanford%20Presentation.pdf.

Most notably, in SB 1383, the Legislature gave CARB clear authority to begin implementing direct regulations on this source of pollution on January 1, 2024, nearly 2 months ago. And CARB *itself* recognized as far back as 2016 that "regulations will be necessary to ensure manure management practices lead to lasting emission reductions" and stated their intention to "initiate a rulemaking process to reduce manure methane emissions from the dairy industry" in-line with their SLCP strategy.[39] Nearly a decade later, CARB has failed to initiate so much as a pre-rulemaking workshop under SB 1383 to explore regulatory options. CARB is uniquely responsible for livestock operators remaining free to dump their methane into the atmosphere. The fact that CARB has abdicated its clear authority cannot justify rewarding polluters. Nothing about livestock methane's chemistry makes it better than landfill or wastewater methane at fighting climate change. Instead, it receives extreme, outlier carbon intensity scores purely because CARB has neglected to treat agriculture the way it treats virtually every other major source of GHG emissions. CARB has used an ineffective carrots-only approach to livestock methane for more than a decade, and it has offered no public justification for granting decades more of immunity to this major pollution source.

Even if CARB conclusively declined to regulate livestock operations, the State's climate commitments would require some alternative mechanism for controlling methane from California dairies and multiple, overlapping subsidies are already in place for precisely this purpose. Indeed, as Earthjustice and many other parties have repeatedly pointed out, the LCFS regularly awards credit for operations that have already been capturing their methane through a mix of subsidies prior to and independent from the LCFS.[40]

b. Extreme, Outlier CI Scores Distort the LCFS Market and Undermine the State's Goals.

The strategy of relying on extravagant transportation subsidies to tame industrial livestock pollution has delivered poor results. As UC Davis agricultural economist Aaron Smith recently concluded, "[a] good rule in policy is to directly target the problem you are trying to
383.27 solve... Negative crediting in the LCFS is a convoluted solution with numerous drawbacks."[41]
We agree. Even if CARB believes that subsidizing methane capture from dairies is a worthy strategy, it is clearly counterproductive to do so in a manner that undermines the agency's ZEV goals.

Despite making up less than 1% of fuel energy used in the state, livestock methane's extremely negative, outlier CI scores has allowed it to receive almost 20% of the credits in the

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[39] CARB, Proposed Short-Lived Climate Pollutant Reduction Strategy (Apr. 2016) at 68, https://ww2.arb.ca.gov/sites/default/files/2021-01/ProposedStrategy-April2016.pdf.

[40] Indeed, the Coalition for Renewable Natural Gas has identified the potential for double-counting biomethane and pointed to the fact that there is no central tracking required for biomethane from production to end use. See Coalition for Renewable Gas, Comments on February 22, 2023 Staff Workshop (March 15, 2023) at 10, https://www.arb.ca.gov/lists/com-attach/88-lcfs-wkshp-feb23-ws-BjRXYgQ1VjZQZwYz.pdf..

[41] Aaron Smith, Cow Poop is Now a Big Part of California Fuel Policy (Jan. 22, 2024), https://asmith.ucdavis.edu/news/cow-poop-now-big-part-california-fuel-policy.

LCFS program to date.[42] In other words, livestock methane significantly dilutes the supply of LCFS credits relative to the actual fossil fuel displaced.

Apart from exacerbating the surplus of credits, which undermines the support available for ZEVs, this distorted accounting sends market signals that are completely misaligned with CARB's own policies. In particular, the following distortions are caused by the LCFS program's avoided methane crediting:

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- **The LCFS diverts biomethane to the on-road transportation sector, despite the overwhelming consensus that this is the wrong application.** There is consensus across CARB's Scoping Plan, Mobile Source Strategy, and State Implementation Plan that biomethane should not play a significant long-term role in transportation. A report on the role of bioresources in economy-wide decarbonization by the independent think-tank Energy Transitions Commission specifically advises against even a transitional role for bioenergy in road transportation, stating that policies that support road transport applications "create significant stranded asset threat, driving inefficient investment allocation and creating a powerful lobbying group in favor of existing policy."[43] Unfortunately, avoided methane credits in the LCFS do precisely this. As the CEC explains, "[t]he LCFS credits can be three times higher than the cost to produce the fuel." Until CARB eliminates avoided methane credits, the LCFS will continue to divert biomethane toward applications where its use has been criticized.

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- **The LCFS offers far greater subsidies for methane-burning trucks than for ZEVs.** Contrary to the State's clear direction to achieve widespread deployment of ZE technology— embodied in CARB's recent approval of the State Implementation Plan—Staff's Proposal would continue preferencing methane-burning vehicles and misdirect fleets to invest in combustion technology and infrastructure. As Earthjustice has explained in multiple comments, relying on CARB's own research and statements, methane-burning trucks are not a clean air solution.[44] Yet the LCFS sends the signal that methane-burning trucks are a far more valuable strategy for displacing diesel in the transportation sector than zero-emissions trucks powered by renewable energy. A fleet that replaces one diesel truck with a single methane-burning truck can generate more value from the LCFS than a fleet that replaces 3 diesel trucks with battery electric trucks powered by entirely renewable electricity.

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- **The LCFS offers far greater subsidies for dirty hydrogen than for green hydrogen.** The most common hydrogen pathway certified under the LCFS is for dirty gray hydrogen producers cited near refinery communities to book-and-claim avoided methane credit attributes from remote biogas projects. This outcome is entirely predictable because as we explain below, the lavish avoided methane credit CI values, coupled with non-existent deliverability requirements, means vastly higher profits can

[42] *Id.*

[43] Energy Transitions Commission, Bioresources within a Net-Zero Emissions Economy (July 2021) at 71, https://www.energy-transitions.org/publications/bioresources-within-a-net-zero-economy/.

[44] See, Earthjustice, Comments on February 22, 2023 Workshop (Mar. 15, 2023) at 14, https://www.arb.ca.gov/lists/com-attach/159-lcfs-wkshp-feb23-ws-Wz5VMlwvVXIEagRu.pdf.

be generated by producing hydrogen through the status quo, polluting Steam Methane Reformation (SMR) method than by investing in new electrolyzers and accompanying renewable energy. ARCHES—California's Federal Hydrogen Hub application—is prioritizing development of green hydrogen and expressly committed not to include hydrogen from dairy biomethane or fossil methane paired with biogas credits.[45] The persistence of avoided methane credits in the LCFS all but guarantees that those excluded production practices will remain the most valued in California and undercuts any rational economic incentive to invest in new electrolyzers.

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- **The LCFS offers lavish subsidies exclusively to large, polluting concentrated animal feeding operations (CAFOs) and disadvantages smaller, more sustainable livestock operations.** A sensible and just climate strategy would target incentives toward dairy farms that already use more sustainable management practices and maintain more sustainable herd sizes, while increasing the costs of business for the largest, highest— revenue generating, most polluting operations. CARB takes the opposite approach. Small farms or those that avoid producing methane in the first place are excluded from the LCFS, while the largest, industrialized CAFOs that have chosen to rely on manure lagoons are able to unlock extravagant new revenue streams. A California Assembly Oversight analysis raised alarms that the State's policies could "provide the largest 225 dairies with a subsidized competitive advantage over smaller dairies" and warns that the State "may be going down a dangerous path for smaller dairies, where these projects don't seem viable."[46]

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What is more, despite these significant drawbacks, there is little evidence that avoided methane crediting is even effective at the one thing its purport to do – reduce California's methane emissions. Over 80% of the biomethane in the LCFS program as of 2022 was from out of state, so while California drivers pay for this subsidy, it has no benefit in California's GHG inventory. In some instances, the subsidies go to out of state dairies that may actually be changing their practices from a more sustainable baseline where they were not producing methane purely to be able to capture California subsidies. For instance, one dairy farmer in New York interviewed for a recently published study shared, "[i]f I don't keep the digester between 90-100 degrees, we're not going to produce gas. So, we are being paid to create methane gas and destroy it. Now wrap your head around that one. If we just did what we normally did it would not produce methane…it makes no sense."[47] Emissions from digesters within California appear to be no better. Although CARB does not monitor emissions from these digester systems on an ongoing basis, recently published studies of real-world methane measurements found CAFOs

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[45]ARCHES, Frequently Asked Questions (Accessed Feb. 20, 2024), https://archesh2.org/frequently-asked-questions/.

[46] California Assembly Budget Committee, Subcommittee Hearing No. 3 on Resources and Transportation (Apr. 19, 2017) at 20, https://abgt.assembly.ca.gov/sites/abgt.assembly.ca.gov/files/April%2019%20-%20Toxics%20Recycling%20Ag.pdf.

[47] M. Hanna Pierce et al., An Evaluation of New York State Livestock Carbon Offset Projects in California's Cap and Trade Program (May 2023), https://www.tandfonline.com/doi/full/10.1080/17583004.2023.2211946 (emphasis added).

with digesters exhibited virtually the same level of methane emissions as those without.[48] CARB's own data shows "mega-emitting" farms that have been equipped with digesters.[49]

Even if methane capture is being achieved at promised levels, it is almost certainly overstated as a result of double- and even triple-counting. Recent reporting has shed light on how
383.33 multiple state programs take credit for the same purported reductions achieved by these digesters, meaning they are often improperly attributed to multiple programs.[50] Awarding excessive credits for practices that have already been required or supported wastes scarce funding for no additional climate benefit.

California's approach stands in contrast to the Federal Government's treatment of biomethane. In its proposed guidance for the federal 45V hydrogen production tax credits, the U.S. Treasury Department (Treasury) recently recognized the imperative to avoid precisely the kind of double-counting in the biomethane space that the LCFS allows. In its proposed guidance, Treasury established the requirement that biomethane could only be treated with a CI lower than fossil gas if use for hydrogen constituted the "first productive use" of the biomethane.[51] It
383.34 explains that [t]his proposal would limit emissions associated with the diversion of biogas or RNG from other pre-existing productive uses."[52] Treasury also made clear its intention to establish requirements to "reduce the risk that entities will deliberately generate additional biogas" for the purpose of receiving the tax credit, "for example by generating biogas through the intentional generation of waste."[53] By contrast, **California has no requirements that prevent intentional production of additional methane**, nor does it monitor methane levels or publicly disclose methane volumes or herd sizes. California also lacks restrictions on use of
383.35 biomethane that has previously been captured for other productive uses, making it easy for pathways to receive significant avoided methane credit value for little or no additional climate benefit, and without safeguards against intentionally producing *more* methane.

Therefore, California's strategy of trying to entice polluters to capture their methane through transportation subsidies, instead of direct regulation, has not only come at significant cost to attainment of our State's climate goals, but it has also grossly under-delivered on its one purported methane-reduction benefit and perpetuated a system of false GHG accounting that federal policymakers are rightly rejecting.

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[48] N.T. Vechi et al., Ammonia and Methane Emissions from Dairy Concentrated Animal Feeding Operations in California, Using Mobile Optical Remote Sensing (Jan. 2023), https://doi.org/10.1016/j.atmosenv.2022.119448.

[49] *See* Carbon Mapper Data, https://carbonmapper.org/.

[50] Phil Mckenna, "Is California Overstating the Climate Benefit of Dairy Manure Methane Digesgters?" (Dec. 30, 2023) https://insideclimatenews.org/news/30122023/milking-it-california-overstating-climate-benefit-dairy-manure-methane-digesters/.

[51] Section 45V Credit for Production of Clean Hydrogen, 88 Fed. Reg. 89238 (Dec. 26, 2023).

[52] *Id*. at 89239.

[53] *Id*.

c. Changes to Biomethane Crediting Run Counter to Board Direction.

383.36 While Earthjustice objected to CARB's initial proposal for delaying until 2030 the phase out of avoided methane crediting during the workshop process, we note that even CARB Staff acknowledged the need to discontinue the practice. Alarmingly, between the SRIA and the December release of the ISOR, it appears that Staff is now further delaying this already overdue phase out. The September draft allowed one 10 year crediting period with avoided methane credits for pathways certified prior to 2030, and would allow a 5 year crediting period for pathways certified between 2030 and 2034 (implying that the practice would finally end for new pathways in 2035).

The new proposal inexplicably abandons these distant restrictions. It shifts the goal posts from the date of certification to the date a project "breaks ground" (which can be 2 or more years prior to certification) and allows up to 3 10-year crediting periods for all those projects that break ground prior to 2030. For those that break ground after 2030, the crediting period is extended from 5 years to until 2040, or until 2045 if they choose a hydrogen pathway.

There is no public discussion for why this change has been made, and there is no honest assessment of the September Board meeting that would indicate this change was made at the direction of the Board. At the hearing, the Board Members that did speak about avoided methane crediting and livestock methane virtually all raised concerns with the practice. These include the following statements:

- **Board Member Hector De La Torre**: "The CI for avoided methane - <u>I would like to see that tightened up</u>…I understand the logic of why we do what we do, but <u>I still think it is too generous in comparison to everything else.</u> So, when I saw that chart that Staff presented that shows most things above the line and a couple things below the line. That gives me heartburn…We can make adjustments that are rational, that are based on science, and based on **our** judgements of what we're looking to do"[54]
- **Board Member Gideon Kracov**: "We regulate every major source of methane and GHG emissions…But not the dairies? Instead, consumers pay them!...This is about LCFS and this exceptionalism seriously distorts our LCFS CI crediting. SB 1383 itself explicitly says this sector can be regulated in 2024. That's in 3 months. That was the deal!...I would support this, and a Board resolution indicating that we will initiate in 2024 a rulemaking for this sector."[55]
- **Board Member Davina Hurt**: "Dairy digesters are a small portion of the LCFS but it definitely has a large impact on communities struggling for clean air – in communities of color…How do we ensure that we are not incentivizing and subsidizing manure to be more valuable than milk? This is what I'm thinking about…I never want us to get to…I think the saying is the tail wagging the dog."[56]

[54] CARB Board Meeting Transcript (Sept. 28, 2023) at 310, https://ww2.arb.ca.gov/sites/default/files/barcu/board/mt/2023/mt092823.pdf (emphasis added).
[55] *Id*. at 318-319.
[56] *Id*. at 322.

- **Board Member Diane Takvorian** (in a quote to Inside CalEPA): "I'm concerned about the irresponsibility of sending a signal that we want to continue that [avoided methane] crediting for another 17 years and increase the economic dependence on this system. I am very concerned in terms of the impact on human health, and our impacts on not incentivizing other methodologies as much as we can. . . . It just doesn't make sense to me that some purely electric systems would have a higher carbon intensity than digesters."
- **Board Member Henry Stern** (to a joint rally of airport workers and frontline factory farm residents): "This is the alliance that can win. I will stand with you at the Board meeting, and we're going to keep fighting…Because so far it's been all carrots and no regulation!"
- **Board Member Tania Pacheco-Werner**: "I think it's important to think about everyone here as a partner. I really want all of us to think about: in our meeting the challenge to save the planet - in 2045 when we look back, <u>we can truly say we are proud of what we did, and that no community was sacrificed to make this happen.</u> And I think if we use that as our North Star, we can come up with really good solutions that continue to see our industries as partners but also challenge them to build on <u>the most innovative practices that yield the most public health benefit."</u>[57]

The Board thus clearly indicated support for reducing avoided methane crediting practices relative to the initial proposal from September. Yet, Staff have swung wildly in the other direction in the Staff Proposal. **To our knowledge, it is unprecedented for the Staff to advance a major policy change that run directly counter to the stated concerns of many Board members.** Staff must correct course. In light of the long overdue nature of this phase-out, we urge CARB to ensure avoided methane crediting is eliminated from new pathways without further delay in this rulemaking.

[57] *Id.* at 325 (emphasis added).

3. **Immediately End the Practice of Allowing CNG Companies to Greenwash Fossil Methane through the Purchase of Unbundled Biomethane Credits.**

Biomethane Deliverability

383.37 **Summary of Problem:** A lack of deliverability requirements for biomethane allows fossil methane producers to greenwash their fuels by using unbundled "environmental attribute" credits that do nothing to contribute to California's climate goals.

Earthjustice Recommendation: Align LCFS deliverability requirements for all fuels, including biomethane, with the RPS beginning in 2025.

Why Staff Proposal Is Inadequate: Staff proposes a weak deliverability requirement to apply to biomethane dispensed at CNG stations in 2041 and for biomethane used for hydrogen production in 2046. These extended timelines are unjustified and will perpetuate greenwashing for decades and fails to align with other programs.

Under Staff's proposed deliverability requirement, industry would only be able to buy biomethane credits from entities that inject biomethane into a pipeline that flows toward California, but they would still be able to characterize their fossil methane purchases as biomethane by buying unbundled credits.

The LCFS gives CNG companies a unique greenwashing opportunity that is not available to any other fuel provider: The CNG industry alone can take credit for using low-carbon fuels that are never delivered to California. Consequently, the CNG industry is now generating lavish credits for purchasing unbundled credits that do nothing to advance the fundamental purpose of the LCFS, which is to reduce the carbon intensity of California's transportation fuels.[58] The Staff Proposal is yet another misdirection running counter to the Board's September comments to Staff. The deliverability requirement is completely excluded for pathways prior to 2030 (or later, based on the unclear "break ground" concept), and projects entering after 2030 have another 11 to 16 years of no deliverability requirements. This subsidizes the very technologies that CARB in other regulations and policies says we must move away from, including combustion CNG vehicles and dirty SMR hydrogen production. By continuing to give public funds to support outdated technologies, CARB is undermining its own ZEV and carbon neutrality goals, for the profit of mostly out-of-state companies, and at the expense of Californians. This U-turn on what Staff told the Board they were considering in September flies in the face of Board direction to go even stronger on deliverability requirements at that meeting, where Board Member Gideon Kracov stated that "these changes to the delivery requirements that are proposed should take effect immediately for all new projects, all the new crediting pathways."[59]

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[58] ISOR at 6 ("The purpose of the LCFS regulation is to reduce the carbon intensity (CI) of transportation fuels used in California").
[59] CARB Board Meeting Transcript (Sept. 28, 2023) at 315, https://ww2.arb.ca.gov/sites/default/files/barcu/board/mt/2023/mt092823.pdf.

To align its deliverability requirements with the Renewable Portfolio Standard (RPS), CARB should only allow an entity to claim it dispenses biomethane if it buys biomethane (bundled with its environmental attributes) and contracts for its delivery to California and any interstate deliveries via common carrier pipelines use pipelines that flow toward California. This commonsense reform will eliminate a stain on the integrity of the LCFS and align the LCFS with federal practice.

As shown in Table 1, the ISOR's delayed phase-in for the biomethane deliverability requirement is part of a troubling pattern. The ISOR's proposed amendments related to biomethane would not only fail to provide the immediate corrections that are necessary to end unjustified subsidies for polluting fuels—they are delayed beyond the unacceptably prolonged timelines discussed in public workshops.

Table 1:Comparing the Timelines for Limiting Unjustified Biomethane Subsidies Proposed in Workshops with the those Proposed in the ISOR

Policy	Public workshops	Staff Proposal	Issue	Fix
Avoided Methane Crediting (AMC)	Allow AMC for 10 years for project certification or recertification before 2030. Allow AMC for 5 years for projects recertified between 2031 and 2035 (i.e., no new project AMC approved after 2030). **AMC is phased out of LCFS by 2040, with no new AMC approved for new projects after 2030.**	Allow projects that "break ground" prior to 2030 up to 30 years of AMC. Allow RNG used in CNG vehicles to get 10 years of crediting if applying between 2030 and 2041. Allow RNG used for book-and-claim hydrogen to get 10 years of crediting if applying between 2030 and 2046. **Allows AMC through 2060 for certain projects, 2056 for others, and 2051 for others.**	The original concept was flawed and the ISOR policy goes counter to Board direction provided to Staff in September 2023, what Staff have said numerous times in pre-rulemaking workshops, and Scoping Plan direction to move RNG out of transportation and to move the State away from combustion.	**End AMC for all new pathways starting 2025. Allow current 10-year crediting periods to finish.**
Biomethane Deliverability	Align deliverability concepts with RPS / CPUC 1440 Program beginning in 2028. Book-and-claim RNG-to-hydrogen is exempt.	Only apply deliverability requirements to project that "break ground" after 2029, and those requirements only begin in 2041 for CNG vehicles and 2046 for book-and-claim hydrogen. **Lifetime exemption of deliverability requirement for projects that "break ground" before 2030. For projects entering LCFS after 2029, they only have to begin to show deliverability starting in 2041 (for vehicle combustion) or 2046 (for book-and-claim hydrogen).**	The original concept was flawed as there is no reason to delay delivery requirements that have uniquely favored RNG, and no reason to exempt any pathways. These do not help meet State climate goals in AB 1279 because they are not included in California's GHG inventory. Continues to treat biomethane differently from other fuels, which are required to be delivered to California.	**Require deliverability for all pathways beginning in 2025.**
"Break Ground" Concept	Never discussed by Staff. Workshop concept introduced phase-outs based on date "pathways certified or recertified."	Allows projects that apply for LCFS years after the official policy has sunset that only applies to biomethane projects, including book-and-claim.	This nebulous concept will result in LCFS project approvals for years after 2030. Favors biomethane projects over ZEV. No such provisions for ZEV projects.	**Remove this concept.**

a. The Current Rules Grant Biomethane Special Status as the Only LCFS Fuel that Can Claim Unbundled Credits that Do Not Reduce Climate Pollution from California Transportation Fuels.

Under the current LCFS rules, CNG companies can generate credits for supplying biomethane even when the fuel procurements for their fueling stations are 100% fossil methane. These companies purchase fossil methane in the natural gas commodities market and contract for delivery of their fossil gas via natural gas pipelines. These CNG fueling companies can generate valuable LCFS credits by using a process that the regulation refers to as "book-and-claim" accounting to characterize their fossil fuels as biomethane. Under this scheme, a CNG company must simply purchase the environmental attributes of biomethane that is injected into a common carrier pipeline anywhere in North America and submit attestations regarding those environmental attributes.[60] There is no requirement for the LCFS credit generator to purchase the biomethane itself or even that the biomethane flow toward California.[61] Thus, the unbundled environmental attributes essentially allow CNG companies to claim they offset emissions from the fossil fuels they procure and sell to the public.

The purchase of biogas credits from Wisconsin cow manure illustrates how CNG suppliers generate outsized credits without reducing the carbon intensity of California's transportation fuels. Wisconsin dairies that sell environmental attributes into the LCFS program sell the biomethane to their utilities, which inject the biomethane into their local gas distribution systems (i.e., the pipes that flow to their customers' homes and businesses—not interstate pipelines).[62] The CNG industry uses these unbundled attributes to generate a bounty of credits, with CNG paired with Wisconsin manure credits currently garnering carbon intensity scores from -130 to -453 gCO2e/MJ.[63] These negative carbon intensity scores reflect bogus carbon accounting, as the dairies participating in the utility program had previously captured their methane and used it to generate electricity.[64] Nonetheless, the dairies receive such generous compensation for selling credits into the LCFS program that they are willing to sell their biomethane to the local utility for less than the price of fossil gas.[65] Driving down the price of methane in Wisconsin threatens to induce additional gas consumption, lock in dependence on gas, and, increase greenhouse gas emissions. CARB can avoid these perverse outcomes by

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[60] 17 California Code of Regulations (CCR) § 95488.8(i)(2).
[61] *Id.*
[62] Chris Hubbuch, Wisconsin State Journal, Biogas: Wisconsin utilities partner with farmers to replace fossil gas (July 19, 2022), https://madison.com/news/local/environment/biogas-wisconsin-utilities-partner-with-farmers-to-replace-fossil-gas/article_a88d7d1f-ec1f-56ed-b5c1-d12d2cd3d814.html.
[63] This is the range of CI scores listed for unretired fuel pathways in CARB's Current Fuels Spreadsheet for the CNG Fuel Type and with a Wisconsin Facility Location (Jan. 9, 2024 ed.), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/current-pathways_all.xlsx.
[64] Chris Hubbuch, Wisconsin State Journal, Biogas: Wisconsin utilities partner with farmers to replace fossil gas (July 19, 2022), https://madison.com/news/local/environment/biogas-wisconsin-utilities-partner-with-farmers-to-replace-fossil-gas/article_a88d7d1f-ec1f-56ed-b5c1-d12d2cd3d814.html.
[65] *Id.*

treating biomethane like every other fuel—requiring credit generators to procure biomethane through bundled contracts and taking delivery of it.

No other fuel suppliers can greenwash fossil fuels by purchasing the unbundled environmental attributes of fuels that are not delivered to California. For instance, as shown in Table 2, entities cannot generate LCFS credits by pairing their sales of fossil diesel with the renewable attributes of renewable diesel. To generate credits for selling renewable diesel, entities must procure and take delivery of that renewable diesel.[66] Similarly, the LCFS' book-and-claim rules for low-CI electricity require electricity to be generated within California or meet the deliverability requirements for Portfolio Content Category 1 Renewable Energy Certificates.[67] In practice, this commonsense requirement ensures that CARB will not consider an electric vehicle charged on the California grid to be powered by a renewable electricity generator unless that generator actually energizes the California grid. As CARB Staff explained in this rulemaking process, "CARB needs . . . pathway or documentation of feedstock usability in California" to consider a feedstock for the LCFS program.[68] CARB should immediately end biomethane's unjustified exception from this rule.

[66] California Government Code § 95488.2(b)(4) (entities to specify a transport mode for each LCFS pathways registration); § 95481(a)(57) (defining "fuel transport mode" to mean "the applicable combination of actual fuel delivery methods, such as truck routes, rail lines, pipelines, and any other fuel distribution methods, and the distance through which the fuel was transported under contract from the entity that generated or produced the fuel, to any intermediate entities, and ending at the fuel blender, producer, importer, or provider in California. The fuel pathway holder and any entity reporting the fuel must demonstrate that the actual fuel transport mode and distance conforms to the stated mode and distance in the certified pathway.").

[67] CARB, LCFS Guidance 19-01 at 2, https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/guidance/lcfsguidance_19-01.pdf.

[68] CARB, Staff Workshop Presentation (Nov. 9, 2022), slide 19.

Table 2: Deliverability Requirements for LCFS Fuels: Biomethane Is the Outlier

LCFS Fuel	Is Delivery to California Required?
Renewable diesel	Yes
Biodiesel	Yes
Ethanol	Yes
Aviation fuel	Yes
Electricity	Yes. Low-CI electricity used as a transportation fuel must be delivered to a California balancing authority. For out-of-state hydrogen producers, low-CI electricity must be delivered to their local balancing authority.
Fossil natural gas	Yes
Biomethane used for process energy (e.g., biomethane burned for heat or power at oil refineries)	Yes. Biomethane used for process energy "must be physically supplied directly to the production facility." 17 CCR § 95488.8(h)(2).
Biomethane used for CNG fueling and hydrogen production	**No**. Staff proposes a weak deliverability requirement to apply to biomethane dispensed at CNG stations in 2041 and for biomethane used for hydrogen production in 2046, and these dates only apply to projects that "break ground" after 2029.

b. Staff's Proposal Does Not Address the Problem and Would Continue the LCFS's Status as an Outlier in Its Faulty Treatment of Biomethane.

Staff propose a long-delayed and incomplete solution to the problem of the LCFS providing credits for biomethane that does nothing to meet State GHG and SLCP reduction goals. Staff propose adding a deliverability requirement for a very limited set of biomethane projects starting in 2041, but the ISOR provides no rationale for this delay.[69] Rather than delay action for over a decade, CARB should immediately end the CNG industry's opportunity to generate credits for biomethane that does not reduce the carbon intensity of California's transportation fuels.

Staff's proposal is inferior to requiring purchases and delivery contracts for biomethane for multiple reasons. First, it provides a credit generation opportunity to CNG companies that prop up the fossil fuel industry by purchasing fossil methane. Second, Staff's proposed deliverability requirement fails to achieve its stated purpose of aligning with other programs, as it does not incorporate the basic standards that CARB's sister agencies require. The ISOR explains that Staff's approach is designed "to align the deliverability policy for biomethane in the California Energy Commission's Renewables Portfolio Standard (RPS) program (Public Utilities Code section 399.12.6) and the California Public Utilities Commission 1440 program."[70]

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[69] ISOR at 31.
[70] *Id.*

However, neither the RPS nor 1440 programs allow industry to greenwash the fossil fuels with purchase of unbundled environmental attributes. Instead, these programs require entities that claim to use biomethane to procure biomethane and deliver it to California.[71] In fact, the CPUC has recognized that allowing "Utilities to purchase renewable attributes separate from physical RNG . . . would result in negligible to no direct environmental benefits to California, contradictory to the statutory and policy goals" of SB 1440.[72] Table 3 demonstrates the LCFS's outlier status. CARB should catch up with its sister agencies and put an end to this carbon accounting gimmick in the LCFS program.

Moreover, the LCFS's subsidies for fossil fuel companies that purchase unbundled biogas credits set it apart from the commonsense approach at the federal level. In the RFS program, U.S. Environmental Protection Agency only allows entities to take credit for biogas if several conditions are met, including that the "biogas/CNG/LNG was injected into and withdrawn from the same commercial distribution system" and that the entity contracted for the specific quantity of renewable CNG used as a transportation fuel.[73] It is particularly unacceptable for California's LCFS to lavishly subsidize fossil fuel users who purchase unbundled biogas credits, when such gimmicks are not tolerated at the federal level.

Table 3: Comparison of the LCFS with Other Programs that Include Biomethane

Programs that Include Biomethane	Does It Require Deliverability?
CEC's RPS	Yes
CPUC SB 1440 Program	Yes
EPA's RFS	Yes
LCFS (process energy)	Yes
LCFS (CNG fueling and hydrogen production)	**No**

[71] In the RPS program, facilities claiming to use biomethane must enter a biomethane procurement contract. CEC, RPS Eligibility Guidebook, Ninth Edition Revised (2017) at 7. To ensure entities claiming to use biomethane can legally take delivery of that biomethane, the CEC also requires entities to "enter into contracts for the delivery (firm or interruptible) or storage of the gas with every pipeline or gas storage site operator transporting or storing the gas from the injection point to the final delivery point." *Id.* at 9. SB 1440 authorized targets for biomethane procurement, not environmental attribute procurement. Cal. Public Utilities Code § 651(a). Once a utility procures biomethane, it can only legally take delivery of that fuel and provide it to its customers if it has legal access to the gas pipeline infrastructure that connects the biomethane supplier to the utility's customers. In implementing SB 1440, the Public Utilities Commission avoided double-counting environmental attributes by requiring the utilities that procure methane to "maintain exclusive ownership of all environmental attributes from contracted renewable fuel sources." Decision 22-02-25, Decision Implementing Senate Bill 1440 Biomethane Procurement Program at 57, Conclusion of Law 19, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M454/K335/454335009.PDF.

[72] Decision 20-12-022, Decision Adopting Voluntary Pilot Renewable Gas Tariff Program at 20, https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M356/K268/356268059.PDF.

[73] 40 Code of Federal Regulations § 80.1426(f)(11)(ii).

Although Staff's proposal regarding deliverability is insufficient as detailed above, its proposed approach to *determining* deliverability is workable. Specifically, Staff proposes requiring a "demonstration that eligible biomethane is carried through common carrier pipelines that physically flow within California or toward end use in California."[74] Data is readily available on the flow of gas pipelines because the U.S. Energy Information Administration (EIA) publishes annual data on the volumes that flow in each interstate pipeline across state lines.[75] The EIA has also synthesized this data into a map that shows that flow of the nation's interstate gas pipelines.[76] Thus, even if CARB decides to base its deliverability requirement on the direction of interstate pipeline flows, there is no barrier to implementing this requirement immediately.

c. Real Solutions Are Needed in this Rulemaking.

CARB should stop allowing industry to greenwash fossil methane with unbundled environmental attributes in beginning in 2025. To actually reduce the carbon intensity of California transportation fuels, CARB should immediately require entities that claim to use biomethane to justify their claims by actually purchasing and contracting for delivery of that biomethane. To adopt meaningful requirements, CARB can borrow model language from the RPS program. To use biomethane in the RPS, the CEC requires contracts for biomethane procurement, contracts for the delivery of the gas that cover the full route from the injection site to the final point of delivery, and that any pipeline delivery use pipelines that flow in the direction of California.[77] The ISOR provides no rationale for adopting a deliverability requirement that lacks these commonsense elements of the RPS requirements.

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[74] *Id.*

[75] EIA, Natural Gas, providing relevant data for download in the agency's releases on U.S. state-to-state capacity, https://www.eia.gov/naturalgas/data.php#pipelines.

[76] EIA, Natural Gas Market Module of the National Energy Modeling System: Model Documentation 2022 (Aug. 2022) at 3, https://www.eia.gov/outlooks/aeo/nems/documentation/ngmm/pdf/ngmm(2022).pdf.

[77] CEC, RPS Eligibility Guidebook at 7, 9–10.

4. **Eliminate Flawed Carbon Accounting Practices that Lead to Lavish Subsidies for Dirty Hydrogen and Undermine Green Hydrogen Production.**

Hydrogen

Summary of Problem: Over-subsidizing methane-derived hydrogen from outdated technology undermines development of zero-emissions electrolytic hydrogen. No certified pathways for hydrogen production with livestock biomethane advance California's climate goals. Instead, all pathways match "environmental attribute" credits from Indiana, Wisconsin, Minnesota, New York, or Missouri to characterize their fossil fuels as carbon-negative.

Earthjustice Recommendation: (1) Apply deliverability requirements for biomethane used in hydrogen production in 2025; (2) End avoided methane crediting for methane used in hydrogen production in 2025.

Why Staff Proposal Is Inadequate: Staff recommends a deliverability requirement for biomethane used in hydrogen production in 2046 and ending avoided methane crediting in new hydrogen pathways in 2045. Thus, for biomethane used in hydrogen production, Staff proposes an additional delay of five years to apply the proposed reforms for biomethane used for CNG fueling. This timeline will stymy the market for zero-emissions hydrogen as a transportation fuel and continue subsidizing greenwashed fossil hydrogen for another two decades.

The LCFS creates a perverse incentive for industry to produce dirty hydrogen from the steam methane reformation (SMR) of fossil fuels (paired with bogus biogas credits) by providing far more lucrative subsidies for this emissions-intensive hydrogen than for truly clean, zero-emissions electrolytic hydrogen. Consequently, the LCFS undermines the nascent market for the innovative zero-emissions hydrogen technologies that are consistent with attaining the NAAQS. CARB should address these unintended consequences by ending two key policies that over-subsidize hydrogen produced from methane: (1) allowing companies that purchase fossil methane to greenwash the gas they use by purchasing unbundled biogas credits that do not reduce the carbon intensity of California transportation fuels; and (2) falsely assuming that livestock biomethane is a carbon-negative resource.

The CEC has recently recognized that this offsetting scheme is not sufficient for achieving California's goals. In its proposed 2023 Integrated Energy Policy Report, the CEC explains: "Hydrogen fuel is often sourced from fossil sources (for example, methane) and uses carbon offsets to reduce the carbon footprint. Longer term, renewable hydrogen must be a critical component to fully achieve state goals for clean energy."[78] CARB should end offsetting opportunities in the LCFS now, as prolonging this flawed system will only entrench it and make it more difficult to achieve State renewable energy goals.

[78] CEC, Proposed 2023 Integrated Energy Policy Report (Jan. 31, 2024) at 75, https://efiling.energy.ca.gov/GetDocument.aspx?tn=254255&DocumentContentId=89629.

In addition, CARB should improve its carbon accounting for electrolytic hydrogen by using the H2-GREET model that the federal government is developing through a thorough examination on the best available science on the emissions impacts of hydrogen production. The ISOR proposes a system for determining the carbon intensity of electrolytic hydrogen that does not match the rigor of the approach in the U.S. Treasury Department's proposed guidance.

a. The LCFS Is Kneecapping the Market for Zero-Emissions Hydrogen and Impeding Progress toward Achieving Air Quality Standards by Over-Subsidizing Hydrogen Produced from Methane and Encouraging Expansion of Dirty Hydrogen Facilities.

The current LCFS rule fails to incentivize genuinely zero-emissions, green hydrogen because it lavishes more credits on entities that produce hydrogen from fossil fuels (paired with unbundled biogas attributes) than on entities who invest in the cleaner technology. For instance, AC Transit's pathway for hydrogen produced from electrolysis powered by solar photovoltaics in Alameda County receives a carbon-intensity score of 0 gCO2e/MJ.[79] According to the LCFS credit calculator, this amounts to a credit value of $1.40/kg of hydrogen, given current credit prices. Meanwhile, hydrogen produced from SMR fossil gas in Wilmington coupled with the purchase of environmental attributes from dairy methane in Indiana receives a carbon intensity score of -287 gCO2e/MJ.[80] This hydrogen generates credits worth $3.81/kg of hydrogen, given current credit prices. In a departure from the standard practice of providing the greatest policy support for the more expensive, next-generation technologies needed to achieve climate and air goals, the LCFS is providing greater incentives to polluting technologies that even CARB acknowledges are cheaper than zero-emission electrolytic hydrogen.[81] Thus, companies can maximize profits by producing hydrogen through SMR of fossil gas—a polluting industrial process that is already the most common and lowest cost means of producing hydrogen in the United States—rather than invest in the nascent market for zero-emissions hydrogen production. Zero-emissions hydrogen producers face a financial double-whammy: (1) their cleaner technology is newer and more expensive, and (2) the best CI they can achieve is 0, whereas SMR facilities that use book-and-claim can characterize their hydrogen as carbon negative.

The LCFS's certified hydrogen pathways reveals that industry is, in fact, seizing the incentive to maximize credits by producing hydrogen with fossil fuels and purchasing biogas attributes that contribute nothing to California's climate goals. Each of the certified hydrogen pathways listed as using biomethane from dairy manure actually pairs fossil gas feedstocks with unbundled purchases of environmental attributes from Indiana, Wisconsin, New York or Minnesota to earn a negative carbon intensity score.[82] Likewise, every single certified pathway for hydrogen that is characterized as using biomethane from swine manure is for a fossil SMR

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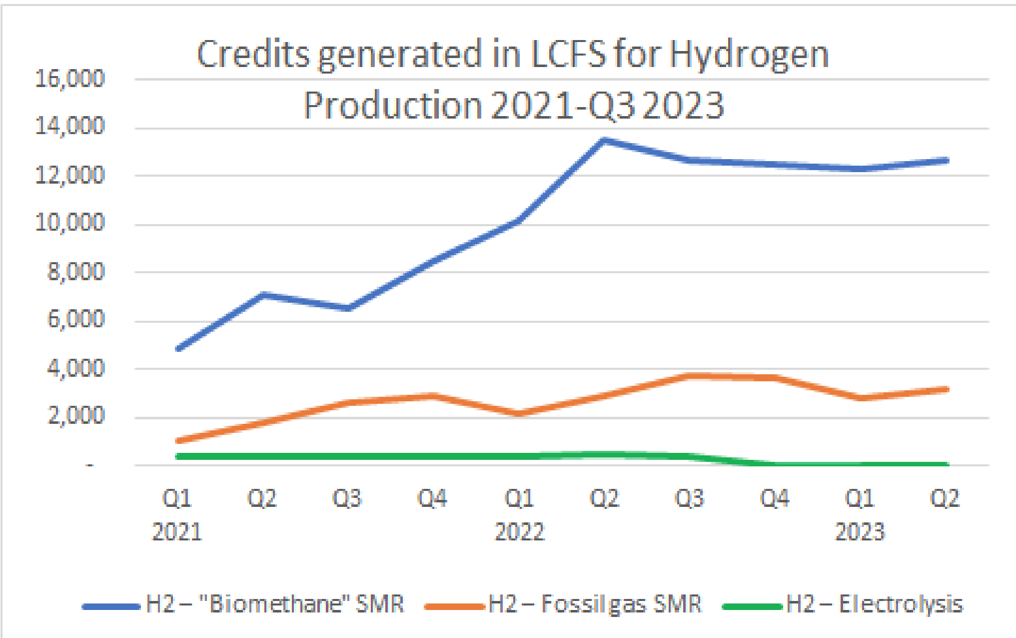
[79] CARB, Current Fuel Pathways (Jan. 9, 2024 ed.), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/current-pathways_all.xlsx.
[80] *Id.*
[81] In CARB's LCFS modeling, hydrogen from dairy gas is $51.20/MMBTU, while zero-CI electrolytic hydrogen is $137.00/MMBTU.
[82] CARB, Current Fuel Pathways (Jan. 9, 2024 ed.), https://ww2.arb.ca.gov/sites/default/files/classic/fuels/lcfs/fuelpathways/current-pathways_all.xlsx.

facility that purchases the environmental attributes of biomethane in Missouri, and the only pathway for producing hydrogen that claimed to use biomethane from wastewater sludge was for a fossil SMR facility that purchases environmental attributes from a water treatment plant in Texas.[83] Without reform, the LCFS's purportedly "renewable" hydrogen pathways will remain dominated by greenwashed fossil fuels.

The impact on the LCFS can be seen from CARB's own data. The chart below in Figure 3 shows the number of credits earned by the different hydrogen production pathways. While data are only available since 2021, the trend is clear—SMR hydrogen is the winner and electrolytic hydrogen is the loser.

Figure 3: Credits Generated in the LCFS for Hydrogen Production



The LCFS' incentive to produce hydrogen through SMR instead of zero-emissions processes is inconsistent with California's plans for achieving health-based air quality standards. SMR facilities emit health-harming pollution such as NOx, carbon monoxide, and fine particulate matter.[84] Reliance on SMR threatens the achievement of air quality standards in California's most polluted air basins, where regulators have noted that "there is no viable pathway to achieve the needed reductions without widespread adoption of zero emissions (ZE) technologies across all mobile sectors and stationary sources, large and small."[85] Yet the LCFS

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[83] *Id.*
[84] Sun et al., Criteria Air Pollutants and Greenhouse Gas Emissions from Hydrogen Production in U.S. Steam Methane Reforming Facilities, Env't Sci. & Tech., Vol. 53 (Apr. 2019), www.osti.gov/pages/servlets/purl/1546962.
[85] South Coast Air Quality Management District, 2022 Air Quality Management Plan (Dec. 2022) at ES-5, http://www.aqmd.gov/docs/default-source/clean-air-plans/air-quality-management-plans/2022-air-quality-management-plan/final-2022-aqmp/final-2022-aqmp.pdf?sfvrsn=16.

provides a strong incentive to construct new SMR facilities, which are long-lived capital investments that would lock in pollution for decades.

CARB should immediately fix the two flawed elements of the LCFS regulation that lead to these absurd results.

b. CARB Should Require Hydrogen Producers that Claim to Use Biomethane to Procure and Contract for Delivery of that Biomethane, Rather than Allowing Them to Greenwash Fossil Fuels with Credits from Out-of-State Biogas that Never Enters California.

CARB should immediately require any hydrogen producer that claims to use biomethane to meet the same common-sense requirements that a power plant must meet in California's RPS program to show that they are using that biomethane. As discussed in detail in Section 3, entities should only be allowed to claim they are using biomethane if they procure it, contract for its delivery, and the biomethane is injected into a pipeline that flows to California. Although Staff proposes a deliverability requirement for biomethane used at CNG stations in 2041, the ISOR proposes the same unjustified greenwashing scheme to continue for methane used in hydrogen production until 2046.[86]

We explain above that the LCFS is an outlier among state and federal clean energy policies for allowing industry to use unbundled environmental attributes to characterize fossil methane as biomethane. Consistent with these existing policies, the EPA has recommended that the Treasury Department can reasonably apply a deliverability requirement for renewable gas as it implements federal tax credits for clean hydrogen production.[87] The EPA did not recommend any delay in applying a deliverability requirement for renewable gas used for hydrogen production, citing such rules that are already in place in its Renewable Fuel Standard program as an example of a reasonable approach.[88]

c. The LCFS Should Not Falsely Assume that Livestock Biomethane Is a Carbon-Negative Resource When It Is Used as a Hydrogen Feedstock.

The assumption that livestock biomethane is a carbon-negative resource distorts the incentives in the LCFS by providing more credits for entities that use polluting biomethane fuels than zero-emissions fuels that are consistent with achieving health-based air quality standards. The ISOR recommends allowing entities that use biomethane to produce hydrogen to claim credit for avoided methane emissions through 2045—five years longer than this unwarranted opportunity would be available for biomethane used for CNG fueling.[89] CARB should end avoided methane crediting for all biomethane in upon the adoption of the 2024 amendments. It is no less urgent to end the LCFS's perverse incentive to invest in polluting grey hydrogen facilities

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[86] ISOR at 31.
[87] Letter of U.S. EPA Deputy Administrator Janet McCabe to U.S. Treasury Department Assistant Secretary for Tax Policy Lily Batchelder (Dec. 20, 2023) at 5-6, https://home.treasury.gov/system/files/136/45V-NPRM-EPA-letter.pdf.
[88] *Id.*
[89] ISOR at 31.

instead of zero-emissions hydrogen production than it is to end the perverse incentive to invest in CNG technologies over zero-emissions vehicles.

d. The LCFS Should Match Proposed Federal Standards to Ensure California's Carbon Accounting for Electrolytic Hydrogen Is No Less Rigorous than the Federal Government's.

Incredibly, the Staff Proposal is far more permissive than proposed federal rules in allowing industry to characterize emissions-intensive hydrogen as being produced with low- CI electricity. Rather than adopting a weaker system that lacks scientific support, California should take advantage of work being done at the federal level on measuring the carbon intensity of hydrogen production. It is important to get the carbon accounting right for electrolytic hydrogen because hydrogen produced with California's grid-average electricity creates even more climate pollution than hydrogen produced from fossil gas.[90]

As explained above, draft guidance from the U.S. Treasury Department includes science-backed standards for when hydrogen producers can claim to use zero- or low-carbon electricity, including the requirement to match a facility's supply of clean energy with its energy demand on an hourly basis (after a phase-in period).[91] In contrast, the ISOR's proposed new option for indirect accounting for low CI electricity would allow matching of low CI energy generation with a facility's energy demand on a quarterly basis.[92] This is a crucial difference that threatens to make carbon accounting for electrolytic hydrogen in the LCFS far less accurate than federal practice. According to research from Princeton University, an hourly matching requirement is necessary to avoid spiking pollution on the power grid from electrolytic hydrogen production.[93] Even a weekly matching standard would lead to emissions increases that are just as dramatic as relying on grid-average electricity.[94] To avoid adopting weaker carbon accounting standards than the federal government, CARB should require electrolytic hydrogen producers who claim to use low CI electricity to meet an hourly matching requirement by 2028, in alignment with standards under development at the U.S. Treasury Department.

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[90] 17 CCR § 95488.5(e), Table 7-1 (providing a default CI value for hydrogen from grid average electricity of 164.46 gCO_2e/MJ and a default value of hydrogen from steam methane reformation of fossil gas of 117.67 gCO_2e/MJ).

[91] Section 45V Credit for Production of Clean Hydrogen, 88 Fed. Reg. 89233 (Dec. 26, 2023).

[92] ISOR at 34.

[93] Wilson Ricks et al., *Minimizing emissions from grid-based hydrogen production in the United States*, Env't Rsch. Letters (Jan. 06, 2023), at 7–8, https://iopscience.iop.org/article/10.1088/1748-9326/acacb5/pdf.

[94] *Id.*

5. **Enhance Credit Generation Potential for Zero-Emissions Transit and Charging Infrastructure.**

Zero-Emission Transit and Charging Infrastructure

Summary of Problem: The LCFS rewards combustion fuels in place long before the LCFS (e.g., ethanol and biomethane) yet fails to fully credit an essential climate, VMT-reduction, and equity-based resource: transit. It also unnecessarily restricts credit generation potential for medium- and heavy-duty charging infrastructure, frustrating achievement of California's ZEV goals

Earthjustice Recommendation: (1) Adopt a credit multiplier for zero-emissions transit vehicles that reflects their impact on vehicle-miles traveled (VMT); (2) end the unique penalty on transit agencies that installed fixed guideway systems (e.g., light rail) prior to 2011; and (3) enhance credit-generation potential for medium- and heavy-duty charging infrastructure.

Why Staff Proposal Is Inadequate: Staff has not considered these transit proposals in the ISOR and would continue the flawed status quo. Staff has added capacity credit opportunities for medium- and heavy-duty infrastructure, but limitations on their use unnecessarily restrict the full potential of the credits.

In its reason for rejecting the EJ scenario (covering the reforms laid out above) CARB Staff argue that restricting credits from combustion fuels will lead to deficits in excess of available credits (the opposite of the problem the LCFS currently faces) causing high program costs and less stated climate benefits. Staff write that "[t]he large net cost of this scenario is associated with higher credit prices and the demand for 76 billion banked credits by 2030 and 288 million banked credits between 2024 and 2046, which far exceeds the available quantity even under the credit clearance market." If this is in fact the limiting reason that CARB is unwilling to restrict bogus credit generation, the solution is to enhance credit generation potential from low-risk, State-aligned ZEV pathways that deliver real benefits for climate, air quality, and environmental justice. This can largely be done by appropriately valuing the true transportation benefits of zero-emissions transit vehicles, the efficiency advantages of light rail transit systems, and reduce unnecessary barriers to credit-generation for medium- and heavy-duty charging infrastructure.

a. **Stop Unfairly Treating Zero-Emissions Transit Relative to Other Fuels and Reflect Its True Emissions Benefits.**

The LCFS fully (and overly) credits biomethane projects that were in place prior to the start of the LCFS and do not contribute to California's climate goals. However, transit, a real climate, air quality, equity, and VMT-reducing strategy, is uniquely penalized by not being credited for "early action." This is the wrong signal to send, undervalues the climate benefits of California's zero-emissions transit vehicles, which impairs the program's ability to decarbonize the transportation sector and deprives transit agencies of needed revenue. Specifically, the program fails to recognize the impact of ZE mass transportation vehicles reducing vehicle-miles-traveled (VMT) and imposes a unique and unjustified penalty on transit agencies that installed fixed guideway systems (e.g., light rail) prior to 2011. The ISOR fails to consider either of these issues.

Fixing these counterproductive and illogical problems must be a priority. The Scoping Plan acknowledges that "VMT reductions will play an indispensable role in . . . achieving the state's climate, air quality, and equity goals."[95] It also acknowledges the difficulty of achieving these urgent reductions, noting that public transit was "significantly impacted during the lockdown months, and has struggled to recover; ridership only averages two-thirds of pre-pandemic levels, and service levels also lag behind."[96] The necessary VMT reductions will require California policymakers to make transformative investments in transit, as the state's current level of car dependence is the result of entrenched practices. These historic decisions have not just entrenched single-occupancy vehicle travel, but also "reinforced long-standing racial and economic injustices that leave people with little choice but to spend significant time and money commuting long distances, placing a disproportionate burden on low-income Californians, who pay the highest proportion of their wages on housing and transportation."[97] To meet these goals, transit agencies need reliable sources of revenue that are not dependent on legislative discretion or flush budget years.

Amendments to the LCFS are required to align the program with the specific strategies in CARB's Policy Framework to Advance Sustainable and Equitable Communities (Appendix E to the Scoping Plan). Under this framework, the very first strategy is to "plan and invest in a sustainable transportation system."[98] The framework recognizes that reducing car dependence can ease several burdens that are inequitably borne by California's low-income communities and communities of color, including diminished access to jobs and services, risks of job loss if a vehicle breaks down, and reduced household wealth generation.[99] Accordingly, CARB's own vision demands transportation "funding frameworks that are clearly aligned and prioritize the State's climate, air quality, and equity goals at all levels of government."[100] Modernizing the LCFS to provide appropriate support for transit is one essential step to aligning California's transportation policies with its environmental and equity goals.

i. Adopt a Credit Multiplier for Zero-Emission Mass Transportation Vehicles to Account for the Outsized Impact of Vehicles that Reduce VMT on the Carbon-Intensity of California's Transportation Fuels.

The LCFS currently ignores the VMT benefits of zero-emissions transit vehicles, even though CARB has recognized that meeting California's climate goals in the transportation sector will require both a transition to zero-emissions technologies and dramatic reductions to VMT. As

[95] Scoping Plan at 192.
[96] *Id.* at 192–93 (footnotes omitted).
[97] *Id.* at 193.
[98] CARB, 2022 Scoping Plan, Appendix E, Sustainable and Equitable Communities: Policy Framework to Advance Sustainable and Equitable Communities at 10 (Nov. 2022).
[99] *Id.* at 6.
[100] *Id.* at 11.

CARB has explained, “despite cleaner vehicles and low-carbon fuels, the path to carbon neutrality by 2045 also depends on reducing per capita VMT.”[101] Therefore, CARB has urged transportation policies that prioritize “the movement of people over vehicles.”[102] One such commonsense policy is an LCFS credit multiplier for zero-emissions mass transportation vehicles (i.e., transit vehicles and school buses) that provides an appropriate incentive to reduce the carbon-intensity of California’s transportation fuels by deploying vehicles that reduce VMT.

The LCFS already recognizes that the carbon intensity of a vehicle fuel alone is insufficient for determining appropriate credit generation. The rule incorporates a multiplier for vehicle energy efficiency factors (known as the energy efficiency ratio or “EER”) because “[t]otal emissions are dependent on both the emissions per unit of energy consumed and the fuel economy of the vehicle.”[103] A multiplier for zero-emissions mass transportation vehicles rests on a similar insight: that *total emissions* depend on more than one factor and the LCFS can account for additional key factors through credit multipliers.

While CARB would need to evaluate the appropriate credit multiplier for zero-emissions mass transportation vehicles, there are multiple reasonable options available. For instance, CARB should consider a 2.75x multiplier because the California Transportation Plan models transit going from 4% mode share to 11% mode share (i.e., increasing transit mode share by 2.75x) in a scenario where VMT reductions align with State climate goals.[104] Alternatively, it would be reasonable to adopt a 2x multiplier because the Scoping Plan includes an objective to double transit capacity and service frequency by 2030.[105] What is not reasonable is assuming that the VMT impacts of these vehicles provide zero reduction to the carbon intensity of California transportation fuels.

ii. Allow Full Credit Generation for All Fixed Guideway Systems to Help Cash-Strapped Agencies Avoid Service Cuts that Could Harm Low-Income Californians and Increase Transportation Emissions.

Allowing full credit generation for all fixed guideway systems is a straightforward update to the LCFS regulation to better align the program with California’s zero-emissions, air quality, VMT, and equity goals. The LCFS regulation currently disfavors transit agencies because fixed guideway systems that were built before 2011 generate an artificially low number of credits, which does not reflect their energy economy ratio.[106] This policy has significant consequences for transit agencies with long-established fixed guideway systems. If older fixed guideway transit

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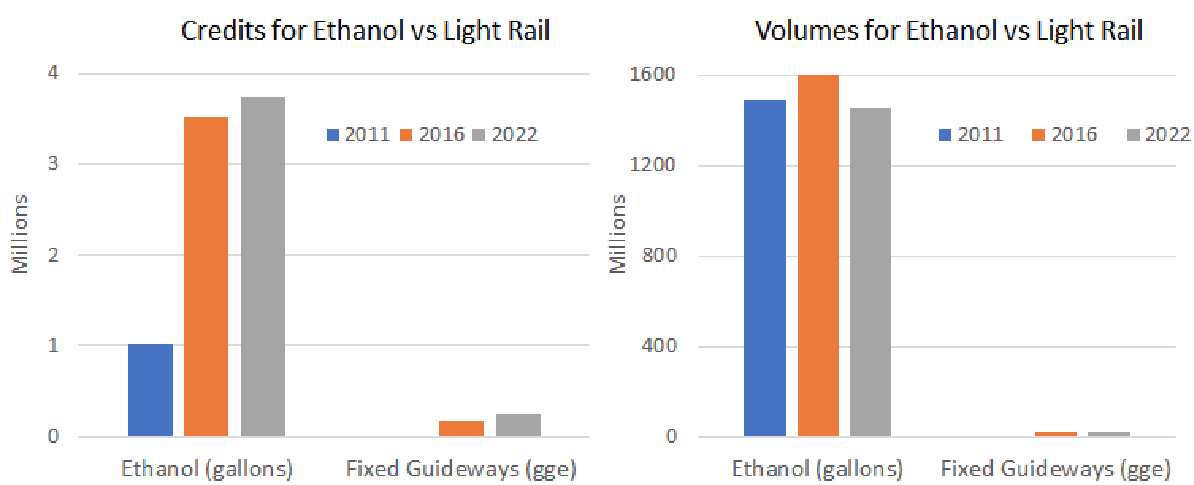
[101] *Id.* at 4.
[102] *Id.* at 10.
[103] CARB, Proposed Regulation to Implement the Low Carbon Fuel Standard, Vol. 1, ISOR (Mar. 5, 2009) at ES-18.
[104] Caltrans, California Transportation Plan 2050 (Feb. 2021) at 97, Figure 38, https://dot.ca.gov/-/media/dot-media/programs/transportation-planning/documents/ctp-2050-v3-a11y.pdf.
[105] CARB, 2022 Scoping Plan, Appendix E, Sustainable and Equitable Communities: Policy Framework to Advance Sustainable and Equitable Communities at 12.
[106] 17 CCR § 95486.1(a)(4).

system were treated the same as newer systems, they would generate 3.1 to 4.6 times as many LCFS credits, depending on the type of vehicles that use the system.[107]

The penalty on older fixed guideway transit systems is not only significant, but discriminatory. The LCFS does not handicap credit generation by other alternative fuels that were already established in the California market at the inception of the LCFS program. Notably, the LCFS does not reduce its subsidy for ethanol volumes that do not go beyond California's 2011 ethanol supply. If CARB had taken comparable steps to limit credit generation opportunities for ethanol to account for its widespread historic use, it would impact almost all ethanol credit generation, as ethanol blending has been mandatory for most of the state's gasoline sales since 2003.[108] The LCFS fully credits ethanol that was being delivered to California prior to the start of the LCFS and only begun to include fixed guideway systems in 2016, and penalizes systems installed prior to 2011 (see comparison of credits earned by ethanol compared to fixed guideway in Figure 4). Despite ethanol having required blending requirements, LCFS awarded full credit to ethanol pathways at the start of the program. However, no zero-emission fixed-guideway credits were awarded in 2011-2015 and then penalizes systems that had electrified prior to 2011, despite no requirements for electrification. Staff has provided no rationale for handicapping California's legacy transit agencies, particularly when legacy biofuels do not face similar treatment.

Figure 4: Comparison of Participation in the LCFS by Ethanol and Fixed Guideway Systems (e.g., Light Rail), as Measured by Credit Generation and Fuel Volumes



Data source: CARB's LCFS Quarterly Data Summary. "Gge" represents gallons of gasoline equivalent.

[107] *Id.* at Table 5 (Heavy Rail has an EER of 4.6; Light Rail has an EER of 3.3; and Trolley Buses, Cable Cars, and Street Cars have an EER of 3.1).
[108] CEC, Cleaner Burning Gasoline without MTBE (Jan. 1, 2003) (explaining that "all gasoline sold in Southern California, the greater Sacramento area, and the San Joaquin Valley (about 80 percent of gasoline in California) would have to contain ethanol once MTBE is eliminated" in 2003), https://ww2.arb.ca.gov/resources/fact-sheets/cleaner-burning-gasoline-without-mtbe.

The LCFS' disfavored treatment of transit systems installed priority to 2011 looks even worse in comparison to the bonus given to biomethane infrastructure installed before the LCFS took effect. CARB rewards entities that installed digesters prior to 2011, when the LCFS began and therefore may be correlated to project development. The LCFS does not appear to have any restrictions for crediting digester projects even while the protocol that the methodology was modeled after (the Cap-and-Trade protocol for Livestock Offset Projects) has some bounds.[109] Factory farms routinely benefit from this rule even when their digesters were installed for economic reasons completely unrelated to the LCFS, as illustrated by the examples in Table 4 below. It is indefensible for CARB to penalize transit agencies for their leadership in installing the first zero-emissions infrastructure, while giving preferential treatment to companies for taking early action to bring combustion fuels to market.

[109] The LCFS takes many aspects of the protocol for Livestock Offset Projects; however, as laid out in https://ww2.arb.ca.gov/sites/default/files/2020-09/2020_dairy-swine-manure_crediting_faq.pdf, there is no strict project commencement date that would exclude LCFS credit generation. The protocol requires that projects must have commenced no earlier than 2007 to qualify for cap-and-trade offsets, per 95973(a)(2)(B) of the Cap-and Trade Regulation, https://ww2.arb.ca.gov/sites/default/files/2021-02/ct_reg_unofficial.pdf.

Table 4: Examples of Out-of-State Dairies Receiving LCFS Credits for Digesters Installed Before 2011 and Using Book-and-Claim Accounting

Applicant	Project Type	Project Location	Application Posted Date	Original Digester Construction Date	Original End Use	CI
U.S. Venture	Bio-CNG from Dairy CAFO (book-and-claim)	Yellow Jacket Boxler, Varysburg, NY	12/2/22	2009	Onsite combustion[110]	-206.88
Blue Source LLC	Bio-CNG from Dairy Biomethane (book and claim)	Green Valley Dairy, Krakow, Wisconsin	11/22/22	2005	Onsite Combustion [111]	-180.73
Element Markets LLC	Bio-CNG from Swine Biomethane (book and claim)	Dalhart Farm, Dalhart, Texas	9/2/22	1997-2001	Onsite Combustion [112]	-417.96

Allowing full credit for legacy fixed guideway systems is a straightforward correction that would yield significant revenue for transit systems and help avoid credit shortfalls the LCFS might otherwise see from restricting credit generation for polluting fuels. The International Council on Clean Transportation estimated that this fix alone would yield about 20 million tonnes of LCFS credits from 2024–2045, providing meaningful support for investments in public transit.[113] For context, this is about 40% of the credit generation foregone by capping credits for virgin vegetable oils in the ISOR's Alternative 1.[114] Combining a cap on lipid biofuels with fair

[110] U.S. EPA, AgStar-Livestock Anaerobic Digester Database, https://www.epa.gov/agstar/livestock-anaerobic-digester-database.

[111] As the LCFS application acknowledges, Green Valley Dairy began operation of its first digester in 2005, and its second in 2008. Project details confirm these digesters were designed to support electric power generation. Northern Biogas, Green Valley Dairy Expansion, https://northernbiogas.com/projects/green-valley-dairy-expansion/.

[112] The LCFS application states that the farms "began operations in 1997, 1998, and two in 2001 with anaerobic lagoons installed the same time." According to AgStar, the original use of these was for boiler and furnace fuel.

[113] In the default scenario of CARB's 2023 CATS modeling, which is very similar to the proposal in the ISOR, electric fixed guideway systems generated about 6.2 million tonnes of credits from 2024–2025. If 90% of these credits became eligible for an EER of 4.6, total credits for fixed guideway systems would rise to about 26 million tonnes.

[114] In the default scenario of CARB's 2023 CATS modeling, which is very similar to the proposal in the ISOR, virgin vegetable oils generate about 47 million tons of credits before they become deficit generators in the mid-2030s.

treatment of public transit would be an important step toward aligning the LCFS with CARB's equity policies.

California's transit agencies are facing critical budget shortfalls and may be forced to severely reduce service without additional revenue. Support for transit in the State budget will help transit agencies cope with short-term impacts of losing access to federal COVID relief funds, but "falls far short of the amount needed to resolve the $2.5 billion deficit that transit operators anticipate over the coming five years."[115] In this fiscal environment, LCFS revenue is a potential lifeline that could help cash-strapped agencies avoid service cuts. These reductions in service could be detrimental to the purpose of the LCFS. Transit riders, who are disproportionately lower income—are likely to shift to driving gas-fueled personal vehicles—increasing not just the carbon intensity of California's transportation fuels, but also health-harming pollution.

b. Enhance Credit-Generating Potential for Zero-Emissions Charging Infrastructure.

The Scoping Plan, the Mobile Source Strategy, and the State Implementation Plan all make clear the urgent need to rapidly transition to zero-emissions in our transportation sector, and electrifying transportation is a lynchpin for achieving this goal. Specifically, diesel trucks' outsized harm on health and the climate, and the widespread availability and cost-effectiveness of truck electrification for most vehicles in this segment makes this a critical lever for climate action. CARB's landmark regulations (Advanced Clean Trucks and Advanced Clean Fleets) help advance the transition by stimulating both production and purchase of these vehicles, especially in the segments that they are most operationally suitable. As CARB's Total Cost of Ownership studies show, by 2035, there is not a single truck class where electric trucks do not have a more favorable TCO than combustion.

However, electrifying transportation at the scale and pace necessary to meet looming air quality attainment deadlines and deliver enormous health and climate benefits critically depends on a comprehensive charging network. This includes everything from depot charging needed to support drayage, transit, and school bus electrification, to public fast charging for light duty, to medium- and heavy-duty fast charging along key freight corridors. CARB can make several, simple changes to enhance credit generation potential for medium- and heavy-duty infrastructure and ensure the LCFS acts to unlock a faster transition. In many cases, this only requires treating electrification and hydrogen with parity, rather than penalizing electric pathways simply because they are relatively lower-cost and better established. Specifically, we urge CARB to make the following critical changes:

---

[115] Transit Center, Unpacking California's Transit Budget: A Huge Victory, But an Unfinished Fight (Aug. 1, 2023), https://transitcenter.org/unpacking-californias-transit-budget-a-huge-victory-but-an-unfinished-fight/. Governor Newsom's proposed 2024 budget would maintain transit funding levels, but delay $1 billion in funding by one year. Dan Zukowski, ESGDive, Climate funding takes hit in California governor's 2024 budget (Jan. 12, 2024), https://www.esgdive.com/news/california-governor-gavin-newsom-2024-budget-proposal-climate-transit/704436/.

- **Create parity in capacity credits for MHD-HRI and MHD-FCI** by allowing MHD-FCI capacity crediting of up to 50% for shared sites and 25% for private (instead of its current limits at 25% and 10% for shared and private MHD-FCI sites respectively). Meeting California's ZEV goals will require a massive deployment of shared charging infrastructure for electric freight vehicles. To date, the slow deployment of these sites has been a primary challenge for transitioning the hardest-to-electrify fleets to ZEVs. CARB should not exacerbate this problem with a discriminatory and unreasonable limit on shared MHD-FCI incentives in the LCFS.
- **Eliminate the geographic restrictions**, which will add administrative burden and unnecessarily exclude sites with high potential to electrify earlier than longer haul routes that would be operating along these corridors. Local and regional fleets will not necessarily charge near these corridors but are highly suitable to early electrification, and the LCFS should help enable operators to overcome one of the few remaining barriers to getting their fleets off diesel. Orienting the capacity credits only toward longer-hauls and limiting to freight corridors missed the opportunity to accelerate near-term action. It is also unclear why this provision is necessary, since Earthjustice has not seen information that suggests an over-building of medium-and heavy-duty charging stations. Charging providers already have a fundamental incentive to cite stations as conveniently as possible for fleets that are interested in electrifying.
- **Increase capacity credits to 5% of prior quarter deficits**. Currently, the language appears to suggest that both kinds of stations will cumulatively share the 2.5% of prior quarter deficits. This should be increased to 5% each to enable larger capacity charging deployments.

CONCLUSION

We look forward to continuing to engage in the Low Carbon Fuel Standard rulemaking process and working with Staff to ensure the program avoids perverse outcomes and provides appropriate support to the technologies at will enable achievement of California's climate, air quality, and equity goals. Appendix A includes a presentation of Earthjustice's proposed LCFS reforms with additional graphics and analysis.

Sincerely,

Sasan Saadat
Sara Gersen
Adrian Martinez
Nina Robertson
Earthjustice
50 California St., Suite 400
San Francisco, CA 94111

Appendix A:
Earthjustice Presentation on LCFS Reforms

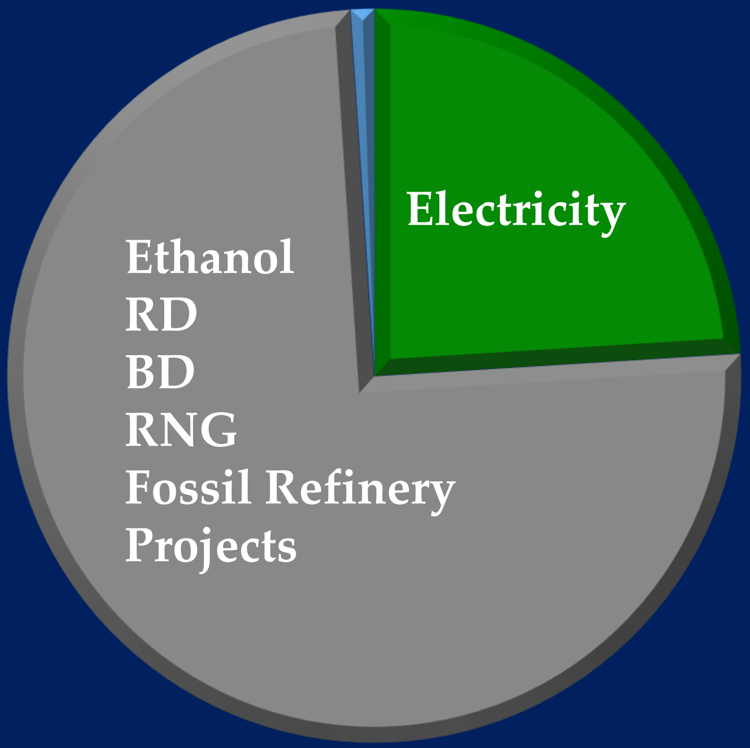
EARTHJUSTICE
BECAUSE THE EARTH NEEDS A GOOD LAWYER

Fueling Change: LCFS Reforms for Climate, Air Quality, and Equity

Changes needed to align the
Low Carbon Fuel Standard with
CARB's ZEV, air quality, and equity goals

Why Does Most of the $3-4 Billion in Annual LCFS Revenues Fund Combustion Fuels?

Credits in 2022



Based on Data from CARB's LCFS Data Summary for 2022

- Nearly 80% of LCFS credits in 2022 went to non-ZEV fuels.
- California must transition away from combustion fuels to meet its Clean Air Act obligations.
- CARB's Board has roundly supported the ZEV transition by passing ACC II, ACF, and ACT.

Continuing to subsidize old, combustion-based technologies works AGAINST CARB'S own priorities.

EARTHJUSTICE

The LCFS Must Support the ZEV Transition

Under Staff's proposed changes, the LCFS will continue to subsidize polluting technologies at the expense of ZEV support.

Stop Subsidizing the Bad

Restrict over-generation of subsidies for polluting fuels

- Stop avoided methane credits for new pathways.
- Align deliverability requirements for <u>all</u> fuels.
- Cap lipid biofuels.
- Prohibit crediting for Enhanced Oil Recovery activities, consistent with SB 1314.

Enhance Support for the Good

Increase LCFS support for ZE pathways with the greatest EJ benefit

- Allow full credit generation for fixed guideway (e.g. light rail) transit.
- Support VMT reductions with a transit and school bus credit multiplier.
- Unlock billions for transportation electrification without adding costs to consumers.

End Avoided Methane Crediting in LCFS

Staff's proposal to extend avoided methane crediting for decades:
Thwarts attainment of State air quality goals;
Undermines transportation electrification;
Hampers green hydrogen production; and
Harms communities.

EARTHJUSTICE

The Assumption that Methane Would Otherwise Be Vented is Flawed

- "It is unrealistic to assume that capturable methane would be vented under a GHG conscious policy regime."
  - E. Grubert, Env. Res. Letters (Aug. 2020).

- Oil & gas, landfills, and wastewater treatment plants are already required to capture methane. **Why aren't dairies?**

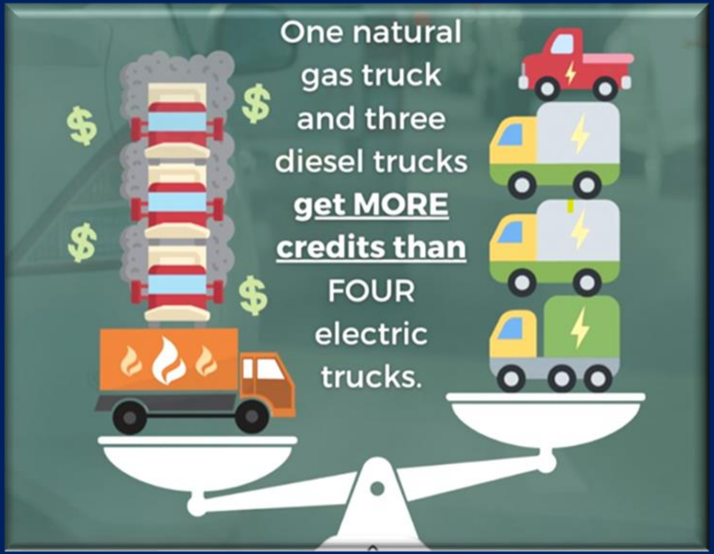
EARTHJUSTICE

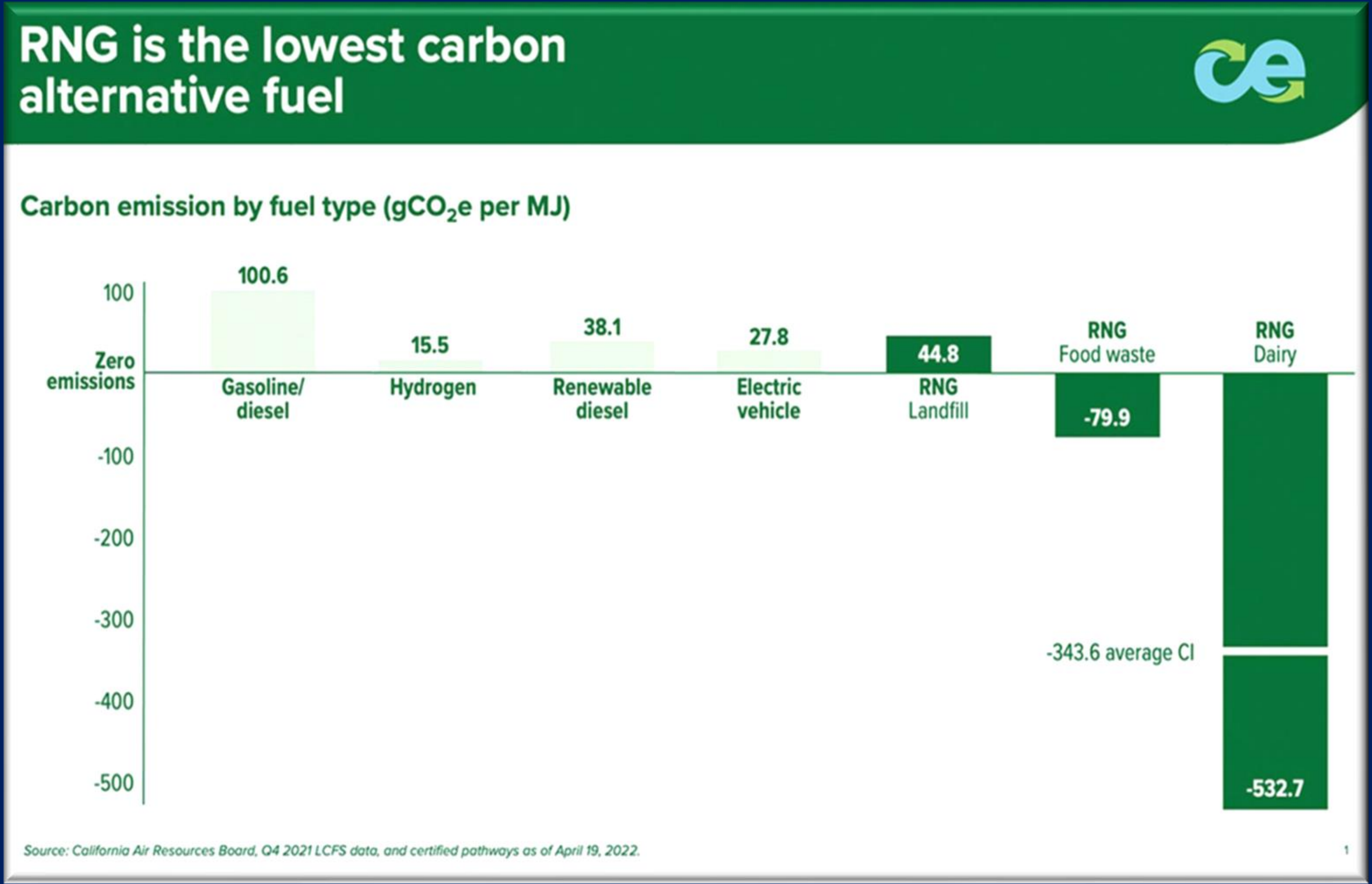
Avoided Methane Crediting Causes Distortions that Run Counter to State Climate and Air Quality Goals

1. Larger subsidies for methane-burning trucks than zero-emission trucks that the State has mandated.
2. Larger subsidies for greenwashed gray hydrogen than zero-emission hydrogen pathways crucial for air and climate goals.
3. Biomethane diverted to on-road transportation from hard-to-decarbonize sectors.
4. Favored polluting pathways (at best) entrench and (at worst) exacerbate environmental injustice of livestock management choices.
5. Billions of LCFS dollars flowing out-of-state for dubious emissions benefits.

EARTHJUSTICE

The LCFS Favors Polluting CNG Trucks Over ZEV Trucks





"Replacing just 25% of a fleet's diesel trucks with negative carbon intensive RNG from dairy manure can reduce a fleet's carbon emissions by 100%."

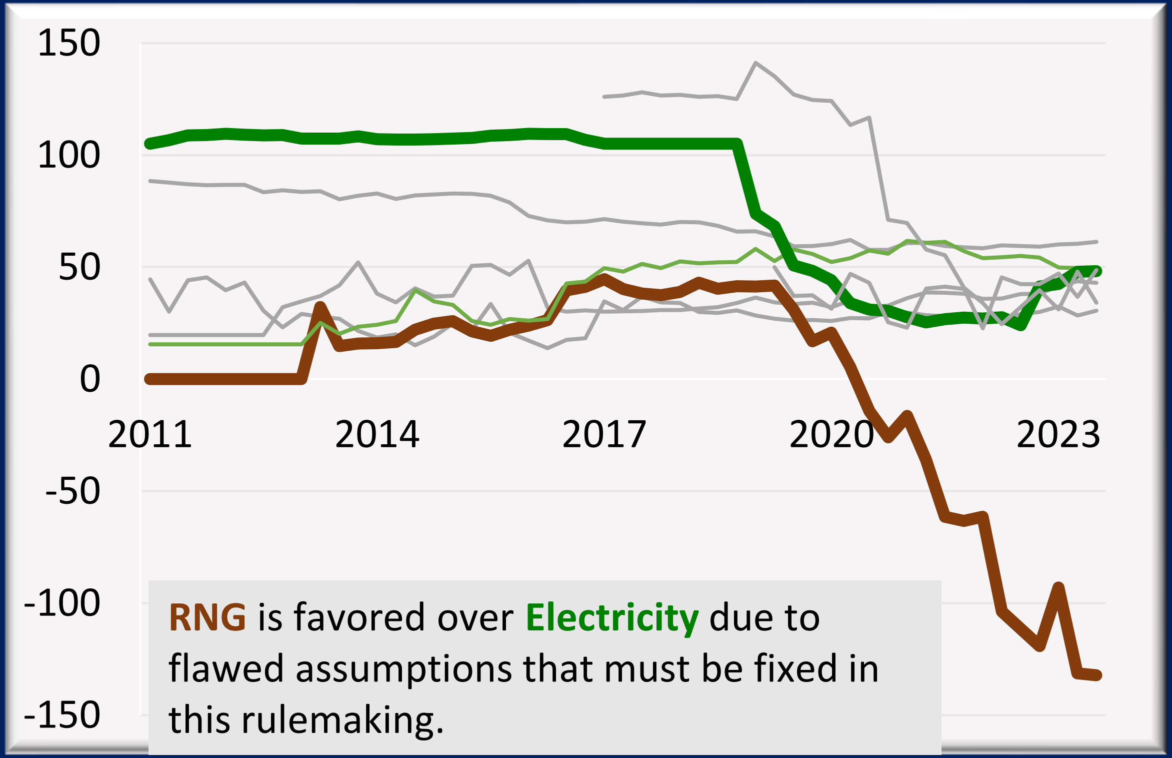
- Greg Roche, VP at Clean Energy Fuels, Op-Ed, (Aug. 2022)

EARTHJUSTICE

The LCFS Favors Polluting CNG Trucks Over ZEV Trucks

Unless fixed, the LCFS will continue to distort market signals for ZEVs.

Average Carbon Intensity of Fuels in the LCFS



Based on Data from CARB's LCFS Data Summary through Q3 2023

EARTHJUSTICE

The LCFS Favors Dirty Hydrogen over Green Hydrogen

Electrolysis in Alameda County, CA, Powered by Local Solar PV

- Carbon Intensity = 0
- LCFS Credit Calculator: $1.40/kg of H2
- Certified in 2016

vs.

SMR of Fossil Gas in Wilmington, CA, Paired with Credits from Dairy in Indiana

- Carbon Intensity = -287
- LCFS Credit Calculator: $3.81/kg of H2
- Certified in 2020

The use of avoided methane credits to greenwash dirty hydrogen harms communities and contradicts the 2022 Scoping Plan, which identifies the need for more electrolytic hydrogen.

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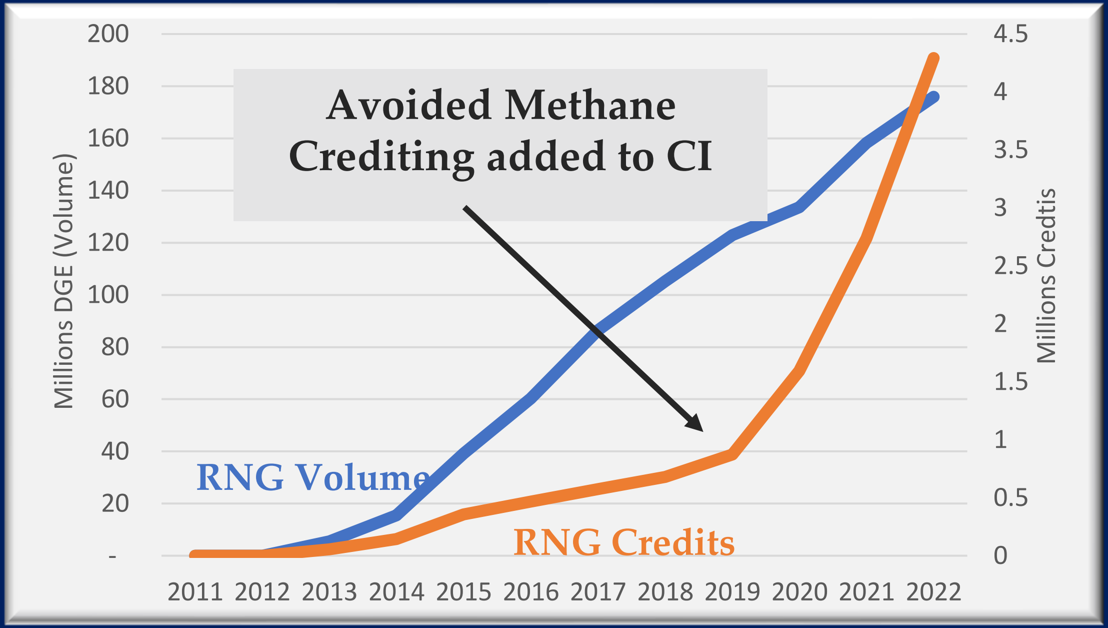
The LCFS Diverts Biomethane to the Wrong Sector

Data shows that nearly $200 million in LCFS subsidies go to methane, much of that due to avoided methane crediting.



Based on CARB's LCFS Quarterly Data Summary through 2022

Why continue to over-subsidize fuels that do not advance CARB's ZEV goals?

EARTHJUSTICE

LCFS Diverts Biomethane to the Wrong Sector

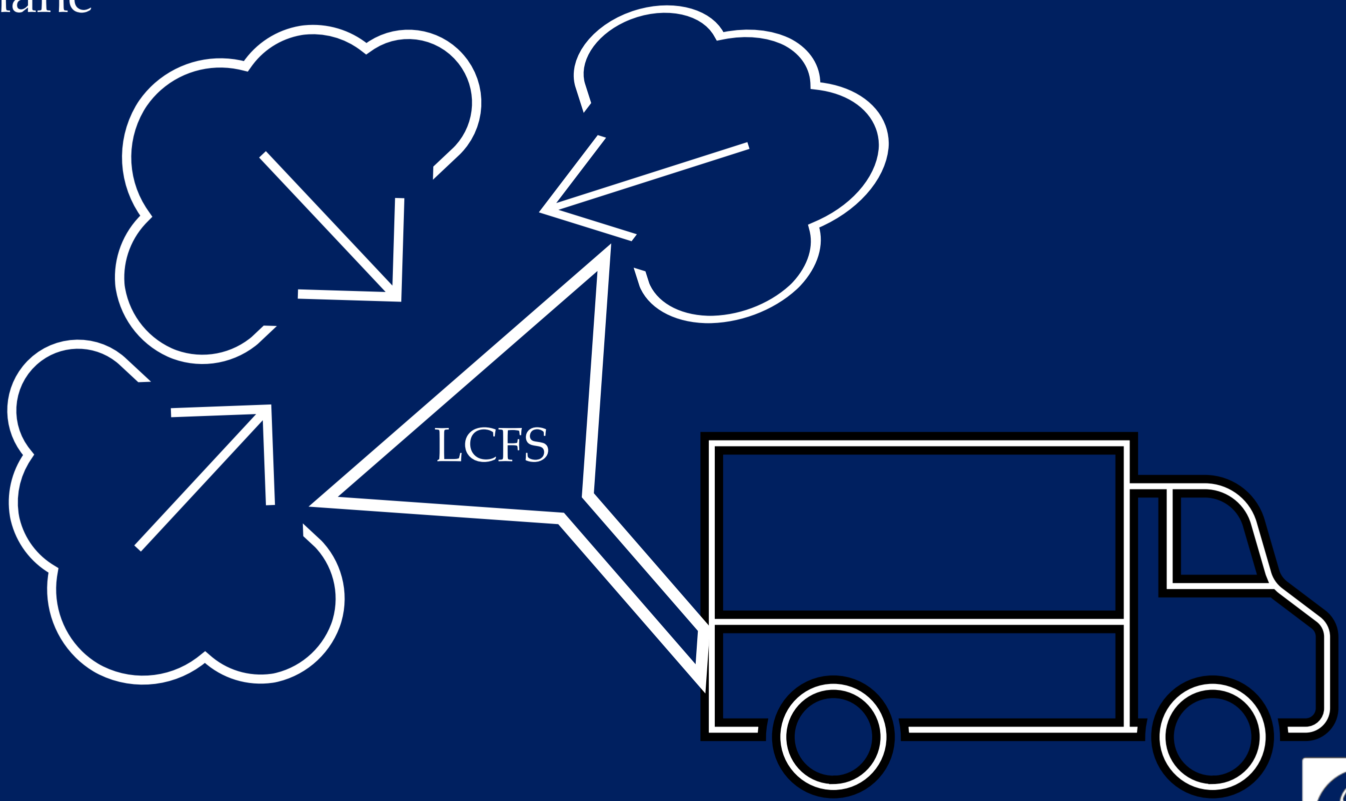
Without changes to the LCFS, methane will continue to be most valued in transportation when the evidence shows (1) a rapid phaseout of combustion fuels is necessary to meet State air quality and climate goals and (2) biomethane should be directed to other sectors.

"[B]iomethane will be largely needed in hard-to-decarbonize sectors"[1]

CALIFORNIA AIR RESOURCES BOARD

"[T]he LCFS credits can be three times higher than the cost to produce the fuel. RNG incentives or credits can be increased if the LCFS credits are stacked with other incentives like those from the federal RFS program."[2]

CALIFORNIA ENERGY COMMISSION



1. 2022 Scoping Plan, page 190.
2. CEC-200-2023-010 (Aug. 2023) (abbreviations added), https://www.energy.ca.gov/sites/default/files/2023-08/CEC-200-2023-010.pdf

EARTHJUSTICE

Is There Even a Climate Benefit?

LCFS funds farms with digesters installed <u>before</u> LCFS avoided methane crediting took off in 2019.

Why is California paying for emissions that have already been captured?

Appendix A: Sample of Projects Applications with Avoided Methane where Actual Baseline Was Methane Capture for Onsite Combustion

Applicant	Project Type	Project Location	Application Posted Date	Original Digester Construction Date	Original End Use	CI
U.S. Venture	Bio-CNG from Dairy CAFO (B&C)	Yellow Jacket Boxler, Varysburg, NY	12/2/2022	2009	Onsite combustion[65]	-206.88
FirstElement Fuel	Hydrogen from SMR of Dairy Biomethane (B&C)	Dallman East River Dairy, Brillion, Wisconsin	11/28/2022	2012	Onsite combustion[66]	-308.67
FirstElement Fuel	Hydrogen from SMR of Dairy Biomethane (B&C)	Jerseyland Dairy, Sturgeon Bay, Wisconsin	11/28/22	2012	Onsite Combustion[67]	-272.08
Blue Source LLC	Bio-CNG from Dairy Biomethane (B&C)	Green Valley Dairy, Krakow, Wisconsin	11/22/22	2005	Onsite Combustion[68]	-180.73
Element Markets LLC	Bio-CNG from Swine Biomethane (B&C)	Dalhart Farm, Dalhart, Texas	9/2/22	1997-2001	Onsite Combustion[69]	-417.96

Earthjustice Review of LCFS Pathways Available for Public Comment (2022)

EARTHJUSTICE

Are Methane Capture Subsidies Even Effective at the One Thing They Purport to Do?

Contents lists available at ScienceDirect

Atmospheric Environment

journal homepage: www.elsevier.com/locate/atmosenv

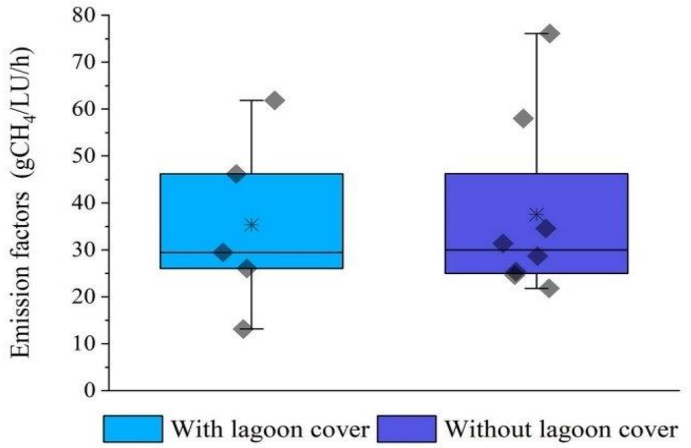
ELSEVIER

Ammonia and methane emissions from dairy concentrated animal feeding operations in California, using mobile optical remote sensing

N.T. Vechi [a,b,*], J. Mellqvist [a], J. Samuelsson [c], B. Offerle [c], C. Scheutz [b]

[a] Department of Space, Earth and Environment, Chalmers University of Technology, Göteborg, Sweden
[b] Department of Environmental and Resource Engineering, Technical University of Denmark, 2800 Kgs, Lyngby, Denmark
[c] FluxSense AB, SE-41296, Göteborg, Sweden

servations, e.g., making it possible to identify farms with and without a manure lagoon cover, which enables the facility to collect the CH_4 produced in lagoons and use the gas as an energy source. In total, 5 of the measured CAFOs used this system. Noteworthy here is that these farms did not emit significantly less than those without a cover (Fig. 8). Uncertainties in terms of animal numbers or the measurements may have contributed to concealing any differences. An alternative explanation is that even though we did observe the presence of a lagoon cover, we



Despite 10 years of overlapping digester subsidies, livestock manure emissions have remained mostly flat.

- Inventory assumes digester = zero methane.
- Measured methane emission factors were 60% higher than CARB inventory.
- Real-world measurements show CAFOs with lagoon covers have <u>virtually the same level of methane emissions as those without.</u>
- Even CARB's own data shows "mega-emitting" farms with digesters.[1]

1. Available at Carbon Mapper Data, https://carbonmapper.org/.

EARTHJUSTICE

Are Methane Capture Subsidies Even Effective at the One Thing They Purport to Do?

"If I don't keep the digester between 90-100 degrees, we're not going to produce gas. So, we are being paid to create methane gas and destroy it. Now wrap your head around that one. If we just did what we normally did it would not produce methane… it makes no sense, and you talk to the carbon offset people and they will admit this won't prevent global warming or climate change. This is a joke. They won't say that on record but in private."

-NY Dairy Farmer

Is the LCFS creating a perverse incentive to create more methane?

Some farmers report generating more methane than they would have otherwise created, so that they can sell it into the LCFS.

M. Hanna Pierce et al., An Evaluation of New York State Livestock Carbon Offset Projects in California's Cap and Trade Program (May 2023)
https://www.tandfonline.com/doi/full/10.1080/17583004.2023.2211946

EARTHJUSTICE

End Biomethane's Book-and-Claim Exceptionalism

Biomethane is the only fuel in the LCFS that can generate credits without being delivered to California.

This "book-and-claim" accounting enables the greenwashing of fossil fuels through purchase the unbundled attributes of out-of- state biomethane that never even flows toward California.

CARB must require biomethane deliverability **now**, as it does for all other fuels, and not postpone it for decades, as Staff proposes.

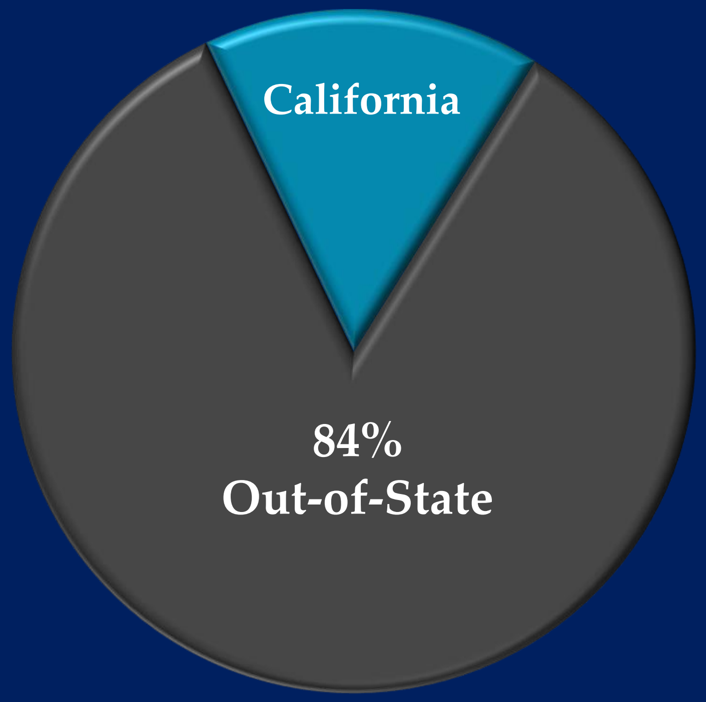
LCFS fuel	Is delivery to California required?
Renewable diesel	Yes
Biodiesel	Yes
Ethanol	Yes
Aviation fuel	Yes
Electricity	Yes
Fossil natural gas	Yes
Biomethane	No. Staff proposes a weak deliverability requirement to apply to biomethane dispensed at CNG stations in 2041 and for biomethane used in hydrogen production in 2046.

EARTHJUSTICE

Why Is California Paying for Dubious Emissions Benefits Out-of-State?

LCFS dollars are flowing out of California and not supporting the State's economy, ZEV transition, or climate goals.

- Most biomethane is from out-of-state and is not captured in California's GHG inventory.
- Every single certified LCFS pathway that purports to use livestock biomethane to produce hydrogen is from an entity that purchases fossil methane and pairs it with unbundled biogas credits from farms in NY, WI, MN, IN, or MO.



Volume share of LCFS biomethane in 2022

Taken from CARB's LCFS Data Dashboard

EARTHJUSTICE

Current LCFS Methane Policy Rewards Polluters in California's Most Burdened Regions

- Results in profits over public health or furthering transportation electrification.
- Eliminates incentive to reduce methane.
- Adds an income stream to the largest/most profitable dairies, exacerbating consolidation.
- Relies on the same management strategies (confinement, consolidation) that cause human and environmental harm. [1]

HOARD'S DAIRYMAN

Energy revenue could be a game changer for dairy farms

Unintended consequences

In addition to lower cost of production, the returns from energy generated by large farms may accelerate the growth of the mega-dairy farms. At the onset, small farms may find it more difficult to participate in these projects.

The New York Times

They Grow the Nation's Food, but They Can't Drink the Water

1. See, e.g., Central Valley Dairy Representative Monitoring Program Report (2019) at 5, https://leadershipcounsel.org/wp-content/uploads/2019/10/Dairy-report.pdf (reporting widespread groundwater contamination at dairies).

EARTHJUSTICE

Avoided Methane: Correcting LCFS Assumptions

Problem:

- Methane's negative CI scores assumes polluters may freely vent methane as a baseline case, causing many market distortions and perverse outcomes.
- Lack of a deliverability requirement for biomethane exacerbates market distortions.

Fix:

- Discontinue credit for avoided methane venting in new pathways.
- The baseline case should **assume mandatory methane control**, e.g. by flaring or alternative manure management, either by authorized regulations or other dedicated investments (similar to landfill gas).
- Require deliverability for biomethane, in alignment with all other fuels.

EARTHJUSTICE

Cap Lipid Biofuels

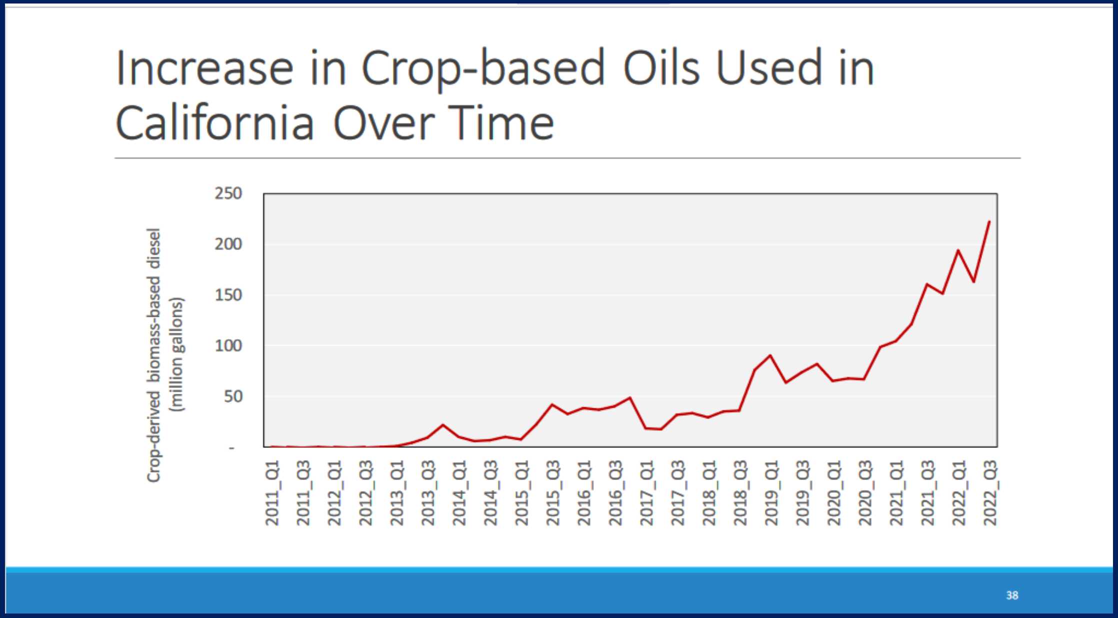
Staff's proposal to leave lipid biofuels unrestricted will:
Exacerbate global hunger and deforestation;
Have dubious climate and air quality benefits;
Depress the credit price; and
Undermine electrification goals.

EARTHJUSTICE

CARB's Current Approach to Biofuels Is Insufficient

The LCFS includes a Land Use Change (LUC) "adder" to the CI score, but crop-based feedstock is surging.

- LUC is an inherently dynamic and difficult concept to quantify.
- LUC risks increase substantially with increased consumption.
- Current levels of biofuel consumption wildly exceed levels contemplated by CARB at the time these figures were selected.



CARB LCFS February 22, 2023 Workshop Presentation

Crop-Based Biofuels Increase Food Prices and Food Insecurity

OCTOBER 3, 2017

Biofuels policies drive up food prices, say over 100 studies

Europe's biofuels policies do increase global food prices. That's the wide scientific consensus, according to a review of more than 100 economic modelling studies of the impact on food prices from increased demand for biofuels made from food crops. Increased demand for biodiesel has driven the price of vegetable oils in the EU, such as rapeseed, palm oil, soy and sunflower, up 171% per exajoule (EJ) of biodiesel produced, according to the analysis by consultancy Cerulogy for BirdLife Europe and T&E.

See C. Malin (Sept. 2017), https://www.cerulogy.com/wp-content/uploads/2017/09/Cerulogy_Thought-for-food_September2017.pdf.

THE WALL STREET JOURNAL.

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COMMODITIES

Renewable Diesel Booms Despite Concern Over Effect on Food Prices

U.S. production of the plant- and animal-derived biofuel soars

By Bob Henderson Follow

Updated April 7, 2023 9:00 am ET

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Crop-Based Biofuels Lead to Deforestation

ARTICLES
https://doi.org/10.1038/s41893-021-00729-z
nature sustainability

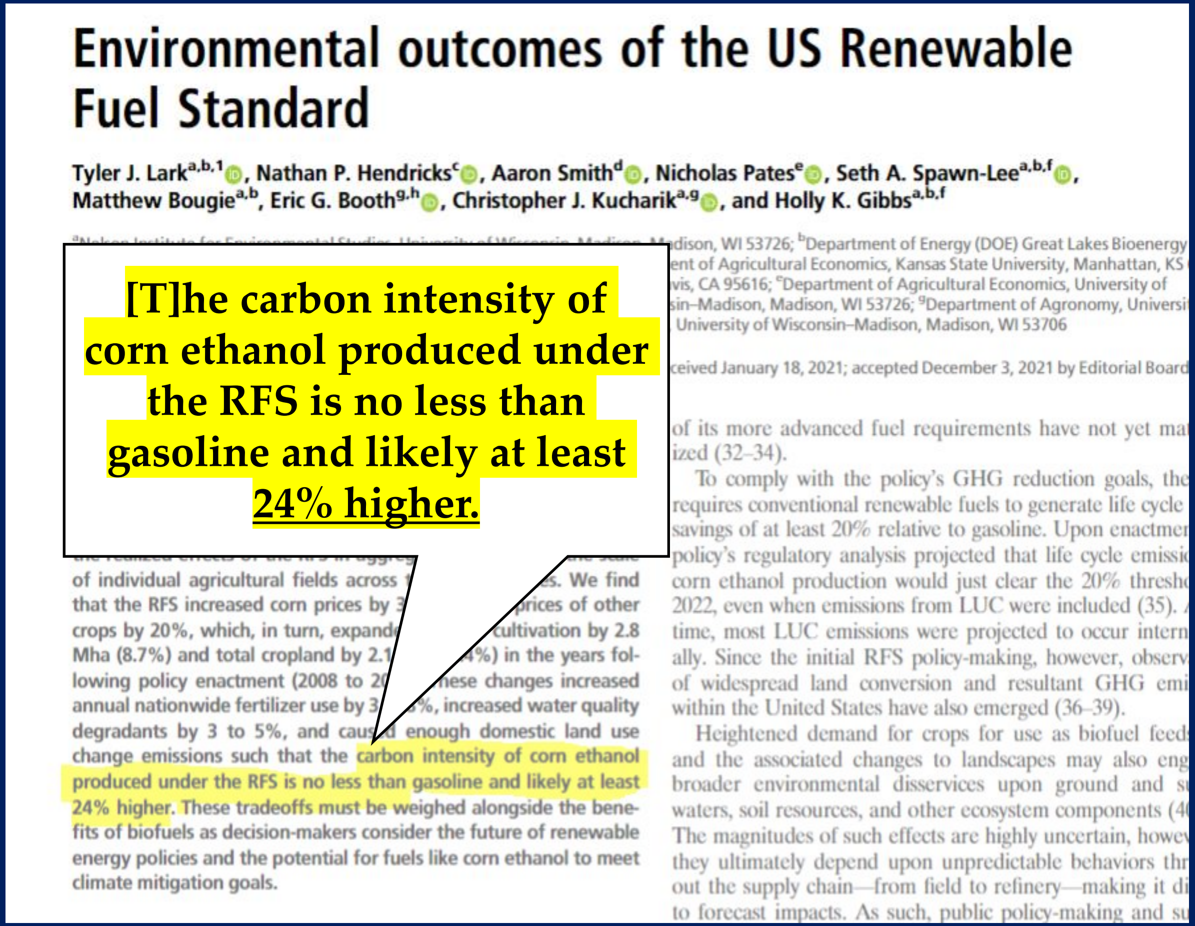
Check for updates

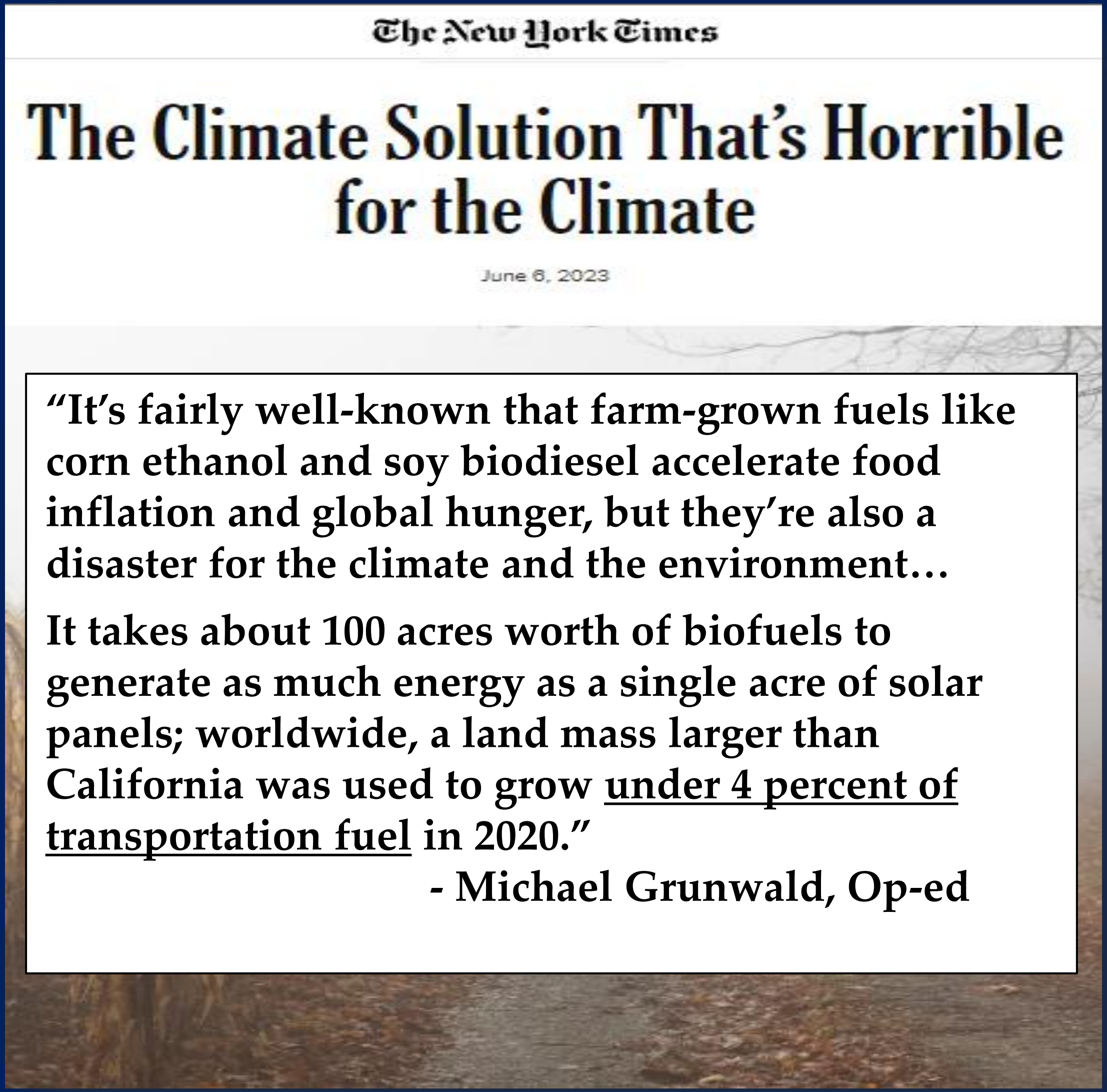
Massive soybean expansion in South America since 2000 and implications for conservation

Xiao-Peng Song[1,2], Matthew C. Hansen[2], Peter Potapov[2], Bernard Adusei[2], Jeffrey Pickering[2], Marcos Adami[3], Andre Lima[2], Viviana Zalles[2], Stephen V. Stehman[4], Carlos M. Di Bella[5], Maria C. Conde[5], Esteban J. Copati[6], Lucas B. Fernandes[7], Andres Hernandez-Serna[2], Samuel M. Jantz[2], Amy H. Pickens[2], Svetlana Turubanova[2] and Alexandra Tyukavina[2]

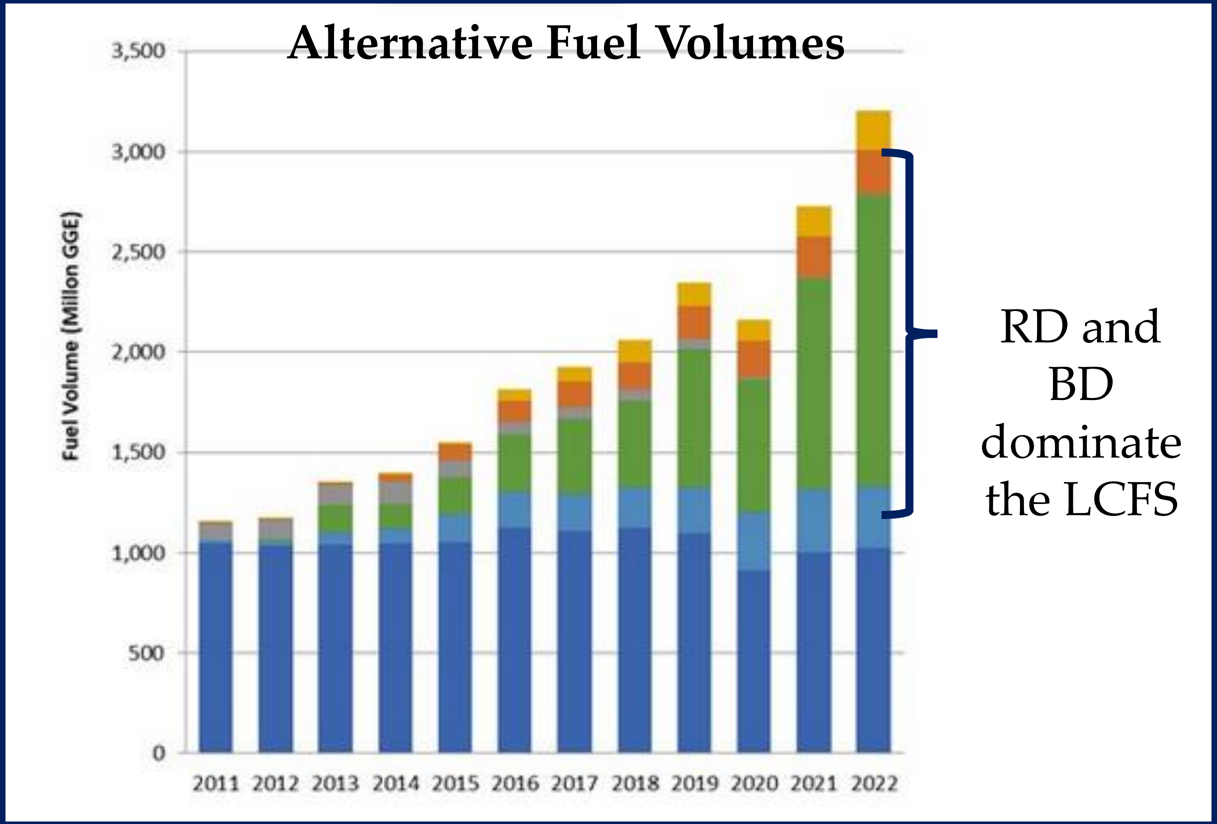
A prominent goal of policies mitigating climate change and biodiversity loss is to achieve zero deforestation in the global supply chain of key commodities, such as palm oil and soybean. However, the extent and dynamics of deforestation driven by commodity expansion are largely unknown. Here we mapped annual soybean expansion in South America between 2000 and 2019 by combining satellite observations and sample field data. From 2000 to 2019, the area cultivated with soybean more than doubled from 26.4 Mha to 55.1 Mha. Most soybean expansion occurred on pastures originally converted from natural vegetation for cattle production. The most rapid expansion occurred in the Brazilian Amazon, where soybean area increased more than tenfold, from 0.4 Mha to 4.6 Mha. Across the continent, 9% of forest loss was converted to soybean by 2016. Soybean-driven deforestation was concentrated at the active frontiers, nearly half located in the Brazilian Cerrado. Efforts to limit future deforestation must consider how soybean expansion may drive deforestation indirectly by displacing pasture or other land uses. Holistic approaches that track land use across all commodities coupled with vegetation monitoring are required to maintain critical ecosystem services.

Crop-Based Biofuels May Not Even Be Low-Carbon



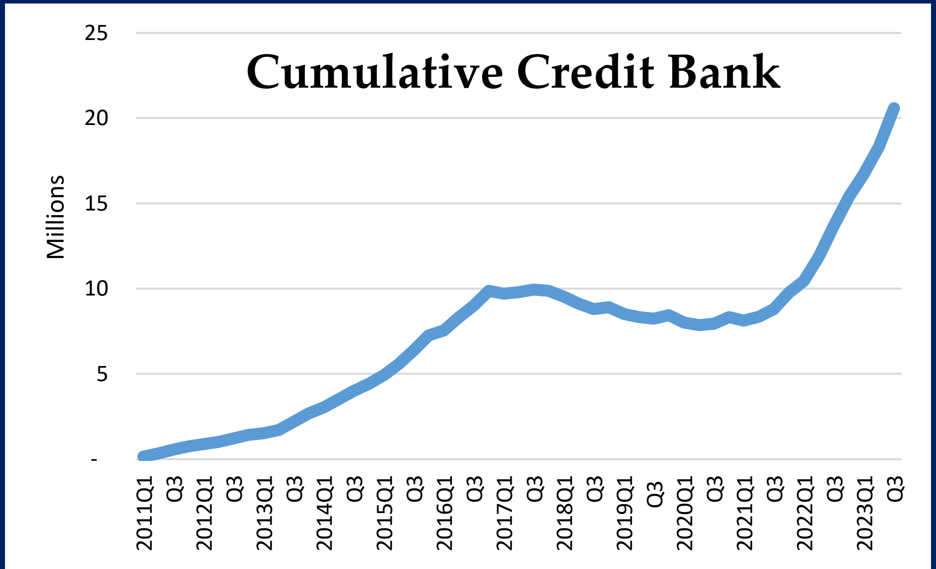


Significant Growth in Biofuels Undermines ZEV Goals



- Unconstrained biofuel growth has led to a glut of credits and plummeting credit prices.
- Continuing to subsidize all biofuels devalues each credit, including those used to support transportation electrification.

Current policy distorts the market signal for ZEVs.



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Staff’s Air Quality Modeling Is Questionable

- Staff’s approach differs significantly from the 2018 LCFS assessment without justification.
- Staff’s modeling ignores relevant science, including CARB’s own 2021 study.
- Appropriately accounting benefits to the LCFS would <u>lower</u> the stated GHG and air pollutant benefits from biofuels.

EARTHJUSTICE

Staff's Air Quality Modeling Is Questionable

Current Proposal's Analysis	2018 Analysis	What's the Issue?
Air quality benefits (PM/NOx) from upstream CA crude production are included.	No upstream benefits were included.	**No evidence that LCFS has a significant impact on upstream CA crude. The 2022 Scoping Plan notes crude production has been on the decline since 1986, prior to the LCFS.**[1]
100% of RD's GHG, PM, and NOx benefits attributed to the LCFS.	Benefits were apportioned between LCFS and RFS.	**LCFS should only account for its portion of benefits.**
PM/NOx emissions are based on 2011 data. Staff cited a lack of data for new engines.[2]	PM/NOx emissions are based on 2011 data, which includes RD PM benefits, and excess NOx from BD offset by RD.	**A 2021 CARB shows no statistical reduction in PM for new technology diesel engines (NTDE) using biofuels and that RD does not offset excess NOx from BD.**[3]

1. LCFS SRIA. 2023. https://ww2.arb.ca.gov/sites/default/files/2023-09/lcfs_sria_2023_0.pdf. Pages B-9, B-10, B-11.
2. Scoping Plan. 2022. Page 103.
3. Low Emission Diesel Study. 2021. https://ww2.arb.ca.gov/sites/default/files/2021-11/Low_Emission_Diesel_Study_Final_Report.pdf

EARTHJUSTICE

Staff's Proposed Biofuels Measures Do Not Solve These Problems

- Staff's proposed prohibition of palm oil is unhelpful.
  - Palm oil is already excluded from the program due to its ILUC score.
  - Palm oil is fungible with soybean oil. Increased demand for soybean oil in California → Increased global demand for palm oil and associated deforestation.
- Staff's proposed certification process will not be effective. It requires burdensome auditing that will not prevent increased crop oil consumption or the associated harms from land use change and food price increases.
- These newly proposed changes were not vetted in workshops, requested by environmental stakeholders, or directed by the Board.

A Cap Is the Best Available Solution.

EARTHJUSTICE

Lipid Biofuels: Limiting Harms

Problem:

The unrestricted growth in lipid-based biofuels in the LCFS exacerbates global food insecurity, threatens critical ecosystems, provides dubious climate and air quality benefits, and depresses the credit price.

Fix:

Cap the use of lipid-based fuels to prevent compliance shuffling with RFS and reduce global hunger and deforestation risks.

EARTHJUSTICE

Limiting LCFS Subsidies for Harmful Biomethane and Biofuel Pathways Provides Many Critical Benefits

- Reduces the credit glut, stabilizing credit prices.
- Provides more funding to boost equitable, zero-emissions solutions.
- Supports attainment of CARB's ZEV and air quality requirements.
- Reduces harms to communities, ecosystems, and the food insecure.

EARTHJUSTICE

Provide Critical ZEV Support

Staff's proposal misses many opportunities to boost zero-emissions solutions that need support now including:

Full credit-generation for fixed-guideway (e.g. light rail) transit;

Credit multipliers for ZE transit and school buses; and

Constraining the credit market to unlock billions for M/HD infrastructure and low-income electrification.

EARTHJUSTICE

Allow Full Credit Generation for Fixed Guideway Transit

- The LCFS can support California's VMT reduction goals by accurately crediting transit agencies.
- The LCFS imposes a unique penalty on transit agencies by artificially deflating credit generation for fixed guideway systems that were built before 2011.
- Providing full credit generation would generate 3-5x credits for transit.

Why disadvantage a <u>real</u> climate, air quality, and equity solution?

EARTHJUSTICE

Boosting Transit Crediting
Supports Real Solutions and ZEV Goals

- In 2018, the Board directed staff to add infrastructure crediting to address the "chicken-and-egg" problem with ZEVs.
- Transit faces similar problems with lack of funding due to lack of ridership and unreliable services due to funding shortfalls.

CARB should lift community access to transit by directing LCFS funds where they are truly needed.

EARTHJUSTICE

CARB Must Re-Focus this $3.5 Billion Program on ZEVs at this Critical Time

- Grim budget cuts make this an <u>urgent</u> time to prudently allocate LCFS credits.
- Allow enhanced funding for key ZEV priorities such as ensuring compliance with CARB's ACF and ACCII rules.
- Restricting harmful biomethane and biofuels credits can lift credit prices without needing to increase stringency as rapidly, and with less pass-through costs to California drivers.
- Result is more funding for transportation electrification, which provides <u>real</u> benefits to Californians.

CAPITOL ALERT

Newsom proposes cuts to clean energy, electric vehicles as California faces $38 billion deficit

EARTHJUSTICE

Reclaiming the LCFS for a ZE Future

Problem:

Almost 80% of the LCFS's $3-4 billion in annual revenues goes to combustion fuels when we known we need to transition to ZE solutions to meet air quality and clean transportation mandates.

Fix:

- Allow full credit-generation for fixed-guideway (e.g., light rail) transit.
- Adopt a credit multiplier for ZE transit and school buses.
- Constrain the credit market to unlock billions for M/HD infrastructure and low-income electrification.

EARTHJUSTICE

The LCFS Runs Counter to State Actions Taken to Reduce Emissions

- ➢ CARB's regulatory actions on mobile sources, eliminating air pollution and advancing the transition to zero emissions, including ACC II, ACF, and ACT.
- ➢ CARB's Mobile Source Strategy, identifying even faster electrification needed to meet attainment.
- ➢ CPUC's denial of utilities' requests to purchase natural gas trucks, recognizing that "California's express policy is to meet [the State's GHG reduction] goal through widespread transportation electrification."
- ➢ CPUC's elimination of gas line subsidies for methane refueling stations.
- ➢ CEC's 2022-2023 Investment Plan Update for the Clean Transportation Program, allocating 95% of its investment toward ZEVs.
- ➢ The State Legislature's clear intent in SB 350 to achieve rapid decarbonization through widespread transportation electrification.
- ➢ Executive Order N-79-20, calling for an end to the sale of internal combustion engine vehicles by 2035, and that by 2045, all vehicles on the road are zero-emission everywhere feasible.

Staff's Proposal Perpetuates Misalignment.

EARTHJUSTICE

The Path Forward

Align LCFS policy with the State's climate, air quality, and equity goals.
Staff's Proposal fails to do this and must be fixed in this rulemaking.

Stop Subsidizing the Bad

Restrict over-generation of subsidies for polluting fuels

- Stop avoided methane credits for new pathways.
- Align deliverability requirements for all fuels.
- Cap lipid biofuels.
- Prohibit crediting for Enhanced Oil Recovery activities, consistent with SB 1314.

Enhance Support for the Good

Increase LCFS support for ZE pathways with the greatest EJ benefit

- Allow full credit generation for fixed guideway (e.g. light rail) transit.
- Support VMT reductions with a transit and school bus credit credit multiplier.
- Unlock billions for transportation electrification without adding costs to consumers.

Appendix B:
Earthjustice Request for Public Records

EARTHJUSTICE

January 30, 2024

VIA EMAIL TO

California Air Resources Board
Office of Legal Affairs
P.O. Box 2815
Sacramento, California 95812
prarqst@arb.ca.gov

Re: California Public Records Act Request for Records Related to the December 19, 2023 Staff Proposal for Amendments to the Low Carbon Fuel Standard.

Dear Public Records Coordinator:

Pursuant to the California Public Records Act ("CPRA"), we write to request the below public records. We submit this request because we require these public records to complete our comments on the December 19, 2023 Staff Report: Initial Statement of Reasons ("ISOR") for the Proposed Amendment to the Low Carbon Fuel Standard,[1] which are due February 20, 2024. We requested this public information on January 18, 2024, via email to California Air Resources Control Board ("CARB") staff, and we did not receive a response until January 26, 2024. That response indicated that a PRA request was required to obtain this public information. Accordingly, we hereby request the following records:

1. The spreadsheets and any other data used by CARB staff to calculate the greenhouse ("GHG") benefits of the ISOR. This includes all data on the share of the GHG reductions that are attributed each year to the carbon intensity associated with the fuels versus the reductions associated with oil and gas extraction emissions.

2. Spreadsheets and any other data used to calculate the particulate matter ("PM") and NOx reduction estimates in the ISOR including:
    a. All data showing the portion of the air quality reductions attributable to each of the four categories named in the ISOR at p.38 (tailpipe emissions from on/off-road vehicles, changes in aircraft emissions, changes in emissions from stationary sources of fuel production, and changes in upstream emissions from oil and gas extraction), and
    b. The spreadsheets and other data used to calculate the PM/NOx emissions reductions assumed from declining oil production at each oil field in California.

[1] Available at https://ww2.arb.ca.gov/rulemaking/2024/lcfs2024?utm_medium=email&utm_source=govdelivery

c. The spreadsheets and any other data on what proportion of engines on the road each year CARB expects to be new-technology diesel engines ("NTDEs") vs. Non-NTDEs.

3. All data used to develop the figures showing the fuel mix under the ISOR's Proposed Scenario, Alternative 1, and the Environmental Justice ("EJ") Scenario, including data regarding the basis for the "cap" or limit on virgin crop fuels in Alternative 1 and how that cap compares with the EJ scenario and the ISOR.

4. The spreadsheets and other data produced from running each scenario in the California Transportation Supply model that were used for the ISOR, including any output data on fuel volumes, feedstock volumes by fuel, and credit price by year.

5. All records including communications among or between CARB staff, consultants, Board, researchers, or other representatives—whether electronic or paper and including but not limited to letters, emails, presentations, reports, text messages, [2] and meeting notes—related to emissions for NTDEs (i.e. post-2007 engines) operating on renewable diesel, including all records concerning the November 2021 CARB Final Report titled "Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines" by Durbin et al, with a contract number No.18ISD027.[3]

This request is made pursuant to the CPRA. (Gov. Code §§ 6250, *et seq*.) It is also made pursuant to Article I, section 3(b) of the California Constitution, which provides a constitutional right of access to information concerning the conduct of government. Article I, section 3(b) provides that any statutory right to information shall be broadly construed to provide the greatest access to government information and further requires that any statute that limits the right of access to information shall be narrowly construed. (*See Citizens for a Better Environment v. Dept. of Food and Agriculture* (1985) 171 Cal.App.3d 704, 711–712.)

In accordance with § 6253.9(a) of the CPRA, we request that CARB disclose responsive records in **electronic** Native File Format. Responsive files may be uploaded to our FTP server here: https://earthjustice.sharefile.com/r-r79714ea7e3dc4ab38b01d27c459fe1cc

[2] Text messages and personal devices are an appropriate subject of a CPRA request when the device or account contains "information relating to the conduct of the public's business." (*City of San Jose v. Superior Court* (2017) 2 Cal.5th 608, 617.) The factors to be evaluated "when writings are kept in personal accounts" include "the content itself; the context in, or purpose for which, it was written; the audience to whom it was directed; and whether the writing was prepared by an employee acting or purporting to act within the scope of his or her employment." (*Id.* at 618.)

[3] Available at https://ww2.arb.ca.gov/sites/default/files/2021-11/Low_Emission_Diesel_Study_Final_Report.pdf

or you may contact me at nrobertson@earthjustice.org to discuss an alternative means of electronic delivery. If any special software or other services are necessary to export the data or files into electronic format, please advise me immediately.

Further, Earthjustice respectfully requests a fee waiver in connection with this request. A fee waiver in this instance is consistent with the letter and spirit of the CPRA because Requesters are public interest, non-profit organizations that work to protect the rights of all people to a healthy environment and to uphold the laws of the State of California. Requesters will not use the requested records for commercial purposes. If CARB does not waive the fees, please immediately inform me of the basis for such a decision and the anticipated costs. We will then consider whether to approve such costs and whether to exercise our right to inspect the records during your office hours. (*See* Cal. Gov. Code § 6253(a).) The costs CARB may recover from Requesters are limited to the direct cost of duplication. (*See N. County Parents Organization for Children with Special Needs v. Cal. Dept. of Ed.* (1994) 23 Cal.App.4th 144, 147–148; *see also* Cal. Gov. Code § 6253.1(a)(2).)

We look forward to your response within ten (10) days of the receipt of this request, as required by § 6253(c) of the CPRA, by **February 9. 2024**. Consistent with the CPRA requirement that CARB "provide suggestions for overcoming any practical basis for denying access to the records or information sought," (Cal. Gov. Code § 6253.1(3)), we request that you contact me within ten (10) days if you anticipate any basis for denying Requesters access to responsive records.

We also request that you provide all records on a rolling basis, as they become available. Such rolling production is critical for public participation in the rulemaking process, given the February 20, 2024 comment deadline that CARB has established for those wishing to comment on the ISOR.

We are interested in collaborating with CARB to make the process as efficient as possible for all parties, and we are happy to arrange a time to discuss the matter in greater detail. Please do not hesitate to contact me at (415) 217-2000 if you have any questions or concerns.

Sincerely,

Nina Robertson
Earthjustice
50 California Street, Ste. 400
San Francisco, CA 94111
(415) 217-2000
nrobertson@earthjustice.org

Comment Log Display

Here is the comment you selected to display.

Comment 393 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Philip
Last Name	Sheehy
Email Address	philip.sheehy@icf.com
Affiliation	
Subject	ICF Analysis of LCFS Staff Report: Initial Statement of Reasons

Comment

```
ICF is a non-partisan, non-political company that delivers a broa
and diverse range of independent, unbiased, objective analyses an
related consulting services to help its clients meet their
missions.
ICF has supported a coalition of interested parties representing
diverse mix of low carbon fuel producers seeking to understand th
potential carbon intensity (CI) reduction that could be achieved
via California's Low Carbon Fuel Standard (LCFS) program assuming
the likely aggregate deployment of low carbon fuels and supportin
technologies. Through a consideration of various factors, the
project has sought to quantify what CI target may be achievable i
2030 and provide analytical insights regarding other aspects of tl
proposed amendments to the LCFS program. ICF's work should not be
construed as ICF's endorsement of any policy or any regulatory,
lobbying, legal, or other advocacy position, organization, or
political party. Furthermore, any conclusions presented by ICF do
not necessarily represent the policy or political views of ICF.
ICF's most recent report, entitled Analyzing Low Carbon Fuel
Targets in California, Response to Staff Report, is attached.
```

Attachment	www.arb.ca.gov/lists/com-attach/7078-lcfs2024-VDVcNFIyVGsLdFQu.pdf
Original File Name	Analyzing Low Carbon Fuel Targets - ISOR Analysis 240214 FINAL.pdf
Date and Time Comment Was Submitted	2024-02-20 22:41:18

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Analyzing Future Low Carbon Fuel Targets in California

Response to Staff Report

February 2024

ICF Resources, L.L.C.
1902 Reston Metro Plaza
Reston, VA 20190
703-934-3000

Contact: Philip Sheehy, PhD
Phone: 415-385-4160
E-Mail: Philip.Sheehy@icf.com

Contact: Fang Yan, PhD, PE
Phone: 916-210-5906
E-Mail: Fang.Yan@icf.com

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Table of Contents

Executive Summary

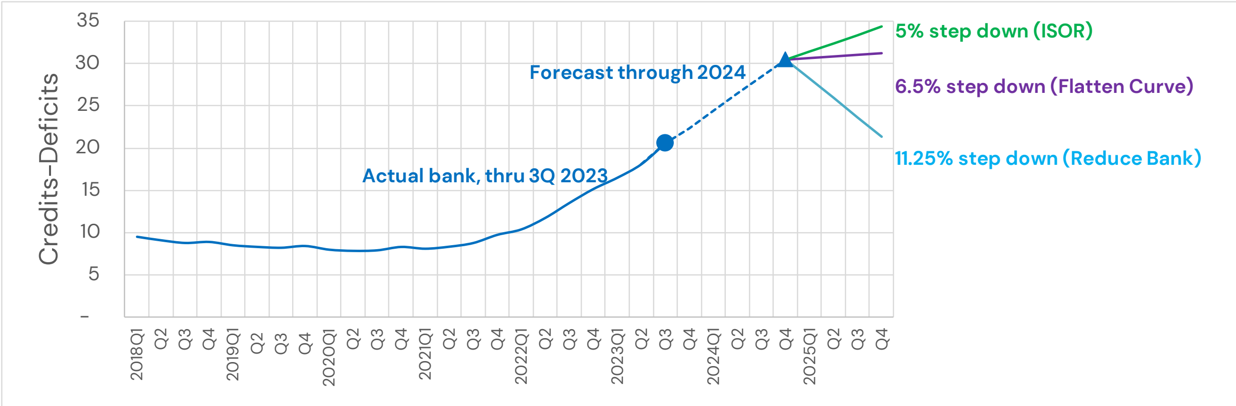
The California Air Resources Board staff released the Staff Report: Initial Statement of Reasons outlining many proposed amendments to the LCFS program in December 2023. The Staff Report identified three key areas of change with respect to carbon intensity targets: 1) increased stringency by 2030 (from 20% to 30% CI reduction), 2) a step down of 5% in the carbon intensity reduction required in 2025 (yielding an 18.75% carbon intensity reduction requirement compared to the 13.75% reduction scheduled), and 3) the introduction of an Automatic Acceleration Mechanism.

ICF previously reported that in an Accelerated Decarbonization *Central Case* a carbon intensity reduction target of 41-44% for 2030 is achievable for California's Low Carbon Fuel Standard program. ICF reached this conclusion based on expected fuel volumes and carbon intensity reductions for a wide array of low carbon fuel pathways. The work presented here, however, was prepared in direct response to the Staff Report and accompanying documentation published in December 2023. ICF modified and updated our analysis by focusing on a) an *ISOR Case*, b) the step down in 2025, c) the Automatic Acceleration Mechanism, and d) credit pricing.

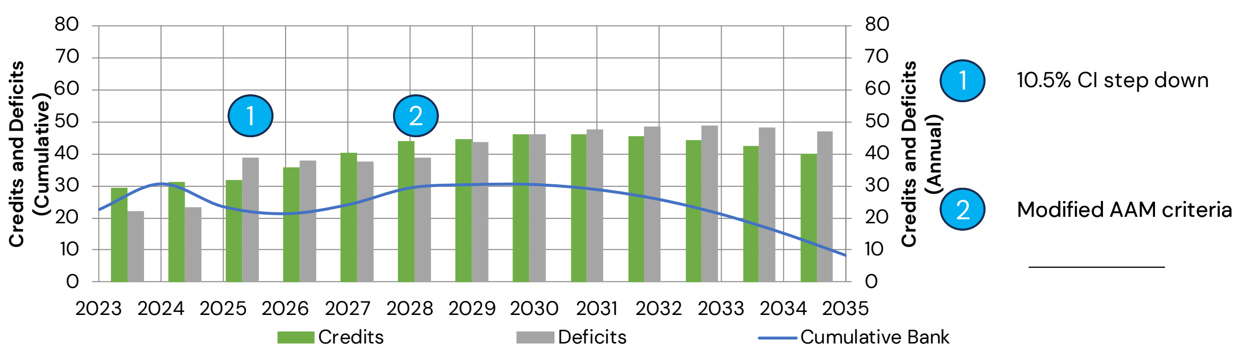
ICF developed the *ISOR Case* by modifying certain aspects of our modeling with the express intent of aligning more closely with the restrictions or constraints included in modeling done by Staff in support of the proposed amendments. ICF removed both the potential for a 15 percent blend of ethanol with gasoline and any pathways in the analysis that generated credits via the implementation of climate smart agriculture practices at the farm level. ICF also constrained renewable natural gas deployment in line with proposed changes to deliverability requirements and avoided methane emissions accounting. Lastly, ICF updated the carbon intensity value for ultra-low sulfur diesel in our analysis to align with the higher value published by Staff. ICF made other minor modifications to our analysis to reflect market developments that occurred over the course of the project.

384.1 ***ICF recommends a step down of 10.5% to 11.5% in 2025 to achieve a target credit bank equivalent of 2-3 quarters worth of deficits.*** This level of stringency is likely what is needed to achieve the stated intent of correcting for the "near-term over-performance" of the program. ICF's analysis indicates that the credit bank will likely continue to build significantly in 2025 if the step down is limited to 5%. ICF analysis suggests that a 6.5% step down is needed to ensure that the credit bank build is flattened in 2025.

384.1 cont.



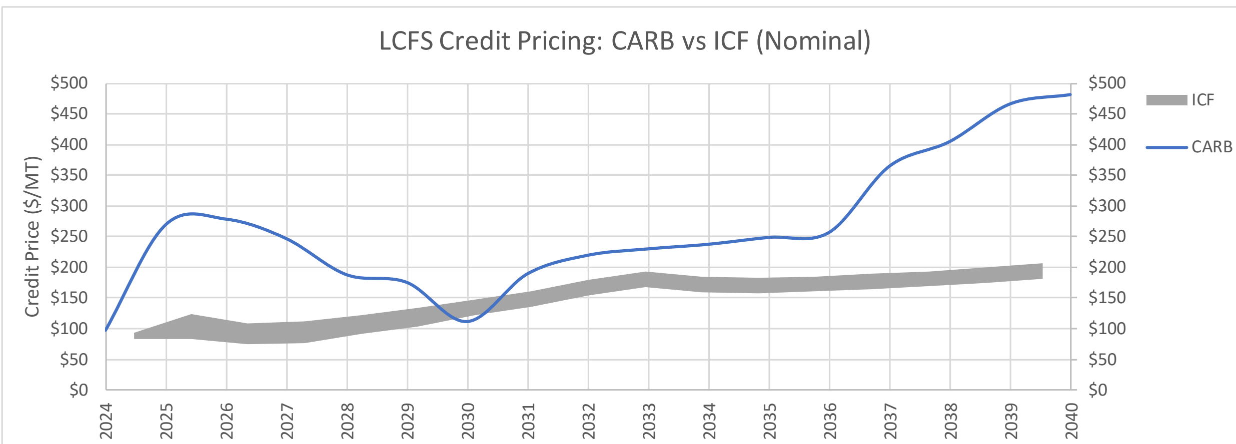
384.2 ***ICF recommends that the Automatic Acceleration Mechanism be considered for implementation as soon as 2026, rather than waiting until 2028. ICF also recommends that the first criteria for the Automatic Acceleration Mechanism be modified such that the mechanism is enacted when the credit bank is more than 2.5 times greater than the quarterly deficits generated in a given year*** (down from the proposed value of 3 times). The figure below shows the results of ICF's modeling using the *ISOR Case*.



The figure above has a shape and curve that ICF thinks is more in line with a successful Low Carbon Fuel Standard program i.e., one that maintains a tighter credit-deficit balance and is flexible enough to respond to market conditions in the near-term future (pre-2030), while enabling California to achieve its long-term GHG reduction targets. ICF's view of the market suggests that a focus on an "ideal" credit bank from pre-2021, quantified using a threshold of 3 quarters worth of deficits, is misguided and may lead to a market that "swings" up and down (as measured by the credit bank) more than necessary, thereby creating market uncertainty for active and would-be participants. Major investments by regulated parties in the last several years have likely improved their respective line of sight on credit generation, thereby reducing the need to carry such a large credit bank.

384.3 ***ICF recommends that Staff make more transparent the credit price modeling so that stakeholders can understand better what is driving the magnitude of credit pricing and the patterns emerging from the data.*** Staff used an internal estimate of credit pricing as

384.3 cont. one of the primary reasons for dismissing a higher carbon intensity reduction target in 2030. Staff claim that a higher target will lead to higher costs faced by consumers associated with pass-through compliance costs. However, Staff's forecasting is flawed and effectively implies that the Low Carbon Fuel Standard program will bear the entire cost of subsidizing low carbon fuel production. This analysis is overly pessimistic because it overlooks the substantial value of the Clean Fuel Production Credit via the Inflation Reduction Act, robust pricing from the federal Renewable Fuel Standard, moderate commodity pricing (e.g., for gasoline and diesel), and increasing California carbon allowance prices. The figure below shows a range of ICF forecasted credit prices in grey compared to the Staff credit price forecast in blue line.[1]



ICF makes three observations associated with the comparison between Staff's forecast and our forecast:

1. In the near-term future (by 2025), Staff is forecasting a four-fold increase in credit pricing. This forecasted credit price spike coincides with the introduction of the Clean Fuel Production Credit and other substantial Inflation Reduction Act incentives that will be flowing to the low carbon fuel market and reducing pressure on the Low Carbon Fuel Standard program.
2. In a post 2030 environment, though the two curves are showing similar patterns of increasing credit prices, Staff's forecast is still $60-65/ton higher than ICF.
3. Post-2035, Staff's forecasts are suggesting that a credit price of $250 to nearly $500/ton is needed to achieve program compliance. There is no reason that the credit price should ever need to be that high to induce the investments necessary to achieve compliance based on ICF modeling.

[1] Staff's credit price forecast has been adjusted to nominal dollars, as ICF has found this is how stakeholders tend to view the market (rather than adjusting pricing to some real-dollar basis).

1 Introduction

The California Air Resources Board (CARB) has proposed more ambitious carbon intensity (CI) targets to increase the stringency of the Low Carbon Fuel Standard (LCFS), with the intent of achieving more significant greenhouse gas (GHG) emission reductions in support of California's pursuit of economy-wide carbon neutrality no later than 2045. With respect to CI targets, CARB has proposed three key areas for change:

1. Increased CI stringency by 2030, increasing the target from 20% to 30% by 2030.
2. Additional 5% CI reduction in 2025 from the current CI target, also referred to as the step down. This step down in 2025 will yield an 18.75% CI target in 2025. The step down in 2025 is "in response to the near-term over-performance."
3. Introduction of an Automatic Acceleration Mechanism (AAM) that is designed to trigger a more stringent CI standard in the event of the market over-performing in the future (with over-performance measured by two criteria).

ICF is supporting a coalition of interested parties representing a diverse mix of low carbon fuel producers seeking to understand the potential carbon intensity reduction that could be achieved assuming the likely aggregate deployment of low carbon fuels and supporting technologies. Previously, in an Accelerated Decarbonization *Central Case*, ICF found that a carbon intensity target of 41-44% for 2030 is achievable based on expected fuel volumes and carbon intensity reductions for a wide array of fuel pathways.[2]

The initial stages of this project were focused on defining an ambitious CI target for 2030. However, the work presented here is in response to the Staff Report: Initial Statement of Reasons[3] and accompanying documentation published by CARB, and ICF has modified the analysis accordingly. The work presented here focuses on a) an *ISOR Case*, b) commentary on the step down in 2025 supported by ICF analysis, c) review of the AAM in light of likely low carbon fuel deployment to California out to 2030 (and beyond), and d) commentary on LCFS credit pricing.

As noted elsewhere, ICF's modeling differs from the modeling conducted by CARB staff using the California Transportation Supply (CATS) model. More specifically, CATS is described as a "transportation fuel supply optimization model" that "minimizes the cost of supplying fuel to meet demand in each year." In other words, given certain modeling constraints, namely a specific CI reduction trajectory and associated policy constraints, the

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[2] In a *High Case* reflecting updated science and analysis, additional cost effective GHG reduction opportunities, and alignment with proposed federal policies, ICF reported that a carbon intensity reduction of 43% to about 57% could be achieved by 2030.

[3] Available online at https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2024/lcfs2024/isor.pdf.

CATS model optimizes compliance accordingly. The CATS model is designed to answer the question: *What is the least-cost compliance pathway associated with a CI target of X in year Y?* ICF notes that CARB has used scenario modeling in previous analysis supporting amendments to the LCFS program and has provided no rationale for switching to an optimization model. ICF maintains that an optimization model is not the right approach for target setting because it puts an out-sized impact on the modeling inputs that are used to solve for what is more likely to be a preconceived outcome. Scenario modeling, when done correctly is more useful to understand market outcomes as they might be, rather than how the author(s) wants them to be.

2 ICF Analysis of the Staff Report

Developing an ICF *ISOR Case*

After reviewing the Staff Report and engaging in a peer-exchange with CARB staff, ICF made several changes to our modeling approach with the intent of aligning more closely with the work done by CARB and the resulting proposed regulatory structure. ICF refers to this as an *ISOR Case*. As a reminder, ICF was previously focused on the CI reduction that was achievable by 2030. In this *ISOR Case*, ICF sought to focus on details that were not available prior to the Staff Report, including the 2025 CI step down and the implementation of the Automatic Acceleration Mechanism. While still standing behind the modeling and assumptions previously employed, ICF made the following changes to the supply-demand for low carbon fuels to more closely align with CARB's modeling approach:

- ***E15 Blending Removed.*** ICF removed the opportunities for E15 blending in the modeling. CARB has signaled that they did not include E15 consumption in their modeling because it is not yet approved as a fuel for sale in California. ICF maintains that E15 should be included in the modeling given the high likelihood of approval before 2030 and the interest in E15 to help reduce retail gasoline pricing in line with SB X1-2 ("discussion of methods to ensure an adequate, affordable, and reliable fuel supply"). However, for the purposes of evaluating the 2025 CI Step Down, E15 blending was excluded.
- ***Climate Smart Agriculture Removed***. ICF removed LCFS credit generation attributable to climate smart agriculture from our modeling because CARB has indicated that they did not include this in their modeling, and ICF's intent in the ISOR Case is to align initial assumptions or modeling boundary conditions to the extent feasible with CARB. This had an impact on credit generation associated with liquid biofuels, including ethanol, biodiesel, renewable diesel, and renewable jet fuel. ICF maintains that California will likely find itself as a disadvantage compared to other states considering incentivizing GHG emission reductions at the farm-level. However, although ICF believes climate smart agriculture has the potential to

provide significant additional CI reductions and will be implemented in the LCFS subsequent to 2028, this was removed from our modeling for this analysis.

- ***Constrained RNG Deployment.*** ICF constrained RNG deployment based on changes to deliverability and avoided methane emissions accounting consistent with the Staff Report. The constraints also account for lower credit pricing in the near-term future because of the over-supply of credits occasioned by the current LCFS targets, thereby restricting investment opportunities. [4]
- ***Updated CI value for ULSD.*** ICF updated the CI value for diesel in 2025 based on the revised value published by CARB--the CI of ULSD increased from 100.45 g/MJ to 105.76 g/MJ. ICF modeling suggests that this will have a material impact on the program because biomass-based diesel (i.e., biodiesel and renewable diesel) have displaced more than 50% of ULSD in California. Without a concomitant change in the CI of biodiesel or renewable diesel, ICF analysis suggests that this will yield substantially more credit generation than previously forecast.

ICF made other minor modifications to our analysis based on the market developments that occurred over the course of the project. For instance, ICF revised upward our renewable diesel projections as a result of additional projects coming online, various projects passing significant milestones, and data released by CARB related to deliveries to California through 3Q 2023. ICF also made modifications to the average carbon intensity of fuels based on data available for 2023, including for ethanol, biodiesel, renewable diesel, renewable jet fuel, renewable natural gas, and electricity.

2025 CI Step Down

ICF views the 2025 CI step down as a critical juncture for the program. In our modeling, we first evaluated the following:

1. What is the impact of the proposed 5% CI reduction step down, yielding an 18.75% CI target in 2025?

As of the end of 3Q 2023, the credit bank surpassed 20 million credits, with a bank build of 2.25 million credits in the most recent quarter for which data are available. ICF forecasts that the program will have a bank of about 29-30 million credits by the end of 2024. ICF analysis suggests that the proposed CI step down will slow the bank build by about 50% compared to previous years; however, the credit bank is still likely to grow by nearly 4 million credits by the end of 2025.

[4] Note that ICF's initial assessment indicates that this constraint may restrict California's ability to achieve its methane reduction targets included in SB 1383. It is conceivable that SB 1383 targets are still met; however, this would likely require changes to procurement rules under SB 1440.

384.1 cont. ICF then sought to determine two things with our analysis:

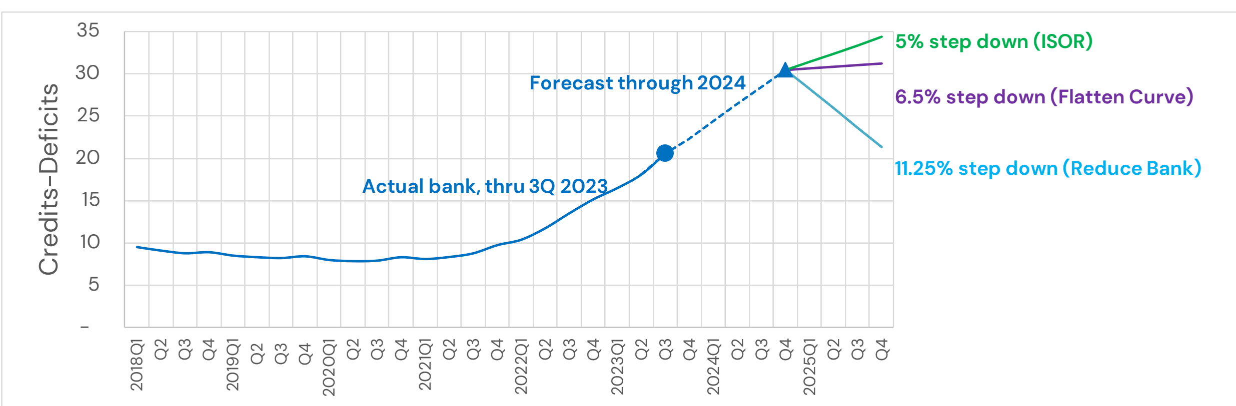
2. What CI step down is necessary to flatten the credit bank in 2025?
3. What CI step down is necessary to decrease the bank of credits to two quarters' worth of deficits?

With respect to the former, ICF modeling sought to identify the level of CI reduction that would be needed for the step down to *at least* flatten the curve of growing credits. ICF analysis shows that a CI of 20.25% in 2025 is likely needed to ensure that the credit bank does not continue to build.

With respect to the latter, ICF sought to identify the level of CI reduction that would be needed for the step down to reduce the bank of credits to about two quarters' worth of deficits in 2025. ICF analysis shows that a CI of 25% in 2025 is likely needed to ensure that the credit bank reverses and that the bank is drawn down to a level that is in line with a credit bank of only two quarters' worth of deficits. This level of stringency, while seemingly high, is likely what is needed to achieve CARB's stated intent of correcting for the "near-term over-performance" of the program.

The figure below illustrates the three aspects of the 2025 CI step down evaluated by ICF: the blue line shows the current credit bank inventory (20 million credits), the dotted blue line shows ICF forecasted credit bank by the end of 2024 (30 million credits), the green line shows the likely growth of the credit bank using CARB's proposed step down in 2025 (5% step down to 18.75% CI reduction), the purple line shows what ICF analysis indicates is needed to flatten the credit bank (6.5% step down to 20.25% CI reduction), and the light blue line shows that a CI step down of 11.25% to a 25% CI step down is needed to restore the program to an appropriate credit bank balance.

Figure 1. ICF analysis of the CI step down in 2025



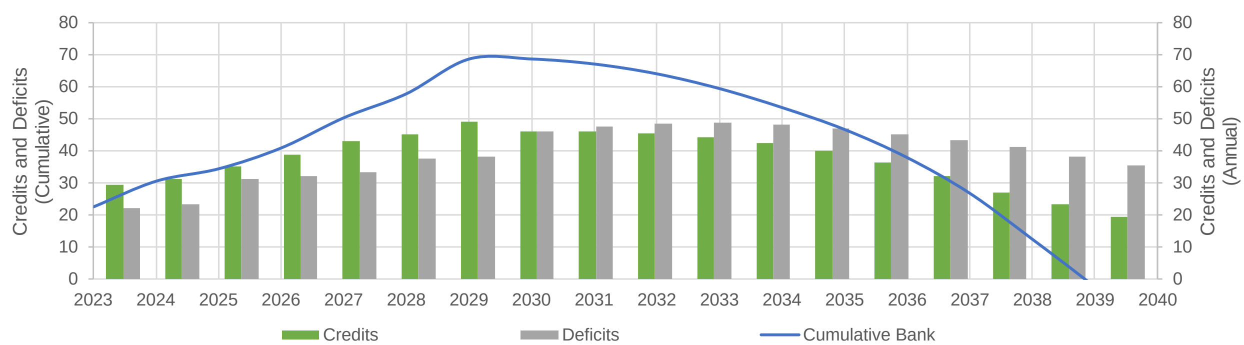
ICF recommends a step down of 10.5%-11.5% to reduce the cumulative bank of credits to the range of 2-3 quarters' worth of deficits by the end of 2025.

Automatic Acceleration Mechanism

The AAM is designed to accelerate the stringency of the LCFS program when certain criteria are met. CARB defined two criteria in the Staff Report: 1) when the credit bank is more than 3 times greater than the quarterly deficits generated in a given year and 2) when credit generation exceeds deficit generation. The Staff Report also indicates that the first year during which the CI reduction schedule can be impacted is in 2028, based on data from 2027.

Building on commentary regarding the CI step down in 2025, ICF's analysis indicates that if CARB keeps the 5% CI step down in 2025, that the credit bank will build in 2025, 2026, and 2027. In fact, by the end of 2027, ICF analysis suggests that the credit bank will reach 45-50 million credits. This will trigger the AAM in 2028 (based on 2027 data). ICF analysis suggests that the bank will be triggered again in 2030 (based on data for 2029)-getting the program to a 39% CI standard by 2030. The figure below shows the credit and deficit generation annually (green and grey bars, respectively) and the associated credit bank (blue line) using CARB's CI trajectory, including the CI step down in 2025, and the AAM as proposed.

Figure 2. Credit-Deficit Balance in the ICF ISOR Case

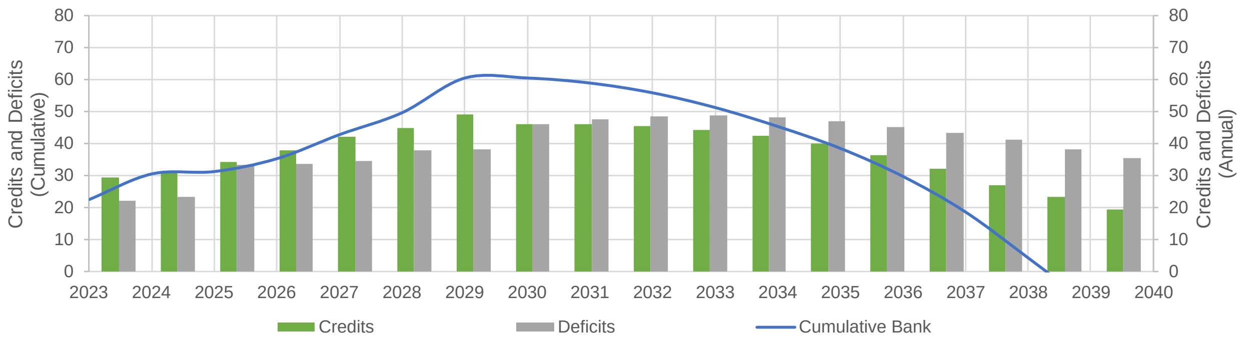


In the long-term future, the AAM modifies the trajectory of the program post-2030. However, the short-term impact is muted-the CI step down does not achieve the objective of reversing the credit bank, and delaying the AAM until 2028 slows credit growth, but does not reverse the credit bank build until 2031. The shape of the curve in the figure above is appropriate, but the magnitude of the credit bank is too high to drive higher credit prices.

384.2 cont. Implementing a more stringent CI step down in 2025 will reduce credit generation but will still likely lead to credit generation post-2025, and the AAM will be inadequate to reverse the credit bank build until 2030.

384.2 cont.

Figure 3. Credit-Deficit Balance in the ICF ISOR Case, with 6.5% CI stepdown in 2025

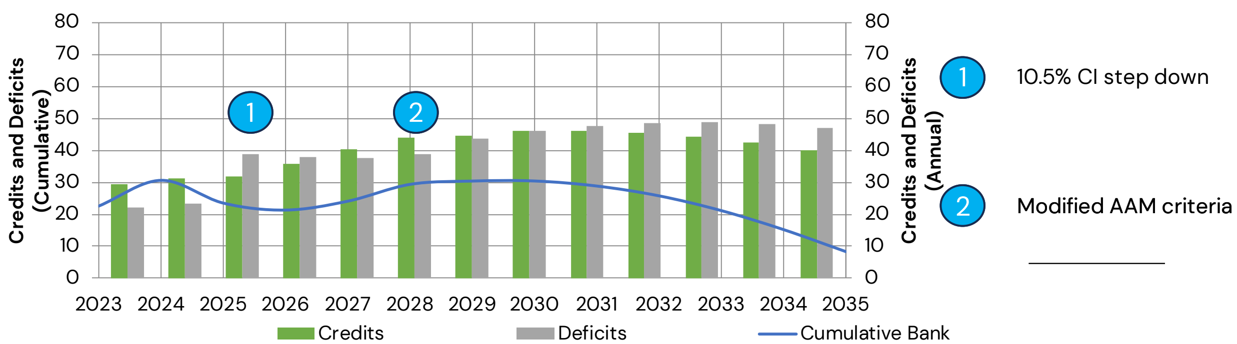


ICF analyzed the ISOR Case using the following assumptions:

- A CI stepdown of 10.5% in 2025 that would require a CI reduction of 24.25%. We adjusted the targets between 2026 and 2030 linearly while maintaining the 30% CI reduction in 2030 and post-2030 CI reduction schedule included in the Staff Report.
- An AAM that is implemented similarly as to what is used in the Staff Report, but adjusting the threshold to being triggered when the credit bank is more than 2.5 times greater than the quarterly deficits generated in a given year.

The figure below shows the results of the ISOR Case using the parameters described above.

Figure 4. ICF ISOR Case with larger CI step down and modified AAM



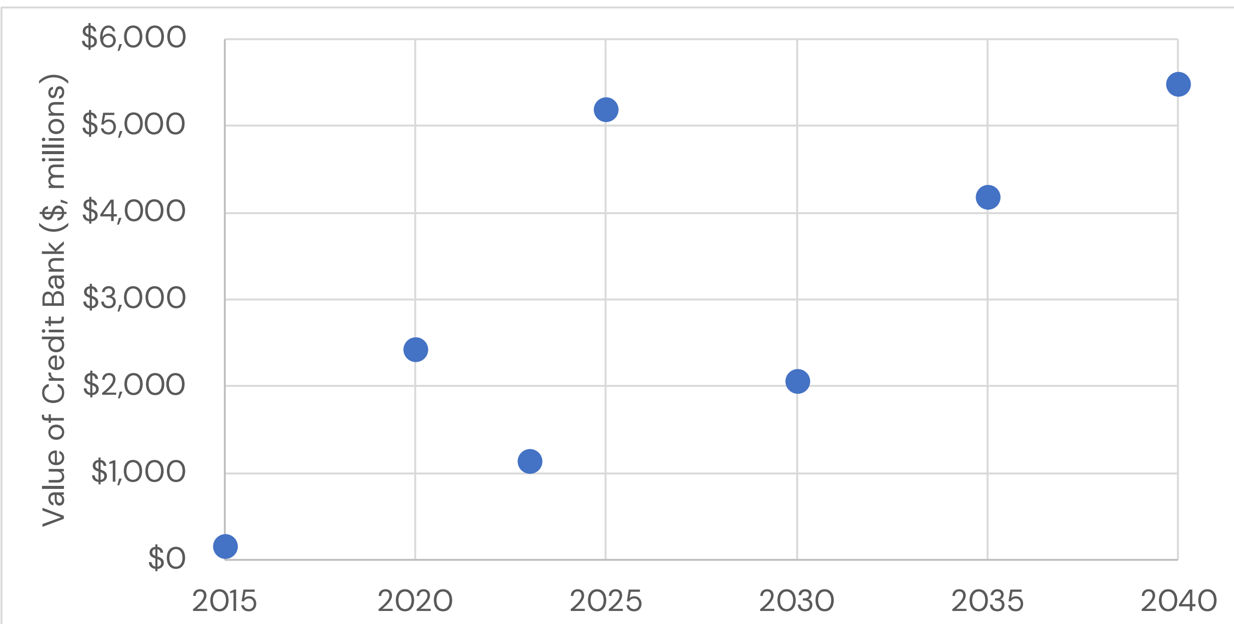
The figure above has a shape and curve that ICF thinks is more in line with a successful LCFS program i.e., one that maintains a tighter credit-deficit balance and is flexible enough to respond to market conditions in the near-term future (pre-2030), while enabling California to achieve its long-term GHG reduction targets. A similar trajectory can be achieved with a shallower step down in 2025, but with an AAM that comes into place in 2026 and an even lower threshold of the first criteria that would trigger the AAM (e.g., lowering the value from 2.5 to 2.0).

ICF recommends that the AAM be considered for implementation as soon as 2026, rather than waiting until 2028, regardless of the 2025 CI step down.

ICF Commentary on AAM Trigger Criteria 1

384.4 ICF disagrees with the underlying presumption that the AAM should be triggered at the proposed threshold i.e., when there are three quarters' worth of deficits in the bank. Based on information presented at the May 23, 2023 modeling discussion, the AAM design is looking to program data from prior to 2021 as an indicator of an "ideal" bank of credits. ICF views this as a critical mistake with respect to how the market is likely to unfold in the future. From a market perspective, if we consider the credit bank as a measure of the risk that regulated parties (i.e., refiners) bear in order to do business in California, then the credit bank should be measured in dollars, not credits/deficits. The figure below shows the estimated value of the credit bank in five-year increments from 2015 to 2040. The data for 2015 and 2020 are based on data reported by CARB for both deficits and credits; whereas the data for 2025 to 2040 is based on the deficit generation in ICF's analysis of the proposed CI reduction trajectory and the credit price reported by CARB in the Staff Report. All values are reported in real dollars using 2021 as the basis year ($2021).

Figure 5. Estimated value of LCFS credit bank as a proxy for refiner risk tolerance



A target credit bank of three quarters worth of deficits in 2015 would have been valued at $140 million; by 2020, the value of the bank grew to $2.4 billion. In 2023, ICF estimates that a credit bank with three quarters worth of deficits is valued at $1.1 billion. Based on CARB's forecasted credit price, the value of a credit bank of three quarters worth of deficits in 2025 would rise to $5.2 billion before collapsing back to $2.1 billion in 2030. The higher pricing reported by CARB in 2035 and 2040 yields an "ideal bank" valued at $4.2 billion and $5.5 billion. When viewed from the lens of dollars tied to risk, rather than risk tied to a specific credit bank, the target bank of three quarters worth of deficits does not make

384.4 cont. sense. By 2035, for instance, petroleum products will have decreased substantially due to efficiency gains, increased liquid biofuel blending, and transportation electrification. ICF estimates that gasoline consumption may decrease by up to 50% by 2035, while ULSD consumption could decrease by as much as 85% by 2035 (compared to 2022 consumption). Why would an industry that has lost so much market share increase the value of its risk burden by nearly a factor of four over that same time frame?

In line with ICF's hypothesis that the AAM should consider the "ideal credit bank" in terms of managed risk (as measured in dollars' worth of exposure), we also believe that the proposed AAM fails to recognize the evolution of the market post-2020. Consider that in 2018:

- The average CI of ethanol was nearly 70 g/MJ
- Biodiesel volumes were averaging around 5% blend rates in California
- There were 2-3 renewable diesel producers delivering product to California
- The first fuel pathway for RNG from animal manure was submitted and approved by CARB
- EVs represented just 7% of new light-duty vehicle sales
- Off-road electrification applications generated about 500,000 credits

Most of the refiners in the LFCS program had limited visibility with respect to LCFS credit generation and were forced into a position of purchasing LCFS credits from a limited market. As a result, refiners generally opted to build substantial credit banks as part of their compliance strategy. This strategy enabled other market participants to benefit via an increased credit price. However, in the interim years, refiners have made substantial investments that give them a clearer line of sight in their credit generation. The table below highlights the key investments that six refiners have made since 2018; these refiners represent what ICF estimates to be more than 90% of the obligation in the LCFS program. This is not meant to be an exhaustive list, rather it illustrates key investments that will impact LCFS credit generation moving forward.

384.4 cont.

Obligated Party	Key Investment since 2018
Marathon	• Retrofitted Dickinson facility for RD production • Martinez Renewables joint venture with Neste in California • Acquired RNG platform (LF Bioenergy)
Chevron	• Acquired REG, largest biodiesel producer in US • Converting diesel hydrotreating unit for renewable diesel / renewable jet fuel production at El Segundo • Investments in RNG platforms including California Bioenergy, Brightmark Energy • Acquired natural gas fueling assets via deal with Mercuria
PBF[5]	• St. Bernard Renewables project in Louisiana producing RD
Valero	• Expanded Diamond Green Diesel (a joint venture with Darling Ingredients) at Norco, Louisiana • Commissioned Port Arthur project with expected completion in 2025
Phillips 66	• On the verge of completing Rodeo Renewed project at San Francisco Bay Area refining complex, converting to renewable fuels entirely
BP	• Expanded co-processing capabilities at Cherry Point • Purchased RNG platform via Archaea acquisition

It is clear from this table that there is a much clearer line of sight to LCFS credit generation for regulated parties today in 2024 than there was in 2018. The view of the credit-deficit balance from pre-2021 will not be a good indicator of how the market will evolve moving in 2025 and beyond.

ICF recommends that the first criteria for the AAM be modified such that the mechanism is enacted when the credit bank is more than 2.5 times greater than the quarterly deficits generated in a given year.

LCFS Credit Pricing

ICF views the LCFS credit price as part of a broader set of environmental commodities available to low carbon fuel producers. ICF models environmental commodities using an approach that assumes the marginal cost of compliance is determined by the value of subsidy needed to offset the difference between low carbon fuel production costs and the conventional fuels that they replace i.e., gasoline and diesel. The complicating factor related to determining marginal compliance costs is the multiple subsidies available and the

[5] Shell sold its Martinez Refinery and related logistics assets to PBF in 2021.

associated "loading order" of those subsidies with respect to various fuels. ICF's modeling assumes the value for low carbon fuel producers is generated via multiple streams, including federal tax credits or incentives, federal policies like the Renewable Fuel Standard, and then state level programs like California's LCFS program.

- ***Federal tax incentives***: ICF considers two types of tax incentives, the Blenders Tax Credit and the Clean Fuel Production Credit (CFPC) from the Inflation Reduction Act (IRA).
    - The BTC is available to blenders that blend biodiesel or renewable diesel into the transportation fuel supply and is valued at $1.00 per gallon of eligible fuel blended. The current version of the BTC will expire at the end of 2024. The BTC is not adjusted for inflation.
    - The CFPC is a carbon intensity-based production tax credit that replaces and expands upon the BTC. The CPFC is codified in the Inflation Reduction Act and is often referred to as the Sec 45z credit. It is valued at up to $1.00 per gallon of eligible fuel; however, in order to qualify, an eligible fuel must be produced in the United States and meet a maximum carbon intensity threshold of 50 kgCO2e/mmBtu. The CFPC is calculated as follows:[6]

$$CFPC = \$1.00\ x\ \left(1 - \frac{CI_{fuel}}{50}\right), (\max \$1.00)$$ [7]

- ***Renewable Fuel Standard***: Most transportation fuels generate value via the Renewable Fuel Standard and generate RINs (or Renewable Identification Numbers), the currency and compliance tracking mechanism for the federal program. There are several RIN buckets in the program: D6 RINs, D5 RINs, D4 RINs, and D3 RINs. The RIN designation is tied to two key factors: a) the feedstock used to produce the renewable fuel and b) the GHG emission reductions attributable to the fuel. <u>It is important to note that while there is a GHG emission reduction requirement or threshold within each RIN bucket, fuels are not differentiated by their carbon intensity score the way that they are in the LCFS program.</u>
- ***California Cap at the Rack (CAR)***: Renewable diesel producers to date have received some share of the value of displacing a gallon of ULSD in the Cap-and-

[6] Note that the GREET model referenced in the IRA is the version of the model developed by Argonne National Laboratory (ANL) and not the CA-GREET model used by CARB to regulate the LCFS program. The CI for renewable diesel in the CA-GREET model is *higher* than the CI for renewable diesel in the GREET model for several reasons, but most notably because CARB's model assumes a higher CI adder for land use change (LUC), specifically for soybeans.

[7] ICF assumes that the CI of the marginal gallon of eligible fuel will have a CI score of 35 kg/mmBtu, yielding an incentive of $0.30 per gallon of 30 cpg. The CFPC is adjusted for inflation from 2022 pursuant to the IRA.

Trade program, which is quantified as CAR. Generally speaking, renewable diesel is the only low carbon fuel that has benefitted significantly from California Carbon Allowance (CCA) pricing, which has helped to maintain profitability of renewable diesel production in light of falling LCFS credit prices.

- ***California LCFS Credit Price***: The LCFS credit price serves as a subsidy for low carbon fuel production, with the understanding that many low carbon fuels cost more to produce than their conventional counterparts. The value of the LCFS credit price can be represented by the cost per ton to deliver the last or marginal unit of low carbon fuel to California in any given year, after accounting for revenue from other subsidies.

ICF modeling calculates the LCFS credit price as the difference between the low carbon fuel cost of production (inclusive of any costs to deliver the fuel to California) minus any other revenue streams that the low carbon fuel would otherwise receive. For example, in the case of renewable diesel, the production costs, $C_{production}$, would include the feedstock costs associated with producing the fuel, the fixed and variable production costs, and any logistical costs associated with bringing the fuel to California.

$$C_{production} = C_{feedstock} + C_{fixed} + C_{variable} + C_{logistics}$$

The revenue streams, *R*, for renewable diesel exclusive of the LCFS credit price, including the commodity value of the fuel, the value of the D4 RIN, any tax credits (e.g., the Blenders Tax Credit, BTC), and some share (α) of the value of displacing a gallon of ULSD in the Cap-and-Trade program, which is quantifies as Cap at the Rack (CAR).

$$R = Commodity + Federal\ Tax\ Incentives + \ D4\ RIN + \ \alpha \times CAR$$

In this example, the LCFS credit price needed to bring that gallon of renewable diesel (*LCFS Credit Price*$_{RD}$) to California would be calculated as the difference between the production costs and the revenue streams:

$$LCFS\ Credit\ Price_{RD}\ (\frac{\$}{ton})\ =\ \frac{C_{production} - R}{Credits}$$

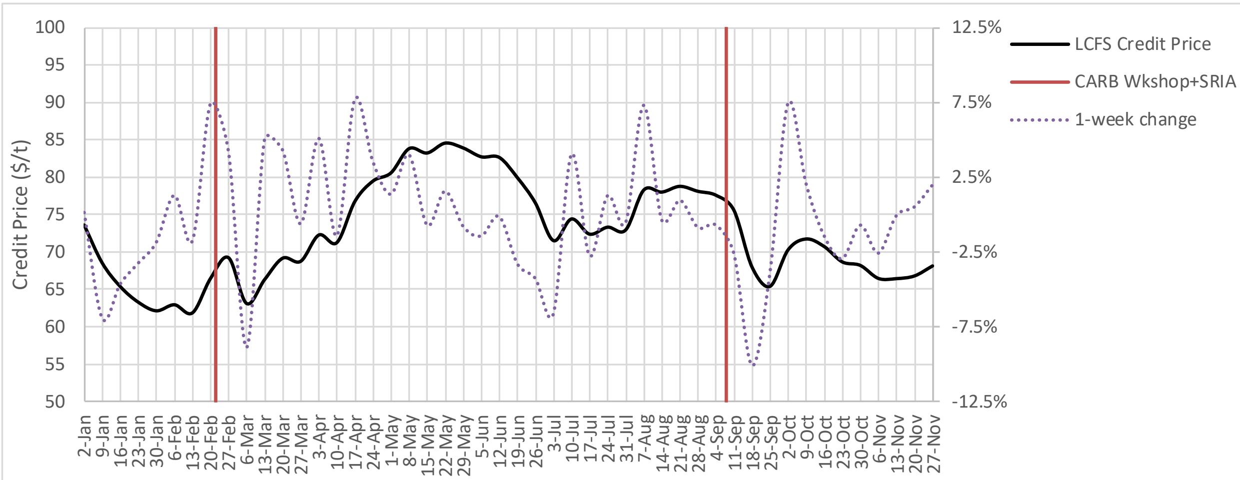
The LCFS credit price in any given year (t) can be approximated as the maximum LCFS credit price amongst low carbon fuels (fuels) delivered to California:

$$LCFS\ Credit\ Price_t\ (\frac{\$}{ton})\ \approx\ Max_t^{fuels}\{LCFS\ Credit\ Price_{fuels}\}$$

LCFS Credit Pricing in response to CARB Proposals

Prior to the Staff Report, CARB staff had two significant opportunities to communicate to the market their intentions with respect to increasing the stringency of the LCFS program. The figure below shows the weekly LCFS credit price for Type 1 transfers reported by CARB from January to late November 2023 (black line), with a range of $60 to $85 per ton over that time frame. The dotted purple line shows the change from week to week on a percentage basis. The two largest week-over-week decreases in LCFS credit pricing for 2023 occurred after the February 22, 2023 LCFS workshop and when the Staff Regulatory Impact Assessment (SRIA) for the LCFS was made publicly available. In both cases, CARB signaled its intention to advance a proposal with a 30% CI standard in 2030.

Figure 6. ICF analysis of LCFS credit prices in response to CARB announcements



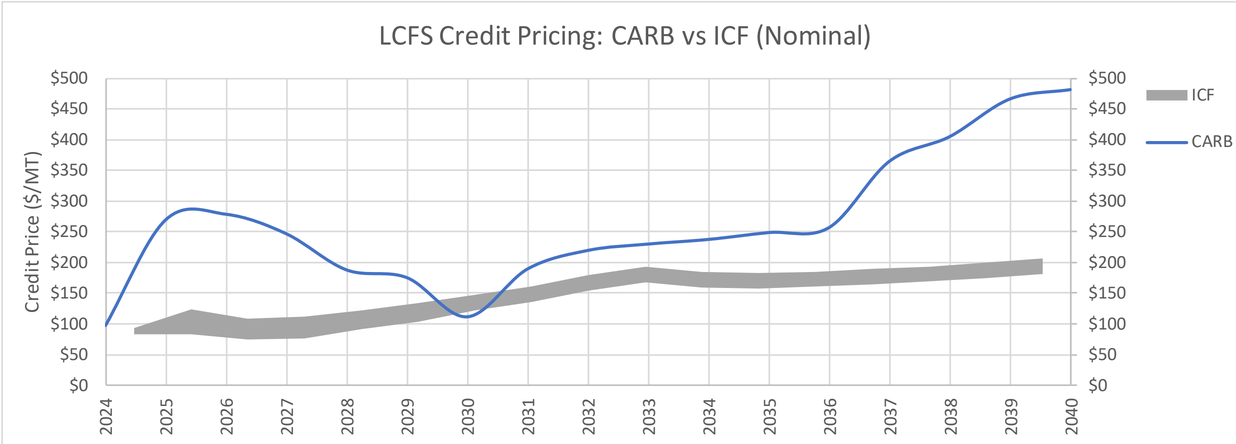
While ICF cautions against overreacting to spot price movements in any market, these movements can be a helpful indicator of market sentiment. In this case, the market was likely hoping for a more stringent standard. This conclusion is bolstered more forcefully in the market reaction after the Staff Report was issued, with credit prices in early 2024 decreasing to below $60/t for the first time in more than five years.

LCFS Credit Pricing: CARB vs ICF

384.3 cont. CARB's forecasted LCFS credit pricing has a variety of caveats associated with it; however, CARB staff use the LCFS credit pricing as one of the primary reasons for dismissing a higher CI reduction target in 2030 because of potential consumer impacts associated with pass-through compliance costs. However, the CARB forecasting is flawed and effectively implies that the LCFS will bear the entire cost of subsidizing low carbon fuel production. This is misaligned with market factors given the significant supplemental value of the Clean Fuel Production Credit via the IRA, robust RIN pricing, moderate commodity pricing (e.g., for gasoline and diesel), and increasing CCA prices.

The figure below shows a range of ICF forecasted LCFS credit prices in grey compared to the CARB LCFS credit price forecast in blue line. The CARB LCFS credit price forecast has been adjusted to nominal dollars, as ICF has found this is how stakeholders tend to view the market (rather than adjusting pricing to some real-dollar basis).

383.3 cont. Figure 7. Comparison of CARB and ICF LCFS credit pricing forecasts (nominal dollars)



ICF makes three observations associated with the comparison between CARB's forecast and our forecast:

1. In the near-term future (by 2025), CARB is forecasting a four-fold increase in LCFS credit pricing. This credit price spike coincides with the introduction of the CFPC and other IRA incentives flowing to the market. [8]
2. In a post 2030 environment, though the two curves are showing similar patterns of increasing credit prices, CARB's forecast is still $60-65/ton higher than ICF.
3. Post-2035, CARB's forecasts are suggesting that a LCFS credit price of $250 to nearly $500/ton is needed in order to achieve program compliance. There is no reason that the credit price should ever need to be that high in order to induce the investments necessary to achieve compliance based on ICF modeling.

[8] The CFPC will apply to a broader set of fuels than the BTC; however, many fuels that were receiving the $1.00 per gallon benefit of the BTC will be reduced to what ICF estimates is more like $0.30 per gallon. Historically, after the removal of the BTC (via expiration of the incentive based on some timeline defined in statute) the D4 RIN price has increased to accommodate the lost value. ICF analysis suggests that the RIN price has increased and helped to recover as much as 75% of the lost value. ICF assumes a similar dynamic will emerge for RIN pricing as the BTC transitions to the CFPC. The transition from the BTC to the CFPC will also likely reduce imports into the United States. Despite these potential changes, ICF analysis of available supply of low carbon fuels to California will not require such a dramatic increase in LCFS credit pricing, as highlighted in the text.

Appendix

Background on ICF Modeling

ICF models the CI reductions that could be achieved using the structure of the LCFS program. The modeling is driven by the demand for transportation fuel in California, which is a function of many variables including but not limited to economic growth, vehicle miles traveled (VMT), vehicle fleet turnover, and the expected compliance with complementary policies that impact transportation fuel demand. ICF's modeling is initiated using documentation associated with the EMissions FACtor model (EMFAC)[9] that is publicly available for download. The EMFAC model is "developed and used by CARB to assess emissions from on-road vehicles including cars, trucks, and buses in California." The EMFAC model enables ICF to characterize top-level transportation fuel demand in California given baseline consideration of the aforementioned key factors, like VMT and fleet turnover. Although EMFAC2021 incorporates expected compliance with several regulations that decrease fossil fuel demand, like the Advanced Clean Truck (ACT) Rule and the Innovative Clean Transit (ICT) Rule, it does not include expected compliance with Advanced Clean Cars II (ACC2) or Advanced Clean Fleet, which were adopted by the Board in 2022 and 2023, respectively. ICF has modified EMFAC2021 to ensure compliance with ACC2 and ACF. ICF then pairs the fleet turnover and fuel demand functions of EMFAC with supply-cost curves for low carbon fuels, including ethanol, biodiesel, renewable diesel, and renewable natural gas (RNG).

ICF previously modeled multiple scenarios for this project and framed each as *Accelerating Decarbonization* in the transportation sector using a diverse array of low carbon fuel strategies that are viable in the timeframe contemplated. Within this framework, ICF presented a Central Case and High Case(s).

- *Accelerating Decarbonization, Central Case*: ICF's primary focus is this case, whereby we limited our consideration of low carbon fuel strategies that require expanded deployment, reasonable technological advancement, and limited, if any, substantive policy changes.
- *Accelerating Decarbonization, High Case(s)*: In these cases, ICF considered additional strategies and/or policy changes that would lead to higher deployment of low carbon fuels and/or greater CI reductions over the course of the analysis. These included but were not limited to reductions in indirect land use change (ILUC) accounting, resumption of FFV manufacturing by OEMs, and relaxation of

[9] ICF is using the most recent version of EMFAC, EMFAC2021 (v1.0.2) as a starting point for our modeling. The EMFAC model is available for download online.

deliverability requirements for electricity used as a transportation fuel and as a processing fuel. Together, these represent a more expansive market and aggressive outlook for decarbonizing the transportation sector.

Stakeholder Outreach

ICF retains exclusive decision-making with respect to the parameters that are included in (or excluded from) the modeling in this project. However, as part of the development of our modeling, we sought (and will continue to seek) input and feedback from stakeholders that are uniquely positioned to characterize trends, constraints, and opportunities across various low carbon fuels. ICF conducted interviews with stakeholders from various low carbon fuel providers. Through these conversations, ICF introduced the broader project objectives and ICF's modeling approach to help stakeholders understand the key drivers for our analysis. ICF then led a discussion guided by the following questions:

- ***Deployment***. What are expected changes in the industry that will increase or decrease the deployment of a particular fuel or fuel/vehicle combination? These generally include supply and demand considerations and should account for opportunities and barriers to the extent feasible. What is the timeframe associated with any changes?
- ***Carbon intensity***. What is the current and projected carbon intensity of the fuel under consideration? Are there any California-specific policy or regulatory changes that can be accommodated to help achieve these reductions? What is the rate at which these carbon intensity changes are likely to occur?
- ***Demand from Other Markets***. Where are the developments likely to occur? Are there any specific advantages or disadvantages associated with delivering these solutions to California that ICF needs to consider? To what extent will other (existing or potential) low carbon fuel markets be advantaged or disadvantaged as it relates to these solutions as a function of their corresponding geography?

Lastly, it is important to note that ICF developed the modeling framework used in this study based on publicly available tools and data—we have purposefully excluded any proprietary data or considerations as part of this analysis.

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Comment 394 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Matt
Last Name	Bright
Email Address	mbright@carboncapture.com
Affiliation	CarbonCapture Inc.
Subject	Proposed Amendments to the LCFS Regulation
Comment	Please see the attached.
Attachment	www.arb.ca.gov/lists/com-attach/7079-lcfs2024-UT0AZVYxBCQLUgZi.pdf
Original File Name	LCFS DAC Quarterly Matching Comment_FINAL.pdf
Date and Time Comment Was Submitted	2024-02-20 22:51:15

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

February 20, 2024

Ms. Liane M. Randolph
Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Re: Proposed Amendments to the Low Carbon Fuel Standard Regulation

Dear Chair Randolph,

The undersigned Direct Air Capture (DAC) Coalition and leading DAC companies welcome the opportunity to comment on the Proposed Amendments to the Low Carbon Fuel Standard (LCFS) Regulation. We affirm the urgent need for both reducing total emissions and scaling carbon removal to limit global warming to 1.5 degrees Celsius. We therefore commend the California Air Resources Board (CARB) for its leadership in recognizing the importance of DAC as an eligible technology under the LCFS, in support of California's carbon removal and net-zero goals. However, **we believe that the proposed quarterly matching book-and-claim accounting for low-CI electricity** (Section 95488.8(i)(1)(C) of the Proposed Amendments) **would present a significant barrier to DAC deployment today, due to current constraints in low-CI electricity supply and temporal attribute market systems.** Such an outcome could set back California's plan to achieve net-zero carbon emissions by 2045. In the near-term, **an annual book-and-claim accounting system would facilitate the growth of the industry, create jobs, and help ensure deployment of a vital tool to enable the state of California to meet its net-zero goals**.

Instead of prescribing a temporal matching framework that is not fit for purpose and does not reflect the current state of low-CI electricity supply or temporal attribute markets, we
385.1 encourage CARB to convene a dialogue with key stakeholders to consider matching requirements appropriate for DAC as the technology and markets for temporal matching mature alongside DAC deployment. Such a dialogue would provide a venue for collecting valuable input to ensure that LCFS requirements mitigate resource shuffling and maximize long-term climate benefits. Prescribing an outcome without a robust conversation risks undercutting the growth of an industry that is likely to be vital to meet the State's 2045 net-zero goal.

Low-CI electricity requirements for successful commercialization of DAC

As leading DAC technology developers and proponents of permanent carbon removals, we are committed to advancing high-quality projects that enshrine the highest levels of transparency, accountability, safety, environmental stewardship, and societal benefits, with full lifecycle emissions accounting–including energy usage–that ensures net removal of carbon dioxide

(CO_2) from the atmosphere. We note the following key points that outline the electricity needs for DAC projects and our specific concerns with the proposed amendments:

- DAC technology requires energy to operate, including from electricity. In order to maximize net removal of CO_2 from DAC facilities, the electricity supply must have low emissions. DAC facilities must also maximize continuous running time in order to remove the maximum amount of CO_2 at the lowest levelized cost, particularly given the nascent stage of DAC technology deployment and associated early-stage technology costs. DAC technologies therefore require a continuous, reliable, and economic electricity supply.
- 385.2 Section 95488.8(i)(1)(C) of the Proposed Amendments includes criteria required for low-CI electricity supplying DAC projects. Criterion 1 requires that low-CI electricity be supplied to the grid within the local balancing authority where the electricity is consumed (local supply). Criterion 3 requires low-CI electricity to be supplied from new or expanded production within three years of the start of the direct air capture project (additionality). **We strongly support these criteria for local supply and additionality as key pillars to mitigate against resource shuffling where existing low-CI electricity is redirected and backfilled with higher-CI electricity.**

Why quarterly book-and-claim proposal will hamper the growth of DAC

Section 95488.8(i)(1)(C) Criterion 4 requires quarterly book-and-claim accounting for low-CI electricity, however, for the following reasons we believe that requirement would make it significantly ***more*** difficult for DAC projects to generate credits in the LCFS, undermining the effectiveness of the program and presenting a barrier to the deployment of DAC projects around the country:

- Intermittent renewable electricity is the lowest cost and most available low-CI electricity source for DAC projects today. The technology for supplying continuous 24/7 low-CI electricity at the scale and duration needed for DAC is not yet readily available, and the market systems for tracking and trading the necessary low-CI power attributes at sub-annual time resolution do not currently exist. This combination presents DAC projects with significant cost and financial risk challenges for complying with sub-annual matching today[1]. For example, one commercial DAC project currently under development in the U.S. estimated that quarterly book-and-claim matching could require 25% more power to be over-contracted and not consumed by the DAC project, at substantial market price risk, compared with annual matching even in the most favorable locations for renewable resources.
- 385.3 **At this nascent stage of both DAC technology deployment and availability of continuous 24/7 low-CI electricity, an annual book-and-claim matching period for DAC under LCFS is appropriate. This would account for the full annual seasonal cycle for intermittent renewables. Matching periods shorter than 12 months will**

[1] Verse, “Heirloom Portfolio Planning Case Study” 2024: (https://verse.inc/blog/heirloom-portfolio-planning-case-study/)

significantly impact the financeability of early DAC projects and impede deployment of this critical climate technology.

Alternative proposal for annual book-and-claim accounting

The inclusion of DAC as an eligible technology to receive credits under the LCFS is an important recognition of the potential for DAC to support California's carbon removal and net-zero goals as set forth in law under SB905 and AB1279. To accomplish the state's goals, ***an annual period for book-and-claim matching of low-CI electricity supply for DAC projects is necessary and appropriate*** given the inherent challenges present within the current technology, market systems, and economics for continuous low-CI electricity.

We request that CARB revise Section 95488.8(i)(1)(C) Criterion 4 of the Proposed Amendments to require annual book-and-claim matching for low-CI electricity for DAC projects in order to help facilitate early DAC project deployment. This would be consistent with other leading global standards. For example, Verra's methodology for electricity consumption emissions, currently under development, includes annual matching requirements[2]. Importantly, DAC projects already under development in the U.S. are being designed with the annual standard in mind. Sub-annual matching could be phased in at a later time once the necessary technologies and markets are available and accessible for DAC projects.

Climate experts, from the Intergovernmental Panel on Climate Change[3] to the National Academies of Sciences[4], have made clear the need for billion-ton scale carbon removal by mid-century alongside rapid emissions reductions. Therefore it is critical that DAC deployments advance today to support the ongoing technology development needed to reduce future DAC deployment costs and enable deployment at climate-relevant scale in the coming decades.

California, through its LCFS regulation, has the opportunity to set the bar for rigorous policy design that accelerates DAC technology deployment and unlocks economic and job opportunities in California and around the U.S.

We would welcome the opportunity for continued engagement with CARB on these important matters.

Signed:

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[2] Verra, "Tool for the Estimation of Emissions Associated with Electricity Consumption" 2024": (https://verra.org/methodologies/tool-for-the-estimation-of-emissions-associated-with-electricity-consumption/)

[3] IPCC, "Summary for Policymakers. Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change," 2022: (https://www.ipcc.ch/report/ar6/wg3/downloads/report/IPCC_AR6_WGIII_SummaryForPolicymakers.pdf)

[4] National Academies of Science, Engineering & Medicine, "Developing a Research Agenda for Carbon Dioxide Removal and Reliable Sequestration," 2019: (https://www.nationalacademies.org/our-work/developing-a-research-agenda-for-carbon-dioxide-removal-and-reliable-sequestration)

Direct Air Capture Coalition
CarbonCapture Inc.
Heirloom Carbon Technologies
Climeworks Corporation
1PointFive

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Comment 395 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Mark
Last Name	Hansen
Email Address	mhansen@ce.berkeley.edu
Affiliation	UC Berkeley

Subject	Comments of Alternative Jet Fuel - Proposed Amendments to the Low Carbon Standard

Comment

Dear California Air Resources Board,

Thank you for the opportunity to submit comments on the proposed amendments to the Low Carbon Fuel Standard (LCFS). We have been actively engaged in researching how to promote aviation decarbonization in California, focusing on both technical feasibility and policy implications. Sustainable aviation fuel (SAF) or alternative jet fuel is one of our main areas of focus. Based on our research, our comments on the proposed amendments to the LCFS are twofold, addressing both policy analysis and legal considerations.

Policy Analysis
We conducted policy analyses for both 2030 and 2035 using a suppl and demand framework. The jet fuel price forecast is $16.44 per million Btu for 2030 and $17.77 per million Btu for 2035, based or EIA forecasts. Our supply model for alternative jet fuel use (SAF is based on the California Transportation Supply Model (CATS), while the demand curve is established using a log-log model incorporating total jet fuel demand and fuel prices, along with fuel price elasticities. We considered two scenarios for jet fuel price elasticity: -0.03 for short-term price responses and -0.35 for long-term responses.

Three scenarios were evaluated: the baseline scenario, consistent with the existing design of the LCFS without eliminating the jet fuel exemption from fossil jet fuels; the proposed scenario, base on proposed amendments to the LCFS with the elimination of the je fuel exemption from intrastate fossil jet fuels; and the enhanced scenario, considering the elimination of the jet fuel exemption from domestic fossil jet fuels (both intrastate and interstate). Under the proposed and enhanced scenarios, we evaluated both case where the carbon intensity standard (benchmark) reduces as stated in the proposal (Low CIstandard) and cases where the carbon intensity standard does not reduce (High CIstandard) , reflecting the current policy.
The following tables show the change in the total demand, SAF consumption, CO2e emission, and environmental impacts under variou scenarios and assumptions regarding jet fuel elasticity.

Based on the results, our main three observations are as follows:

1. Effectiveness of carbon intensity standards: Strengthening annual carbon intensity benchmarks in the aviation sector as proposed may not be as effective as maintaining the current higher carbon intensity standard.
2. Scope of exemptions for fossil jet fuel: Eliminating the exemption for domestic fossil jet fuel (both intrastate and interstate) appears to be more beneficial than eliminating it for intrastate only.
3. Influence of jet fuel elasticity: Jet fuel elasticity significantly influences the outcomes, highlighting its importance in policy formulation.

Legal Considerations
While we are not trained lawyers, our research background includes several studies that involved understanding legal constraints pertaining to taxes and fees imposed on airlines and air transportation. Based on this knowledge and a review of relevant case law, we offer a few observations:
The LCFS is sometimes viewed as an "implicit tax." If extending th LCFS to incorporate jet fuel were considered a form of airline taxation, then it would be subject to strict limitations. Accordin to 64 Fed. Reg. 7696, which implements the several federal statutes:
"State or local taxes on aviation fuel (except taxes in effect on December 30, 1987) are considered to be airport revenue subject to the revenue-use requirement. However, revenues from state taxes on aviation fuel may be used to support state aviation programs or fo noise mitigation purposes, on or off the airport."
This would seem to preclude the use of LCFS revenue to pay for credits. Notably, this restriction would apply irrespective of whether the LCFS was applied to fuel for intrastate flights only o a larger set of flights.
If the LCFS is not considered a form of airline taxation, then the most significant legal constraint is the Dormant Commerce Clause. Here, the application of the LCFS to interstate flights might be considered to violate the DCC. However, the issue is by no means clear cut. Since the LCFS has been held not to be discriminatory against out-of-state businesses, the question would be whether the state interests it promotes offset the burden it places on interstate commerce. There is ample precedent that controlling global warming is a legitimate state interest, which increases the possibility that an LCFS that applies to all domestic flights woul

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survive a DCC challenge.

Sincerely,

Professor Mark Hansen
Department of Civil and Environmental Engineering, UC Berkeley
Co-Director, National Center of Excellence for Aviation Operations
Research

Yati Liu, Ph.D. Student
Department of Civil and Environmental Engineering, UC Berkeley
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Attachment	www.arb.ca.gov/lists/com-attach/7080-lcfs2024-VTYGb1E9VmgBYgdp.pdf
Original File Name	Comment letter to CARB.pdf
Date and Time Comment Was Submitted	2024-02-20 23:14:43

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Comments of Alternative Jet Fuel - Proposed Amendments to the Low Carbon Fuel Standard

Dear California Air Resources Board,

Thank you for the opportunity to submit comments on the proposed amendments to the Low Carbon Fuel Standard (LCFS). We have been actively engaged in researching how to promote aviation decarbonization in California, focusing on both technical feasibility and policy implications. Sustainable aviation fuel (SAF) or alternative jet fuel is one of our main areas of focus. Based on our research, our comments on the proposed amendments to the LCFS are twofold, addressing both policy analysis and legal considerations.

Policy Analysis

We conducted policy analyses for both 2030 and 2035 using a supply and demand framework. The jet fuel price forecast is $16.44 per million Btu for 2030 and $17.77 per million Btu for 2035, based on EIA forecasts. Our supply model for alternative jet fuel use (SAF) is based on the California Transportation Supply Model (CATS), while the demand curve is established using a log-log model incorporating total jet fuel demand and fuel prices, along with fuel price elasticities. We considered two scenarios for jet fuel price elasticity: -0.03 for short-term price responses and -0.35 for long-term responses.

Three scenarios were evaluated: the baseline scenario, consistent with the existing design of the LCFS without eliminating the jet fuel exemption from fossil jet fuels; the proposed scenario, based on proposed amendments to the LCFS with the elimination of the jet fuel exemption from intrastate fossil jet fuels; and the enhanced scenario, considering the elimination of the jet fuel exemption from domestic fossil jet fuels (both intrastate and interstate). Under the proposed and enhanced scenarios, we evaluated both cases where the carbon intensity standard (benchmark) reduces as stated in the proposal (Low $CI_{standard}$) and cases where the carbon intensity standard does not reduce (High $CI_{standard}$), reflecting the current policy.

The following tables show the change in the total demand, SAF consumption, CO_2e emission, and environmental impacts under various scenarios and assumptions regarding jet fuel elasticity.

Table 1. The Results of 2030 (when jet fuel elasticity is -0.03)

Scenario	Baseline	Proposed Scenario		Enhanced Scenario	
		Low $CI_{standard}$	High $CI_{standard}$	Low $CI_{standard}$	High $CI_{standard}$
Total Demand (Million Gallon)	5195	5193	5193	5183	5185
SAF Consumption (Million Gallon)	972	960	974	976	983
SAF Percentage (%)	18.7%	18.5%	18.8%	18.9%	19%
CO_2e emission (Million ton CO_2e)	55.9	55.9	55.1	55.7	55.7
CO_2e Change (%)	-	0%	-1%	-0.4%	-2%

Table 2. The Results of 2030 (when jet fuel elasticity is -0.35)

Scenario	Baseline	Proposed Scenario		Enhanced Scenario	
		Low $CI_{standard}$	High $CI_{standard}$	Low $CI_{standard}$	High $CI_{standard}$
Total Demand (Million Gallon)	5195	5184	5188	5135	5160
SAF Consumption (Million Gallon)	972	960	974	976	983
SAF Percentage (%)	18.7%	18.5%	18.8%	19%	19%
CO_2e emission (Million ton CO_2e)	55.9	55.8	55.8	55.1	55.4
CO_2e Change (%)	-	-0.2%	-0.4%	-1.4%	-0.9%

Table 3. The Results of 2035 (when jet fuel elasticity is -0.03)

Scenario	Baseline	Proposed Scenario		Enhanced Scenario	
		Low $CI_{standard}$	High $CI_{standard}$	Low $CI_{standard}$	High $CI_{standard}$
Total Demand (Million Gallon)	5583	5557	5560	5564	5574
SAF Consumption (Million Gallon)	1101	984	1105	1018	1113
SAF Percentage (%)	19.7%	17.7%	21.7%	18.2%	20%
CO_2e emission (Million ton CO_2e)	59.3	60.0	59.2	59.7	59.0
CO_2e Change (%)	-	+1%	-0.2%	+0.7%	-0.5%

Table 4. The Results of 2035 (when jet fuel elasticity is -0.35)

Scenario	Baseline	Proposed Scenario		Enhanced Scenario	
		Low $CI_{standard}$	High $CI_{standard}$	Low $CI_{standard}$	High $CI_{standard}$
Total Demand (Million Gallon)	5583	5538	5569	5331	5511
SAF Consumption (Million Gallon)	1101	983	1105	1055	1122
SAF Percentage (%)	19.7%	17.7%	19.8%	19.8%	20.4%
CO_2e emission (Million ton CO_2e)	59.3	59.6	59.1	56.7	58.3
CO_2e Change (%)	-	+0.5%	-0.3%	-4%	-2%

Based on the tables above, our main three observations are as follows:

1. **Effectiveness of carbon intensity standards**: Strengthening the annual carbon
386.1 intensity benchmarks in the aviation sector as proposed may not be as effective as
maintaining the current higher carbon intensity standard.
2. **Scope of exemptions for fossil jet fuel**: Eliminating the exemption for domestic
386.2 fossil jet fuel (both intrastate and interstate) appears to be more beneficial than
eliminating it for intrastate only.
3. 386.3 **Influence of jet fuel elasticity**: Jet fuel elasticity significantly influences the
outcomes, highlighting its importance in policy formulation.

Legal Considerations

While we are not trained lawyers, our research background includes several studies that involved understanding legal constraints pertaining to taxes and fees imposed on airlines and air transportation. Based on this knowledge and a review of relevant case law, we offer a few observations:

The LCFS is sometimes viewed as an “implicit tax.” If extending the LCFS to incorporate jet fuel were considered a form of airline taxation, then it would be subject to strict limitations. According to 64 Fed. Reg. 7696, which implements the several federal statutes:

“State or local taxes on aviation fuel (except taxes in effect on December 30, 1987) are considered to be airport revenue subject to the revenue-use requirement. However, revenues from state taxes on aviation fuel may be used to support state aviation programs or for noise mitigation purposes, on or off the airport.”

This would seem to preclude the use of LCFS revenue to pay for credits. Notably, this restriction would apply irrespective of whether the LCFS was applied to fuel for intrastate flights only or a larger set of flights.

If the LCFS is not considered a form of airline taxation, then the most significant legal constraint is the Dormant Commerce Clause. Here, the application of the LCFS to interstate flights might be considered to violate the DCC. However, the issue is by no means clear cut.
386.4 Since the LCFS has been held not to be discriminatory against out-of-state businesses, the question would be whether the state interests it promotes offset the burden it places on interstate commerce. There is ample precedent that controlling global warming is a legitimate state interest, which increases the possibility that an LCFS that applies to all domestic flights would survive a DCC challenge.

Sincerely,

Professor Mark Hansen

Department of Civil and Environmental Engineering, UC Berkeley

Co-Director, National Center of Excellence for Aviation Operations Research

Yati Liu, Ph.D. Student

Department of Civil and Environmental Engineering, UC Berkeley

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Comment 396 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Paul D.
Last Name	Hernandez
Email Address	phernandez@volterapower.com
Affiliation	Voltera

Subject Comments of Voltera on the Proposed Low Carbon Fuel Standard Amendmen

Comment

California Air Resources Board Members and Staff,

Voltera appreciates the opportunity to provide these, "Comments of Voltera on the Proposed Low Carbon Fuel Standard Amendments" to th California Air Resources Board, in response to the proposed Low Carbon Fuel Standard Amendments.

Please reach out with any questions or for clarification regarding these comments.

Respectfully submitted,

Paul D. Hernandez

Sr. Policy Manager, Government and Utility Relations
Voltera
E-mail: phernandez@volterapower.com

Attachment www.arb.ca.gov/lists/com-attach/7081-lcfs2024-W2liUWBjWGoQCm0d.pdf

Original File Name	Comments of Voltera on the Proposed LCFS Amendments, Filed 2.20.2024 PDF.pdf
Date and Time Comment Was Submitted	2024-02-20 23:18:25

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

February 20, 2024

California Air Resources Board
1001 I Street
Sacramento, CA 95815

Re: Comments of Voltera on the Proposed Low Carbon Fuel Standard Amendments

California Air Resources Board Members and Staff,

Voltera appreciates the opportunity to provide comments to the California Air Resources Board (CARB), in response to the proposed Low Carbon Fuel Standard (LCFS) Amendments. Voltera commends CARB's continued leadership in accelerating the transition to zero emission vehicles (ZEVs), across the light, medium, and heavy-duty sectors. CARB has established a critical portfolio of ZEV regulations, including Advanced Clean Cars II, the Clean Mile Standard, and the Innovative Clean Transit (ICT), Advanced Clean Trucks (ACT) and Advanced Clean Fleet (ACF) regulations, which are driving the ZEV market in a number of segments. Meeting these regulations and achieving a number of other essential ZEV deployment and emissions reductions goals will require a fortified and robust LCFS program. Voltera provides the following recommendations to strengthen the ability of the proposed LCFS Amendments to enable ZEV infrastructure deployment.

I. About Voltera

Voltera sites, develops, owns, and operates strategically located, fit-for-purpose charging facilities enabling our customers to deploy and operate EVs at scale. The company is backed by EQT, a leading global infrastructure investor, that has the capacity and track record to further expand its investment in Voltera, supporting the growth of EV charging infrastructure and the zero-emission vehicle (ZEV) transition.

Voltera provides a charging infrastructure as a service (CIaaS) model. CIaaS is a turnkey solution that includes site identification and acquisition, site development, hardware deployment, operations, and maintenance. Voltera coordinates the entire real estate process for (and often with) customers and develops the site on their behalf. Voltera procures and installs electric vehicle supply equipment (EVSE) hardware and operates and maintains the site, including the EVSE. Reliability, availability, and speed of charging are typically guaranteed through service-level agreements that Voltera holds with our customers.

Voltera's current initiatives in California include:

- **Goods movement:** Voltera began charging operations at its first Class 8 drayage charging depot in the Los Angeles region, in the fall of 2023. The project is Voltera's first scaled truck site with 65 installed high-powered DC fast chargers (DCFC). Voltera has purchased properties in the Los Angeles and Sacramento regions and is in the process of developing these and purchasing and developing additional properties in these geographies to support medium and heavy-duty goods movement.

- **People movement:** Voltera has purchased and is developing multiple properties in California to support light-duty rideshare electrification, including in San Francisco, and the Los Angeles region, and is evaluating purchasing and developing properties to support medium and heavy-duty people movement.

- **Regulatory**: Voltera is a party to Rulemaking 23-12-008, Order Instituting Rulemaking Regarding Transportation Electrification (TE) Policy and Infrastructure, before the California Public Utility Commission (CPUC). The new Rulemaking is intended to address future utility TE programs and is especially pertinent to these comments based on the potential overlap with LCFS resources. Notably, utilities will be responsible with implementing LCFS holdback credit programs which are the dual jurisdiction of CARB and the CPUC. Voltera intends on engaging in the CPUC setting to discuss a broad array of ZEV matters, including LCFS strategy recommendations. Voltera has also enrolled as a party in Rulemaking 24-01-018, the Order Instituting Rulemaking to Establish Energization Timelines.

II. Comments

Voltera provides these comments as a stakeholder focused on building infrastructure to accelerate ZEV goods and people movement, across the light, medium, and heavy-duty sectors:

387.1
- **For light-duty fleets**, the LCFS program will continue to play a critical role in helping the sector with important resources to help accelerate ZEV infrastructure deployment. As the market continues to mature, it is imperative that CARB

maintain the course to support mass light-duty ZEV deployment. This is especially important in support of market segments that do not readily have access to EVSE and ZEVs. For example, it is important that CARB ensures alignment between the LCFS program and the transportation network companies (TNCs), who are compelled to electrify consistent with achieving 100% electric vehicle miles traveled (eVMT) by 2030 under the Clean Mile Standard.[1]

387.2
- **For medium- and heavy-duty (M/HD) fleets**, it is critical that CARB maintain and expand support for a nascent market. Here, the LCFS program is an essential tool that will help accelerate the transition to M/HD ZEVs to help achieve ACT and ACF mandates. The M/HD market needs this mission-critical support at least in its early stages. According to 2022 data, the sector has seen only 2,300 M/HD ZEVs deployed (1,708 buses, 272 trucks, and 340 delivery vans, respectively).[2] As such, the LCFS program will be a critical tool to help accelerate market penetration for ZEVs in the M/HD segment.

A. Light-Duty Recommendations

The following sections detail Voltera's recommendations for key modifications of the proposed regulation to better support light-duty fleet deployment.

387.3
Maintain the 2.5% cap

From 2026-2030, CARB proposes to lower the cap on prior quarter deficits to 0.5%. Voltera's recommends that the current 2.5% cap continue. Maintaining the provision better aligns with CARB's Scoping Plan, the Advanced Clean Cars II regulation, as well as the AB 2127 report by the California Energy Commission (CEC). These policy drivers outline the need for a substantial build-out of DCFC infrastructure to meet our light-duty ZEV goals. Thus, this is not the time to lower the cap that will in turn lower incentives for deploying public DCFC. Voltera encourages CARB to maintain the 2.5% cap as a tool to encourage continued DCFC deployment.

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[1] https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2021/cleanmilesstandard/fsor.pdf

[2] California Energy Commission. Total Medium- & Heavy-Duty ZEVs end of 2022. Website Access: https://tableau.cnra.ca.gov/t/CNRA_CEC_PUBLIC/views/MDHDVehiclesPop/MDHD?%3Adisplay_count=n&%3Aembed=y&%3AisGuestRedirectFromVizportal=y&%3Aorigin=viz_share_link&%3AshowAppBanner=false&%3AshowVizHome=n

387.4 **Create a light-duty Fast-Charging Infrastructure (FCI) provision for EV ridesharing, EV rental, and EV carsharing**

CARB proposes various changes to the light-duty FCI provision that will greatly limit areas of deployment.[3] In addition, the light-duty FCI provision would remain available only for public EVSE. Voltera encourages CARB to adjust this provision to allow for FCI incentives to be applicable anywhere, especially in scenarios where infrastructure is specifically designated to promote EV access (such as EV ridesharing, EV rental, or EV carsharing). By making this adjustment to allow for FCI incentivization of these sectors, CARB can help embolden parties to more aggressively achieve technological and economically feasible solutions for shared electrification in the TNC, taxi, rental, and carsharing sectors. This adjustment would be especially valuable to provide additional resources to TNCs, which as noted earlier must meet 100% eVMT by 2030 under the Clean Mile Standard. In addition, California has prioritized electric car rentals and sharing as detailed in the 2013 ZEV Action Plan[4] and EV sharing policies in the 2015 ZEV Action Plan.[5] As such, Voltera recommends that CARB align resources to support the electrification of these sectors.

B. M/HD Recommendations

With key modifications, CARB's proposed M/HD FCI program can be an effective way to help accelerate the deployment of the charging infrastructure needed to enable future
387.5 M/HD ZEV deployment. We deeply appreciate CARB's proposal to add an FCI for the M/HD sector, and to make it available for both private and shared fleet depots. The following sections detail Voltera's recommendations for key modifications of the proposed regulation to better support M/HD fleet deployment.

Modifications to the proposed M/HD ZEV infrastructure crediting process are warranted

[3] CARB proposes to adjust the program for HRI and FCI to prioritize incentivization for light-duty vehicle refueling in low-income, rural, or disadvantaged communities, and proposes that these investments are more than 10 miles away from the nearest fast charger.

[4] https://opr.ca.gov/docs/Governors_Office_ZEV_Action_Plan_(02-13).pdf

[5] https://www.ca.gov/archive/gov39/wp-content/uploads/2018/01/DRAFT_2015_ZEV_Action_Plan_042415.pdf

Voltera appreciates CARB's proposed inclusion of the new provision, there is a need to strengthen the M/HD FCI program incentives to ensure that they better align with the on-the-ground realities of deploying M/HD infrastructure. Voltera recommends the following adjustments:

387.6
- **Adjust the Fueling Supply Equipment (FSE) provision that limits the per site FSE credits to 10.** Voltera encourages CARB to remove this provision. Removing this cap will allow project stakeholders to rapidly scale in the manner necessary to meet the state's M/HD goals and will likely encourage stakeholders to engage in cost reductions from economies of scale that come with investments in larger projects. Voltera encourages CARB to embolden the industry to accelerate deployment of M/HD fleets by removing this cap. If CARB feels that there are strong reasons not to eliminate the FSE cap, Voltera would encourage CARB to consider a higher step-down cap to 30 FSE credits per site, and a potential tiering of further site FSE credits partial credit value to support additional infrastructure deployments. Voltera stresses that many fleets have more than 10 trucks to be transitioned to ZEV, and indeed, the implicated credit support for FSEs adequate to support such fleets is significant.

387.7
- **Reduce the 250kW minimum capacity.** Voltera encourages CARB to enable infrastructure developers to provide a variety of solutions to meet market needs, which may or may not meet the proposed 250kW threshold. Moreover, to ensure uniformity with existing and emergent infrastructure programs, and as an alternative to the 250kW threshold, Voltera would encourage CARB to align the LCFS program with NEVI-funded DC fast charge stations, which will have (at minimum) four 150 kW Combined Charging System (CCS) connectors and a minimum total station power of 600 kW.[6]

387.8
- **Remove geographic limitations of 1 mile.** CARB proposes to limit the M/HD FCI program to places, "Located within one mile of a ready or pending EV Federal Highway Administration Alternative Fuel Corridor or on or adjacent to a property used for M/HD vehicle overnight parking or has received capital funding from a

[6] California Energy Commission; National Electric Vehicle Infrastructure (NEVI) Formula Program: Website Access: https://www.energy.ca.gov/programs-and-topics/programs/national-electric-vehicle-infrastructure-nevi-formulaprogram#:~:text=Each%20NEVI%2Dfunded%20DC%20fast,freeway%20exit%20or%20highway%20roadway.

387.8 cont. State or Federal competitive grant program that includes location evaluation as criteria." This provision would unduly impact the nascent M/HD market, as these restrictions do not necessarily align with customer and market needs, and equally may not align with some regional initiatives. Moreover, land in urban areas is already scarce, hence further restricting FCI sites will only exacerbate existing challenges. In contrast, removing the one mile from corridor restriction will encourage fleets to deploy based on demand, which potentially will result in faster infrastructure deployment.

387.9
- **Clarify the ¼ mile factor and eliminate the 10 MW limits per site.** CARB proposes that: "The total nameplate power rating for all FSEs claiming MHD-FCI credit owned by a single applicant within ¼ mile of an MHD-FCI site cannot exceed 10 MW." Voltera reads this as there being a ¼ radius component to the number of proposed FSE MHD FCI credits that can be claimed by a single entity. However, this language reading could also result in linking this not to a single entity, but to multiple entities. From Voltera's perspective, this latter scenario is a direct concern, and in any logical scenario, Voltera recommends removal of the 10MW combined nameplate threshold altogether.

387.10
- **Increase the MHD-FCI program deficit to 5% to help California meet state M/HD deployment goals.** The current proposal for the MHD-FCI program is limited to 2.5% of the previous quarter's deficits. Unfortunately, Voltera needs to stress the nascency of the M/HD market segment and encourages CARB to raise this cap to attract the scope and scale of market investment needed to accelerate the M/HD ZEV market and meet relevant regulations. As identified in the CEC's AB 2127 analysis, the state will need approximately 2,900 MW by 2025 and 11,600 MW by 2030.[7] Relatedly, the California Trucking Association estimates that 300-600 DC fast chargers need to be installed every week to meet the state's 2035 needs.[8] As such, Voltera encourages CARB to raise the proposed cap to 5% to help meet M/HD infrastructure demands.

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[7] The California Energy Commission's AB 2127 report uses the HEVI-load model to forecast the number of depot and public chargers required for MHD charging under the AATE3 primary scenario. This forecast predicts the number of chargers and their respective power ratings that will be required in 2025 and 2030, as seen in Appendix-H, Table H-1. The sum of the total MHD charging capacity based on this forecast was calculated to be 2,900 MW and 11,600 MW by 2025 and 2030, respectively, by taking the sum-product of the number of chargers and their respective power rating.

[8] Chris Shimoda Senior Vice President of Government Affairs California Trucking Association; R.24-01-018 — Public Workshop Discussing the Development of Energization Timing Targets and Processes to Report

Conclusion

Voltera appreciates the opportunity to provide recommendations to CARB's proposed LCFS amendments to better enable effectiveness in the deployment of ZEV infrastructure to support the light, medium, and heavy-duty ZEV sectors.

With the recommended adjustments, Voltera is confident that the LCFS program will continue to provide key resources to the ZEV sector to help it achieve the goals and regulatory compliance of Clean Cars II and the Clean Mile Standard, ICT, ACT and ACF.

387.11 Voltera acknowledges that the Board has postponed voting on the proposed amendments. While Voltera acknowledges CARB's need for additional discussion, we urge the Board to move expeditiously to send clear and stable market signals to the ZEV infrastructure sector.

Please reach out with any questions or for clarification regarding these comments.

Respectfully submitted,

By: ***/s/ Paul D. Hernandez***

Sr. Policy Manager, Government and Utility Relations
Voltera
E-mail: phernandez@volterapower.com

Energization Delays California Public Utilities Commission, Energy Division Emmanuelle Truax, Senior Transportation Electrification Analyst February 2, 2024; Website Access: https://www.cpuc.ca.gov/-/media/cpuc-website/divisions/energy-division/documents/infrastructure/energization/ab50_sb410-energization-workshop_02022024.pdf

Comment Log Display

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Comment 397 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Fariya
Last Name	Ali
Email Address	fariya.ali@pge.com
Affiliation	Pacific Gas & Electric
Subject	PG&E Comments on 45-day LCFS Amendments
Comment	See attached
Attachment	www.arb.ca.gov/lists/com-attach/7082-lcfs2024-BmpRNFUyUnIEXQM3.pdf
Original File Name	LCFS_45-Day Comments_PGE_FINAL.pdf
Date and Time Comment Was Submitted	2024-02-20 23:34:12

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Pacific Gas and Electric Company

Fariya Ali
Air & Climate Policy Manager
State Agency Relations

(415) 635-7113
fariya.ali@pge.com

February 20, 2024

Rajinder Sahota, Deputy Executive Officer
California Air Resources Board
1001 "I" Street
Sacramento, CA 95814

RE: PG&E Comments on the Proposed Amendments to the Low Carbon Fuel Standard Regulation

Pacific Gas and Electric Company (PG&E) appreciates this opportunity to comment in response to the California Air Resources Board's (CARB) release of Proposed Amendments to the Low Carbon Fuel Standard (LCFS) Regulation for public comment on January 5, 2024. The LCFS program has been a vital part of California's decarbonization strategy and will continue to
388.1 be critical in the State's path towards carbon neutrality. Given the importance of this program and the potentially far-ranging consequences of the proposed amendments, PG&E appreciates the extension of the rulemaking timeline to allow sufficient time to ensure all stakeholder input is considered, while still prioritizing completion of the rule by this summer. There are a number of important policy and technical details that all parties could benefit from additional engagement on.

PG&E's remaining comments are organized into the following sections:

I. Overall support for the LCFS amendments
II. Electricity holdback programs
  a. 50% utility contribution
  b. Holdback project list
  c. 75% equity requirement
  d. Grid-side investments
  e. Equity administration
  f. Equity community definition
III. The California Clean Fuel Reward Program
IV. Third-party verification for electricity pathways
V. Biomethane crediting

I. Overall Support for LCFS Amendments

388.2 **PG&E supports the increase in program stringency through a near-term step down, increased 2030 and 2045 benchmarks, and the creation of an automatic acceleration mechanism.**

PG&E continues to support California's ambitious climate and air quality goals and believes the LCFS program is an important and central tool for achieving them. We are excited to see CARB's leadership in refining the LCFS program to maximize its impact on decarbonizing the transportation sector.

Over the past decade, the LCFS has been remarkably successful in supporting the transition to cleaner transportation fuels, and in doing so, has reduced climate change pollutants as well as localized air and toxic pollutants that adversely impact communities and public health. Moreover, the program has served as a catalyst for billions of dollars of investments in clean fuels, infrastructure, and growing industries that have made a profound impact within California.

CARB's proposed amendments are critical to carrying out the 2022 Scoping Plan for Achieving Carbon Neutrality, which charted a path to reach carbon neutrality by 2045. Importantly, credits for low-carbon fuels will support the mobile source regulations that are driving the transition to zero-emission vehicle (ZEV) technology identified as necessary in the Scoping Plan, such as the Advanced Clean Cars II and Advanced Clean Fleets regulations.

PG&E supports CARB's overarching proposal to strengthen the Carbon Intensity (CI) reduction benchmarks in LCFS both pre- and post-2030 in support of the Scoping Plan, and specifically the 30% reduction in overall fuel CI by 2030 and 90% reduction in fuel CI by 2045 from a 2010 baseline. This is critical in order to stabilize credit prices and balance supply and demand in the LCFS market, as well as providing stakeholder and market certainty. We also support a step-down reduction in the CI benchmark of at least 5% in 2025 to increase the stringency of the CI target, sending an important near-term signal to accelerate investment in cleaner fuels.

388.3 PG&E also appreciates the inclusion of a proposed Automatic Acceleration Mechanism (AAM) which will help support market stability in the event that transportation fuel decarbonization outpaces deficit generation in the program. Program success or overperformance should not destabilize the market, and the AAM can prevent such a dynamic from reoccurring.

II. Electricity Holdback Programs

A. Utility Base Credit Allocations

388.4 **PG&E supports and believes the 50-50 base credit allocation requirement between utility holdback programs and the statewide program will help support utility-specific EV barriers, especially for hard-to-electrify communities.**

388.4 cont. PG&E supports the overall proposed updates to residential base crediting for electric vehicle (EV) charging and the adjustment to the percentage of base credits that can support utility "holdback" programs. Specifically, PG&E supports the modification of the contribution required from large utilities to a 50-50 split of credits supporting holdback programs and the statewide California Clean Fuel Reward (CCFR) program. PG&E participates in the LCFS program on behalf of our residential EV customers who use the electricity we deliver as a low-carbon transportation fuel, and the revenue from the credits we receive goes back to customers (either through holdback programs or the CCFR program), not the utility itself.

This important adjustment will enable better support of programs addressing market gaps specific to each utility's service territory and unique customer barriers. For example, there are significant differences in EV adoption and customer barriers between an urban municipal utility, a rural co-op and a larger investor-owned utility (IOU) due to differences in housing stock, vehicle use cases, and medium- and heavy-duty traffic, amongst other variables. This rebalancing between the statewide and utility-driven programs directly enables more creative, focused interventions on community-specific barriers which are essential for equitably driving the transportation electrification market forward.

Additionally, electric utilities are subject to extensive reporting and compliance requirements, ensuring that the distribution of LCFS proceeds is open and transparent. We have a duty to serve all customers, including populations that have been slower to adopt EVs such as those residing in disadvantaged communities (DAC) and multi-family residences (MFR). Residents of DACs and MFRs are utility customers, and as such the utilities are incentivized to assist those customers in transitioning to electric transportation.

To date, PG&E has provided over $100 million in EV rebates through our utility holdback programs (separate from the statewide CCFR program). Our portfolio now includes rebates for used EVs and home charging options, charging installation for MFR and small businesses, and managed charging in High Fire Threat Districts. Three of our four holdback programs focus on low-income customers and DACs.

Over the coming decade we anticipate that LCFS will continue to provide revenue that can meaningfully help remove barriers to EV adoption, beyond vehicle rebates, and especially for hard-to-electrify communities. CARB's proposed base credit allocation changes are critical to continue and expand these important programs, including into critical new areas such as ZEV infrastructure support for medium- and heavy-duty ZEVs, and building out distribution system capacity to support rapidly growing EV loads. Importantly, this base credit allocation allows us to do all of this without passing those program and infrastructure costs onto our customers, significantly helping to support market transformation, EV equity, and downward rate pressure simultaneously.

B. Holdback Project List

388.5 **To minimize confusion and competing interpretations, CARB should have a single project list for holdback projects and clarify that certain project types are considered equity regardless of their geographic location.**

The current LCFS regulation includes one project list for equity projects only, and the proposed amendments expanded this to two separate project lists – equity projects must come from the equity project list, and non-equity projects can come from the non-equity project list but it is not exclusive. This approach provides more certainty on the types of electrification projects CARB views as priorities both in and out of equity communities, but it also adds confusion: are rebates for purchasing a pre-owned EV (included on the equity list) also valid for non-equity customers? What if a program to avoid panel upgrades (included on the non-equity list) wants to provide equipment at no cost to low-income customers?

A single project list that *must* be used for equity projects, in addition to meeting the definitions of customers/communities served, and *may* be used for non-equity projects is more straightforward and minimizes opportunity for conflicting interpretations. This provides certainty on expectations around CARB's priorities while still allowing flexibility for utilities to propose non-equity programs that are best suited to their specific territories. In addition, we understand from discussions with CARB staff that electrification of medium- and heavy-duty vehicles should be considered equity regardless of whether the vehicles are domiciled in an equity community. PG&E supports this, due to those vehicles contributing to air pollution benefits in the communities they drive through, which may be far from the locations they are domiciled or charged.

388.6 Finally, PG&E recommends specifically allowing panel and service upgrades in the equity project list.[1] PG&E has heard repeatedly from equity advocates and community-based organizations that many low-income customers live in older housing stock with smaller electric panels and/or outdated wiring, and panel upgrades – which can be expensive, time-consuming, and daunting – are required before many customers can even consider electrification.

388.7 The comment letter from CalETC, of which PG&E is a member, includes an appendix with suggested regulation language on how to accomplish these recommendations.

C. 75% Equity Requirement

388.8 **PG&E can be supportive of increasing the equity requirement to 75% for large IOUs if there is definitional alignment with the CPUC for all aspects of the requirement, not just the percentage.**

[1] i.e. § 95483. (c)(1)(A)(5)(a)(iv), added text underlined: Additional rebates and incentives for low-income individuals beyond existing local, federal and State rebates and incentives for: purchasing or leasing new or previously owned EVs; installing EV charging infrastructure in residences, <u>including panel and service upgrades,</u> and offsetting costs for residential or nonresidential EV charging.

388.8 cont. While increasing the equity requirement from 50% to 75% in CARB's draft amendments appears to align with the California Public Utility Commission's (CPUC) 2020 LCFS decision requiring 75% of each IOU's annual holdback spend to go to equity projects, CARB and the CPUC currently measure progress against that metric in very different ways.[2] CARB counts percent of proceeds earned in a calendar year, which was clarified by guidance document to include percent of proceeds either spent or encumbered (i.e. budgeted or set aside) to an equity program. The CPUC counts spend that occurs during the calendar year, regardless of when the credits were earned. Though this may seem like semantics, it means that PG&E reports entirely different data to substantiate compliance to each agency in their annual reports. To CARB, PG&E reports current-year proceeds encumbered or budgeted to be used for the next year – in other words, the next year's equity budget. To the CPUC, PG&E reports what was spent on equity in the current year.

In addition, many real-life scenarios exist that make the proceeds vs. spend accounting further diverge. For example, underestimating the amount of proceeds that will be received leads to underspending relative to actual proceeds – even if spending is at 75% of what the forecasted proceeds are, it may be lower than 75% against actual proceeds. Thus, underestimating the credit price – which utilities have no control over and can be difficult to predict – will cause the utility to underbudget and therefore underspend relative to a proceeds-based target.

It is critical that both CARB and the CPUC adopt the same method of tracking compliance for the same programs funded with the same credits. This ensures that the data being reported to the agencies aligns and reduces the amount of time spent calculating two versions of compliance metrics. It also eliminates the possibility of a scenario arising where the calculations diverge enough that compliance is not possible with both agencies and a utility must pick whether to comply with the CPUC or with CARB.

PG&E recommends that both CARB and the CPUC track holdback equity compliance based on holdback program spend within the calendar year.[3] This method has several major advantages over proceeds-based tracking (which is CARB's current requirement):

- Spend is within utilities' control and thus creates more accountability. The utilities have no control over credit prices or credits generated, which can push a utility out of compliance even if it has acted reasonably.
- Spend encourages prudency when funding is being used, whereas budgeting (proceeds encumbered) may be based on ideal situations or inaccurate forecasts.

[2] D.20-12-027, Ordering Paragraph 1 requires that 75% LCFS holdback expenditures must meet the equity project requirements in the CARB LCFS regulation in 2024 and afterwards.
[3] i.e. 75% of a utility's holdback program spend in a calendar year must serve priority communities or low-income customers.

388.8 cont.

- Spend can handle "banked" proceeds from prior years. Tracking only current-year proceeds can lead to an inaccurate view of the whole portfolio if funding is coming from prior years.[4]
- Spend allows for better accounting of LCFS overhead costs, which are not program-related and therefore cannot be accounted as equity or non-equity.[5] Under proceeds-based tracking, overhead costs must be treated as non-equity, reducing the amount of funding that can be used to support broad electrification projects. With spend-based tracking, overhead costs are removed from the calculation so that only program spend is used to calculate compliance.

D. Grid-Side Investments

388.9 **PG&E recommends that grid-side investments that support both light-duty and medium/heavy-duty EV charging be eligible for equity spending requirements, if serving projects in an equity community**

PG&E appreciates and supports CARB's proposed expansion of its Holdback Credit Pre-Approved Project Types list to include grid-side investments. With state policy rapidly accelerating transportation electrification (TE), not only with light-duty vehicles but also with medium- and heavy-duty (MD/HD) vehicles, the need for grid investments to support electrification is growing. PG&E anticipates a significant increase in these EV loads over the next two decades, accelerated by major policy drivers and regulations from CARB and the State.

PG&E believes grid and infrastructure upgrade work needed to support California's TE goals should not be borne by utility ratepayers alone, and that alternative sources of funding, such as LCFS revenues, can represent an opportunity for PG&E to support and accelerate additional TE-related projects in priority communities. Accordingly, PG&E appreciates CARB's proposed revisions which, with corresponding CPUC regulatory changes, would allow for this.

This said, we believe it is important to have a broad definition for grid-side investments that encapsulates both light-duty and MD/HD loads. CARB's current proposal would limit grid-side investments that can count towards the high 75% equity spending requirement to only those supporting MD/HD vehicles. The current language would unnecessarily limit and complicate grid planning, program development, and the ability to scale such a program to maximize downward pressure on rates and positively impact affordability, a significant equity issue. It is

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[4] For example, if a utility earned $50,000 in proceeds in years 1 and 2, and in year 2 spent $50,000 on equity programs and $50,000 on non-equity programs, then it would appear that their year 2 equity compliance was at 100% compared to current-year proceeds, even though the spend was at 50%.

[5] Overhead costs are costs associated with participating in LCFS regardless of whether the utility is offering any programs. They include broker fees or staff time from selling credits, quarterly & annual reporting, analysis and costs of transferring funding to the CCFR, utility participation in the CCFR Steering Committee, and verification. These costs are different from program administration, which include contracting, invoicing, performing income validation, reviewing applications, and mailing rebates.

388.9 cont. possible that a grid side capacity project may not be located in or entirely located in an equity community, but that capacity project is indeed serving TE projects in an equity community.

388.10 Additionally, PG&E's pipeline of upstream distribution capacity needed to serve EV loads is currently driven by public DC fast charging, primarily intended for light-duty, rather than fleet or MD/HD charging. Moreover, light-duty DC fast charging is critical to supporting EV equity, as those who cannot charge at home disproportionately rely on such charging as their primary charging option.[6] Finally, in the scenario where proactive grid-side capacity projects are possible and prudent in relation to forecasted locational EV demand, the ability to trace that to any specific customer project or type/category of project (i.e. light-duty versus MD/HD) becomes more tenuous. An unnecessarily narrowly worded rule could foreclose on the possibility of developing such projects to minimize future energization delays for larger EV loads using non-ratepayer funds.

For these reasons, PG&E recommends that the definition proposed to be used under "Other Holdback Projects," which is "Investments in grid-side distribution infrastructure necessary for EV charging," should also be the definition for such investments if it is a "Holdback Credit Equity Project" – in other words, that equity spending should not be limited to MD/HD charging. Whether or not the investment counts against a utility's equity holdback spend requirement should be based on whether the grid-side investment is serving EV projects in an equity community, as the rules ultimately define it, rather than if it narrowly supports MD/HD vehicles.

E. Equity Administration

388.11 **CARB should revert to a 10% cap on equity administration spend for holdback programs, expand the definition of administrative costs to include program-specific costs aligned with how utilities report for other regulators, and clarify that this excludes start-up costs and marketing, education, and outreach (ME&O) costs.**

Administrative costs are not defined in the LCFS regulation, but Guidance 20-03 provides a very narrow definition focused on the utility's overall administration rather than program-specific administration, such that most costs utilities must report as program administration to other regulators are excluded.[7] PG&E views administrative costs as the costs associated with managing a program and ensuring good stewardship of the funding. This includes activities that

[6] See, for example, https://innovation.luskin.ucla.edu/wp-content/uploads/2021/03/Evaluating-Multi-Unit-Resident-Charging-Behavior-at-Direct-Charging-Behavior-at-Direct-Current-Fast-ChargersCurrent-Fast-Chargers.pdf at p.2-3.

[7] LCFS Guidance 20-03 defines administrative costs as including:
- Salaries, wages and benefits of employees who perform administrative functions, including EDU management, payroll, personnel, accounting, and budgeting;
- facility and occupancy costs directly associated with administrative functions;
- Computer support services;
- Training, travel, and licenses directly associated with administrative functions;
- Taxes, interest, and general insurance; and
- General expenses.

388.11 cont. may fit in CARB's original definition, such as the program manager's time spent running the program, invoicing, and regular check-in meetings; however, it also includes activities that are directly related to providing incentives, such as development and maintenance of a website and online application, reviewing customer applications, conducting income validation, implementing fraud controls, and issuing checks.

A cap of 5% administration may be adequate for the narrowly-defined set of criteria in the current Guidance 20-03, but the definition does not align well with the much more expansive set of criteria that PG&E and other utilities use when reporting administrative costs to regulators like the CPUC for most clean energy programs. Maintaining the guidance document's definition would lead to PG&E reporting two different sets of administrative cost numbers to CARB and the CPUC. Instead, CARB should adopt the standard, more expansive definition of program administrative costs (including utility administration, third-party implementer administration, and non-incentive implementation costs) and revert the cost cap to 10%. Ten percent of costs is the industry standard for utility clean energy programs across the United States, and is what PG&E typically maintains for transportation electrification and other clean energy programs.

PG&E notes that a 5% cost cap with the expanded definition is not tenable for utility holdback programs, even if it may be for very large, established statewide programs. This is because much of the program-specific administrative costs are required regardless of program size. For example, PG&E had a former program that provided 150,000 rebates to the general population and is currently implementing one expected to reach around 5,000 income-qualified customers. Despite the massive size difference, the programs both required a similar website and in-house application (and because of the income qualification, the second, smaller program's application was more complex and therefore more expensive to build). Equity-focused programs require additional verification methods to ensure the funds are making it to customers that need the funding. Income validation adds substantial time and cost to each rebate application given the lack of standardized methods for accomplishing it, and the extra required details often lead to far more customer support time.

388.12 In addition, CARB should clarify that start-up costs are not included in the 10% cost cap, to align with how costs are defined for the statewide CCFR program. Startup costs occur before any incentives have been paid and are therefore nearly 100% administrative. As a result, it is almost impossible to comply with any administrative cost cap the year a program is being set up.

388.13 Finally, CARB should clarify that program-related ME&O is important for program success and separate from administrative costs. In its proposed amendments, CARB removed ME&O as a standalone equity project type, which PG&E generally agrees with. The CPUC similarly disallows general EV marketing but acknowledges the need to alert customers about the existence and value of the incentive programs. However, the language used in the Purpose and Rationale appendix is broader than this and seems to say that utilities are not allowed to use any

388.13 cont. holdback proceeds on marketing at all, rather than just on general marketing not tied to customer incentive programs.[8]

ME&O is a critical part of program success, especially for programs serving equity customers. PG&E has partnered with several community-based organizations (CBOs) to provide education about our EV programs in ways that most align with how the local community receives its information, answer questions in-person and in-language, and support customers in applying to the programs. Their work has been invaluable and must be allowed to continue for LCFS-funded programs. ME&O serves a different function from administrative costs, however, and should not be included as part of the 10% cost cap. This ensures that programs are not forced to forego ME&O to equity communities to pay for more costly equity program components, such as income validation costs or customer support.

F. Equity Community Definition

388.14 **PG&E supports the revised definition of an equity community to better align with the CPUC and AB 841.**

PG&E supports CARB's proposed revision of its equity community definition to include federally recognized tribes, as well as a community in which at least 75% of public-school students in the project area are eligible to receive free or reduced-price meals under the National School Lunch Program. This expanded definition will incentivize investments into these important communities and, importantly, help to align CARB's equity community definition with that used by the CPUC and as defined by the Legislature in AB 841 (Ting, 2020).

III. California Clean Fuel Reward

388.15 **PG&E recommends CARB gather additional stakeholder input on the pivot of the statewide clean fuel reward program from a light-duty vehicle rebate to a targeted MD/HD rebate.**

PG&E is still evaluating CARB's proposed changes to the CCFR program. The release of the 45-day draft regulatory language represented the first time implicated stakeholders became aware of what is a rather significant change to this program, changing it from a universal new light-duty electric vehicle rebate to a rebate focused on MD/HD vehicles that are not subject to the Advanced Clean Fleets Regulation. While PG&E agrees that there is a need to incentivize this category of trucks, it is unclear to us how this program would exist and interact with other similar incentive programs for such vehicles. Moreover, there remains significant need to

[8] Appendix E, "Purpose and Rationale of Proposed Amendments for the Low Carbon Fuel Standard Requirements," pg 15 states "Staff is also proposing the removal of holdback credit proceeds for Marketing, Education, & Outreach for electric vehicles."

388.15 cont. incentivize light-duty vehicle purchases, in particular for income-qualified customers, which is what the CCFR was in the process of being revised to do. PG&E believes it is far too early to declare victory in the state's efforts to equitably accelerate the light-duty vehicle market.[9]

Moreover, the revised program mandate that has been proposed would likely represent a significant wealth transfer from the residential, light-duty customers that exclusively generate the base utility LCFS credits to commercial MD/HD customers. In addition to this customer class and vehicle type wealth transfer, the revised program would also disproportionately benefit the parts of the state where the significant clusters of these medium- and heavy-duty trucks exist, representing a geographic wealth transfer as well.

For these reasons, PG&E highlights the importance and need to gather stakeholder feedback on such a significant program change, in particular from community-based organizations and equity groups, and suggests this should be a significant factor in the decisions around the program's ultimate direction. Should this wholesale change take place, it would heighten the need for and highlight the critical importance of utility holdback programs in supporting the light-duty market, especially for equity customers that may otherwise be left behind.

IV. Third-Party Verification for Electricity Pathways

388.16 **PG&E could be supportive of adding electricity pathways to verification if revisions to accommodate the unique, distributed nature of EV charging are made.**

Firstly, PG&E believes CARB should exempt residential and non-residential on-road electricity pathways from Fueling Supply Equipment (FSE) site visits except in cases where there is a reasonable concern about accuracy. Commercial and residential EV charging stations are largely standardized pieces of equipment subject to existing accuracy regulations.[10,11,12] Requiring site visits will yield very little value over actual usage data for most revenue-grade networked charging stations, where the data is used to bill customers and is provided digitally by the EV Service Provider (EVSP). In addition, charging stations represent a highly distributed infrastructure with a large number of units made up of a small number of equipment models. Even though California is still in the early majority for EV adoption, there are already an order of magnitude more public charging stations than there are gas stations in the state, and that

[9] As of the end of 2022, only 4% of California's light-duty vehicle population is a zero-emission vehicle per the California Energy Commission's Zero Emission Vehicle and Infrastructure Statistics dashboard: https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics
[10] Utility meters are certified to ANSI C12 standards by Nationally Recognized Testing Labs (NRTLs)
[11] California Department of Food and Agriculture's Division of Measurement Standards (DMS) regulates EV chargers for metering accuracy: https://www.cdfa.ca.gov/dms/pdfs/regulations/EVSE-OAL_EndorsedLetter-and-FinalText.pdf
[12] Each California county's Department of Weights and Measures conducts inspections to enforce the DMS requirements, paid for through county device registration fees: https://www.cdfa.ca.gov/dms/docs/publications/2023/2023_Combined_BPC.pdf

388.16 cont. number will only rise. PG&E alone has around 400 charging stations – all from one EVSP, and nearly all the same model – at 100 offices across Northern California for our employees to use.

As § 95501 (b)(3) seems to indicate, requiring site visits to each facility with fueling equipment – i.e., a charging station – represents a massive time requirement and cost for very little benefit. Residential metered charging is an even larger problem as there are already hundreds of thousands of EVs being reported to CARB, and reporting may be done either by vehicle telematics or charging station. Conducting site visits to even a fraction of those sites is nonsensical – if the data comes from telematics, would the verifier just be checking there is an EV in the garage? – and intensely disruptive to the vehicle owner, again for little to no benefit over the raw usage data.

388.17 Second, CARB should create an exemption for very small credit generators. Level 2 charging stations are highly distributed and often owned by fleets, workplaces, multifamily buildings, grocery stores, and other businesses rather than a single entity with a large network. If a multifamily building is only generating a dozen credits per year from its charging stations, then requiring verification – even if deferred – will likely wipe out all of their credit proceeds and negate the benefits of participating in LCFS. CARB might consider this as a smaller credit cap within the 6,000-credit cap used for deferment (i.e., entities that generate fewer than, say, 2,000 credits are exempt from verification; entities that generate between 2,001 and 6,000 credits qualify for deferment).

388.18 Finally, CARB should clarify in §95500(c)(2)(B) that only credits subject to verification are counted towards the 6,000-credit cap used to qualify for deferred verification (or exemption as recommended above). The overwhelming majority of utility credits come from estimated residential charging, which CARB calculates on behalf of each utility and are therefore not subject to verification. However, including all credits in the LCFS Reporting Tool system as the current definition states means that many utilities will be ineligible for deferment even if they are only generating a few dozen credits from charging at their offices.

V. Biomethane Crediting

388.19 **PG&E urges CARB to develop an alternative incentive program or policy lever to support the transition of biomethane to hard-to-decarbonize sectors.**

As noted in CARB staff's Initial Statement of Reasons (ISOR) report on the proposed LCFS amendments, PG&E agrees that capturing methane from California's methane sources is critical for achieving the State's climate targets and that actions to reduce methane emissions will provide immediate benefits. The 2022 Scoping Plan also identifies a long-term role for biomethane in decarbonizing California's energy use, either through the production of renewable hydrogen or for use in non-transportation sectors. To this end, CARB is proposing to phase out crediting for biomethane used in CNG vehicles after 2040. While PG&E supports this long-term

388.19 cont. transition for biomethane to hard-to-decarbonize sectors, CARB should ensure that this proposed phase-out from the LCFS program does not stymie the growth of critical methane capture projects in the near-term, which can take many years for design, build, and connection.

Conclusion

PG&E looks forward to continuing our collaboration with CARB staff and public stakeholders on potential amendments to the LCFS Program that will best support the State's climate goals.

Sincerely,

/s/
Fariya Ali
Air & Climate Policy Manager

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Comment 398 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Daniel
Last Name	Chandler
Email Address	dwchandl@gmail.com
Affiliation	350 Humboldt
Subject	Comments on LCFS Amendments 2_20_2024
Comment	Please see attached file.
Attachment	www.arb.ca.gov/lists/com-attach/7083-lcfs2024-AW0AYwdyACcAYwJw.pdf
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Date and Time Comment Was Submitted	2024-02-20 23:35:34

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Board Comments Home

February 19, 2024

Liane Randolph, Chair
Members of the Board
California Air Resources Board
via electronic submittal

Comments on the Proposed Amendments to the Low Carbon Fuel Standard and Initial Statement of Reasons, released December 19, 2023

Dear Chair Randolph and Board Members,

Eliminating the use of fossil fuels in transport is crucial to California's goal of carbon neutrality by 2045. There seems to be agreement that this can best be accomplished by accelerating the transition to ZEVs in both private and public transport, and further improving and expanding public transit. The success of the Low Carbon Fuel Standard (LCFS) is exhibited by California's early and continuing adoption of electric vehicles.

Unfortunately, California Air Resources Board's (CARB's) latest Proposed Amendments to the Low Carbon Fuel Standard rely heavily on accelerating the rate of reduction of the LCFS Carbon Intensity (CI) benchmark without correcting flawed CI scoring. This would increase production of renewable diesel made from soybean oil, canola oil and other seed oils, increasing both food insecurity in the near term and unsustainability in the medium term as more primary forests and savannas are converted to croplands. CARB must go back to the drawing board for a major reset of California's LCFS.

The most important policies for keeping global warming well below 2 degrees C are those that work to eliminate either the burning of fossil fuels or the destruction of nature. The UN estimates that the world's lands and oceans each sequester about 25 percent of our carbon emissions annually. It is essential that we halt further destruction of the world's natural forests, savannas and grasslands—because they are our most effective tools for removing carbon emissions from the atmosphere. Far too often these undisturbed natural lands are carelessly destroyed or degraded because the policies and laws needed to protect them do not exist. The world needs to stop using land in a way that worsens climate change. We believe that CARB's review of the Low Carbon Fuel Standard (LCFS) offers an opportunity to do just that; and as we know, the eyes of the world are on our state.

Substantial evidence suggests that the carbon intensity scores used by CARB for biomass-based diesel produced from seed oils are flawed.

In this comment we suggest changes to the LCFS that we hope will be useful to CARB in its review. These recommendations include:

389.1
- Update and Improve, or replace, models used to calculate the carbon intensity (CI) of crop-based fuels (Recommendation 1)

389.2 389.3 389.4

- Beginning in 2025, institute annually declining caps on both the volume of seed oil-based diesel and corn ethanol eligible for LCFS credits, with a goal of phasing out credits for crop-based fuels by 2030 (Recommendations 2 and 3)

389.5

- In 2025, introduce a fixed cap on the volume of UCO- and tallow-based diesel eligible for LCFS credits (Recommendation 4) 389.6

389.7

- Consider eliminating tallow from tier 2 pathways for biomass-based diesel by 2030 (Recommendation 5)

389.8

- Delay a more rapid decline in the LCFS carbon intensity benchmark until caps on lipid-based fuels have been in place for a year or more (Recommendation 6)

389.9

- Identify and measure negative environmental effects of LCFS credits for crop-based biofuels (Recommendation 7)

389.1 cont **Recommendation 1: Update and Improve, or Replace, Models used to calculate CI of crop-based fuels**

Other well-respected models, both national and international, that we have seen referenced in scientific journals, workshops and European laws calculate carbon intensity values of transportation fuels made from fossil fuels virtually identical to CARB's GREET model estimates, for diesel the CI is 94gCO2e/MJ.[1] However, their **calculated values for the carbon intensity of crop-based biofuels made from oilseeds such as soybean, palm, canola or sunflower seed are vastly different from CARB's GREET/GTAP/AEZ-EF model estimates.** For example, the GLOBIOM Model used by the European Union (EU) estimates the carbon intensity of soybean oil to be 182.9gCO2e/MJ,[2] while CARB's GREET/GTAP/AEZ-EF models estimate it to be around 55gCO2e/MJ. Two well respected US models, ADAGE, Applied Dynamics of the Global Economy, developed and maintained by RTI International and GCAM, Global Change Assessment, developed and maintained by the University of Maryland, were studied by the EPA during its 2023 CI Model Wokshop related to the Renewable Fuel Standard (RFS). ADAGE and GCAM estimates of CI values for oil-seed diesel differed from each other but were both closer to those of GLOBIOM rather than the GTAP combo CARB uses. The substantial difference in CI estimates results primarily from the models' different estimates of indirect land use change (ILUC) emissions.

The **GLOBIOM, ADAGE and GCAM models** all estimate the carbon emissions of any increase in seed oil-based diesel to be greater than the fossil diesel they replace.[3] The GTAP and AEZ-EF models used by CARB, on the other hand, calculate lower indirect land use change (ILUC) effects for these fuels, and as a result lower CI scores. This difference explains why CARB is still encouraging the production of more crop-based renewable diesel.

Last year's EPA Workshop on CI Models looked at three models: ADAGE, GCAM and GTAP, as it sought to estimate the impact of an increase of 1 billion gallons of renewable diesel. The ADAGE model estimated a net increase in greenhouse gas emissions of 35.5 kgCO2e/gal, while the GCAM model

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[1] A. Christensen, "Transportation Carbon Intensity Targets for the European Union—Road and Aviation Sectors", GAMS, 2012, Appendix D Baseline Data.
[2] Ibid.
[3] GLOBIOM: the New Basis for EU Biofuel Policy 2021-2030, Transport&Environment.

estimated a smaller, but still significant, net emissions increase of 5.4 kgCO2e/gal. Only GTAP estimated a net decrease in emissions of 5.4 kgCO2e/gal.

One is left puzzled as to why the EPA went ahead and increased the volume mandates under the RFS for 2023-2025 since 2 out of the 3 models it consulted indicated an increase of 1 billion gallons of biomass-based diesel would result in more not less carbon emissions.[4] A recent UCS blog suggests that the EPA raised volume requirements partly because of the large increase in US renewable diesel production capacity that was already in process, especially in California.[5] In other words, it appeared to be a fait accompli.

The IPCC's 2019: Climate Change and Land report comments on the "large variance in the outcomes of these models" and the "deep uncertainty" attached to their parameters, the associations they model and the data sets they use.[6] The report further notes that as a result of this uncertainty "it is important to assess the impact of mitigation actions on the broader environment such as biodiversity, ecosystem
389.1 cont functioning, air quality, food security, desertification/degradation and water cycles."[7] But CARB continues to approve pathways solely on the basis of the deeply uncertain and narrow CI score calculated by its models.

CARB needs to reevaluate the GTAP and AEZ-EF models it uses to estimate carbon intensity and indirect land use change for its crop-based alternative fuel pathways. CARB CI scoring assumes that the rate of increase in a feedstock's supply or the size of its volume increase does not affect its CI score, but this is unlikely to be an accurate description of the relationship.[8] The crucial need for caps, that we discuss under Recommendations 2 and 3 in this comment, is partially a result of CARB's flawed CI scoring.

Several researchers have proposed abandoning computer modeling for land use change in favor of a more straight-forward carbon opportunity cost of land approach.[9] This approach is based on the idea that land is more valuable storing and sequestering carbon than producing biofuels.

Comparison Of CARB's GTAP and the EU's GLOBIOM models: There are many differences that explain the models very different ILUC results for oilseed feedstocks.[10] The GTAP-BIO model assumes greater productivity increases result from feedstock price increases, though historical data does not seem to support this assumption. The GTAP-BIO model also assumes that consumers will buy fewer vegetable oils as prices rise in response to greater biofuel production. However, world population and per capita incomes continue to increase and vegetable oil consumption is increasing more rapidly than most food types making this an unreasonable assumption. Crushing more soybeans to produce soybean oil for

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[4] Lashof, "EPA's New RFS Will Increase Global Carbon Emissions—Not Lower them", World Resources Institute, 7/3/23.
[5] Martin,J., A Cap on vegetable oil-based fuels will stabilize and strengthen California's Low Carbon Fuel Standard, The Equation, Union of Concerned Scientists, 1/30/23.
[6] IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security and greenhouse gas fluxes in terrestrial ecosystems, p. 95-96.
[7] Ibid, p.95.
[8] NRDC Letter to CARB RE Recommendations for Updates of the Low Carbon Fuel Standard, 6/14/23.
[9] Lashof, op. cit.
[10] C. Malins, "Understanding the indirect land use change analysis for CORSIA", Cerulogy, Transport&Environment, 12/2019.

biofuels also produces more of the co-product soybean meal which is used as animal feed. The GTAP-BIO model predicts that farmers will substitute this cheaper feed for other feeds, while the GLOBIOM model predicts that the lower price will encourage more livestock production and hence increase demand for complementary feeds such as cereals.

389.1 cont The two models categorize land differently. In the GTAP-BIO model there is a "cropland pasture" category that refers to pasture land that was previously cropland and is easily converted back to cropland with little loss of carbon. This is the category that accounts for most of the land conversion in the US and Brazil despite any evidence to support it.[11] In Brazil the Soy Moratorium for the Amazon Region has reduced land conversions for soybean cultivation in the rainforest area, but as a result the unprotected, partially forested Cerrado Region has seen dramatic clearing of land for soy. The GLOBIOM model includes an "other natural land" category which refers to unmanaged natural land that has a lower carbon stock than forests but higher than the cropland pasture category of the GTAP-BIO model. This is the land category that absorbs much of the land conversion resulting from increased biofuel production in the GLOBIOM model. Certainly for Brazil which has accounted for over 50% of the growth[12] in soybean production since 2008 the GLOBIOM model's description of land use change is more accurate.

Recommendation 2: Cap LCFS Credits for Crop-based Biofuels Immediately

389.2 cont **In order to avoid existential threats to the global food supply, CARB must cap the volumes of biomass-based diesel eligible for LCFS credits, starting 1/1/25. The initial annual cap should be set at volume levels recorded from the end of 2020 through the beginning of 2021.** According to CARB dashboard data, this would entail setting an annual cap for renewable diesel around 800 million gallons and for biodiesel around 350 million gallons.[13] The growth rate of renewable diesel credits jumped to unsustainable levels during the second half of 2021. Annual US renewable diesel production capacity increased from under 500,000 gallons in 2017 to close to 1 billion gallons in 2020, to about 1.75 billion gallons in 2021 and about 4 billion gallons in January 2024.[14] ***There is not enough feedstock currently being grown to allow all these facilities to operate at capacity without seriously harming both global vegetable oil markets and primary forests.***[15] The US needs to scrap further expansion plans, which are being driven mostly by California's LCFS credits.

The recent increase in renewable diesel capacity is primarily the result of converting old petroleum diesel refineries to renewable diesel refineries.[16] This is an attractive option for oil companies burdened with excess refining capacity since refinery conversion to biofuels is cheaper than refinery decommissioning.[17] Hence, capping the amount of renewable diesel eligible for LCFS credits at 2020 or 2021 levels would merely result in earlier decommissioning of old, converted refineries.

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[11] Ibid, p. 9.
[12] According to FAO data Brazil contributed over 50% of the increase in global production from 2008-2021. Ritchie, Ibid, Soybean Production Chart, World, Brazil and US.
[13] California Air Resources Board, LCFS Data Dashboard.
[14] Martin, J., "Everything You Wanted to Know about Biodiesel and Renewable Diesel. Charts and Graphs", The Equation, Union of Concerned Scientists, 1/10/24.
[15] Ibid.
[16] Ibid.
[17] Ibid.

In short, the growth in US renewable diesel production capacity needs to be reversed. There is still time to prevent some of the land use conversions being encouraged by the spike in vegetable oil prices the vast increase in US renewable diesel capacity has caused.

389.3 cont An annual cap for corn ethanol should also be set around 1 billion gallons.

The importance of these caps should not be underestimated. As the World Resources Institute recently stressed: "***Because vegetable oil markets are linked globally, increased demand for vegetable oil anywhere increases deforestation pressure everywhere.***"[18]

The Union of Concerned Scientists, among many other NGOs, has called for capping the volume of crop-based biofuels that qualify for LCFS credits.[19]

> Vegetable oil is expensive, its availability is limited, and expansion is linked to deforestation, so the large-scale diversion of vegetable oil to fuel production is an especially bad idea….The predictable next step is to move vegetable oils from renewable diesel production to jet fuel production; claiming generous tax credits while still generating Renewable Fuel Standard (RFS) and LCFS credits….The oil industry was once the primary opponent of the LCFS but they have found a way to work the system to their advantage.[20]

Based on the conviction that any increase in the supply of crop-based renewable diesel or biodiesel creates too much pressure to convert more land to agriculture, especially in the tropics, the EU government disallowed these fuels from counting toward recently mandated carbon emission reductions in the aviation and maritime industries. This exclusion includes intermediate crops, palm fatty acid distillates and all other palm- and soy- derived materials as well. The EU regulations for the aviation and maritime industries require **all** food- and feed crop-based fuels to assume the same emission factors as the least favorable pathway.[21]

CARB has proposed to deal with the deforestation risk associated with increasing renewable diesel and other crop-based biofuels by requiring independent feedstock certification for crop-based pathways. This would require tracking crop-based feedstocks back to their point of origin to verify that they were not produced on recently deforested cropland. The Union of Concerned Scientists clarifies why this is not a solution:

> Tracking the chain of custody won't work because there is more than enough soybean oil produced on existing cropland in the US, Argentina and Brazil to produce 100 percent of California's diesel fuel. The problem with chain of custody is that California won't be tracking the chain of custody of vegetable oils being used to replace those diverted from global markets.[22]

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[18] D. Lashof, op. cit.

[19] Martin, A Cap on vegetable oil based fuels, op. cit.

[20] Ibid.

[21] C. Baldino, "Provisions for Transport fuels in the European Union's finalized "Fit for 55" package", International Council on Clean Transportation Policy Update, July 2023, p. 6 and 8.

[22] Martin, op. cit.

China and India are large importers of soybeans and vegetable oils; they will become the buyers of the crops produced on newly converted natural lands.

When the EU adopted caps on crop-based biofuels in 2018, the EU Commission pushed for more stringent caps. While it could not convince the heavily lobbied EU Parliament to adopt them, countries were given the option of setting lower caps and subtracting any cap reduction from their overall road transport emissions reduction target. Several EU countries have adopted lower caps for crop-based biofuels. Germany's cap is about 40 percent lower than the EU cap, Spain's 50 percent lower, Finland's and Estonia's about 65 percent lower, and the Netherlands 80 percent lowerCountries were also given the option of not allowing high Indirect Land Use Change (ILUC) feedstocks to count towards their mandated emissions reductions targets.[23] So far only palm oil has been designated a high ILUC feedstock; hence it will not be allowed to count towards any EU country's emission reduction targets after 2030. But countries have been permitted to exclude both palm oil- and soybean oil-based biofuels from counting towards their mandates. France, the Netherlands and Denmark have all excluded both palm oil- and soybean oil-based biofuels from credits.[24] Discussions as to whether soybean oil-based biofuels should also be officially classified as a high ILUC feedstock are ongoing.[25]

Recommendation 3: Phase out LCFS credits for crop-based fuels by 2030

389.4 cont **Cropland must be reserved for growing crops for people and animals. Our goal needs to be halting all conversion of natural land to agriculture despite population and income increases.[26] Instituting declining annual caps for crop-based biofuels is crucial to attaining this goal.**

World population, slightly over 8 billion at the end of 2023, is forecast to increase to 8.5 billion by 2030 and 9.7 billion by 2050.[27] Per capita calorie intakes are trending upward for both developed and

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[23] According to a supplemental regulation of the EU's second Renewable Energy Directive (RED II) "ILUC can occur when land previously devoted to food or feed production is converted to produce biofuels, bioliquids and biomass fuels. In that case, food and feed demand still need to be satisfied, which may lead to the extension of agricultural land into areas with
high carbon stock such as forests, wetlands and peat land, causing additional
greenhouse gas emissions…. Renewable fuels made from {oil crop} feedstocks are therefore widely considered as having a higher ILUC-risk…these crops are also...responsible for an overwhelming majority of the observed worldwide expansion of the production area of food and feed crops into land with high-carbon stock." EU criteria for determining feedstocks with high ILUC risk include "(a) the average annual expansion of the global production area of feedstock since 2008 is higher than 1% and affects more than 100,000hectares; (b) the share of such expansion into land with high-carbon stock is higher than 10%".

[24] Lieberz, S. and Rudolf, A., Biofuel Mandates in the EU by Member State–2023, Foreign Argicultural Service, USDA, 7/6/23,

[25] The global area harvested for soybeans increased 2.9% per year on average from 2008 to 2021, meeting the EU's first condition referred to above in footnote 13. According to a Transport&Environment briefing "Is soy the new palm oil?" in November 2020 there is data showing that this expansion into high-carbon stock land has been greater than 10%, meeting the second condition cited in footnote 13.

[26] Hanson, C. and Ranganathan, J., How to Manage the Global Land Squeeze? Produce, Protect, Reduce, Restore, World Resources Institute, 7/20/23.

[27] UN, Global Issues, Population, medium variant projection.

developing countries.[28] The global demand for vegetable oil and meat is growing especially fast.[29] Yield increases have not kept up with the increased demand for food.

The IPCC 2019 Special Report on Climate Change and Land estimated that "around" 2015 only 9 percent of all global land was primary forest and 7 percent unused grassland or wetlands, forests managed for timber, or other uses, accounted for 22 percent of global land, used grazing land for 37 percent, cropland for 12 percent and barren wilderness 12%.[30] It also set a large goal for the world, suggesting that **"Maintaining the resilience of biodiversity and ecosystem services at a global scale depends on effective and equitable conservation of approximately 30–50% of Earth's land, freshwater and ocean areas, including currently near-natural ecosystems."[31]** Unfortunately**,** the UN Food and Agriculture Organization (FAO) estimates that the world is currently losing an average of 10 million hectares per year to deforestation.[32] Natural grasslands may be disappearing at an even faster rate. The IPCC identifies preventing further deforestation as one of the most substantial policies available for reducing carbon emissions, able to deliver additional reductions of 4GtCO2e/yr by 2030.[33] Currently, forests absorb about 11GtCO2e/yr but annual forest conversions for agriculture increase carbon emissions by about 5 GtCO2/yr, leaving net removal of carbon by forests at about 6GtCO.[34]

Though the task appears daunting, the world's intent to preserve nature has been expressed. In 2022 at the Convention on Biological Diversity Conference, the US and most other countries pledged to identify, eliminate, phase out or reform subsidies harmful to biodiversity.[35] This would include California LCFS incentives for crop-based biofuels. The US also signed the Declaration on Forests and Land Use at the 2021 United Nations Climate Change Conference, which commits countries to halting and reversing global deforestation and land degradation by 2030.

The IPCC's Climate Change 2023: Synthesis Report recognized the many competing demands on land and the inherent conflicts between crop-based biofuels, food security, water security, biodiversity and forest conservation.[36] But the report highlighted that the mitigation pathways that limit global warming to 1.5 or 2 degrees C all **rely on emission reductions proceeding the fastest in the land use change sector** by halting deforestation and restoring recently deforested areas, "with reduced deforestation in tropical regions having the highest total mitigation potential"[37].

389.4 cont **Eliminating incentives for crop-based biofuels could prove to be one of the world's best opportunities for stopping the conversion of natural land to agriculture.** The dollar value of LCFS credits that have

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28 Economic Research Service, US Department of Agriculture, "Feeding the world: Global food production per person has grown over time", Chart Gallery.

29 Per capita consumption of meat and vegetable oil has more than doubled since the early 1960s. IPCC 2019: Climate Change and Land, p. 86.

30 Ibid., p.85.

31 IPCC Synthesis Report, op. cit., p. 73.

32 UN Food and Agriculture Organization, Forest Resources Assessment, Annual Deforestation, 2015-2020, Our World in Data.

33 Ibid, p.69.

34 IPCC, Special Report on Climate Change and Land, op. cit.,p. 10.

35 Target 18 in UN Convention on Biological Diversity, "COP15: Final Text of Kunming-Montreal Global Biodiversity Framework", 12/22/22.

36 IPCC, Climate Change 2023: Synthesis Report, Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Geneva, Switzerland, 2023.

37 Ibid, p. 58 and p.73.

been received by crop-based biofuels is large. Over half of all LCFS credits from 2011-2022, worth about
389.4 cont $22 billion in 2023 dollars, went to providers of crop-based fuels.[38] Last year approximately $2 billion worth of LCFS credits went to suppliers of crop-based fuels.[39]

Recommendation 4: Put Caps on LCFS Credits for UCO and Tallow

389.5 cont **CARB should cap the volumes of used cooking oil (UCO) and tallow eligible for LCFS credits, starting in** 389.6 cont
2025 when caps on crop-based fuels are introduced. The low CI scores of UCO encourage fraud**,** such as the mislabeling of either pure vegetable oil or UCO-vegetable oil mixtures as UCO. Capping crop-based diesel volumes without capping UCO volumes increases the likelihood of this happening.

UCO, often referred to as yellow grease, and category 3 tallow, the largest and cleanest category of tallow, are used for animal feed, pet food, cooking oil, cosmetics, soaps and lubricants. Category 2 tallow is clean enough to be used for some of these purposes. Because global tallow and UCO supplies are not easily increased, when they are used for biofuels the demand for vegetable oils, especially palm
389.5 cont oil which is often the cheapest substitute, increases.

The UCO content share in the renewable diesel consumed in California has grown rapidly over the last few years, raising questions about its authenticity. A certification requirement, similar to the one used in the EU, regarding the origin of the tallow and UCO might be helpful.[40] However, substantial fraud in UCO imports to the EU despite such a certification scheme suggests that this alone will not solve the fraud problem.[41] Caps are needed to curb fraud.

The EU has capped the amount of UCO and tallow that can count toward its transportation mandates in 2030 at about 12%.[42] Both Germany and France have already introduced similar caps. LCFS caps should probably be at least this stringent since importing UCO and category 3 tallow should not be encouraged. They are already sought after to meet local needs.

389.6 cont There has been some concern about the recent decline in LCFS credit prices. Since the oil refiners who must buy credits to balance their deficits are now receiving substantial credits for the renewable diesel they are producing, overall credit demand is decreasing. Without guardrails in place any decrease in the carbon intensity benchmark will just further depress credit prices by encouraging even greater renewable diesel production. Declining caps on crop-based renewable diesel and fixed caps on UCO and tallow should help to increase credit prices.

Recommendation 5: Consider eliminating tallow pathways from the LCFS

Tallow provides another example of the danger of giving very different CI scores to different
389.7 cont commodities that resemble each other. Under EU transportation regulations (RED III) Category 3 tallow receives a carbon intensity score similar to that of seed oils. Category 1 and 2 tallow, on the other hand, because they carry some health risk are eligible for double credits, essentially halving their CI scores. But any increase in the demand for category 1 and 2 tallow may result in the downgrading of category 3

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38 Velez,K., CARB Must Reform LCFS Program to Meet Climate Goals, Expert Blog, NRDC, 8/23/23.

39 California's Low Carbon Fuel Standard Update, BioCycle, 12/19/23.

40 UCS, A Cap on Vegetable Fuels…., op.cit.

41 S. Carroll, "Biofuel certification schemes slammed for failing to halt fraud", Euractiv, 2/1/24.

42 Lieberz, op. cit., p. 7. A 1.7 percent cap for UCO and animal fats out of a 14.5 percent transportation sector greenhouse gas intensity reduction target.

tallow. If a small amount of category 1 comes in contact with category 3 the entire batch of category 3 tallow must be downgraded to category 1.

389.7 cont

Germany has excluded tallow-based diesel from meeting its transportation mandates even though EU regulations allow it. Germany decided that "using these materials for biofuels displaces them from uses in industry and leads to indirect GHG emissions". So categories 1 and 2 tallow continue to be burned for energy at rendering plants and category 3 tallow continues to be used for other needs.

Recommendation 6: Hold off on increasing LCFS stringency

389.8 cont

CARB should not lower the LCFS carbon intensity benchmark more quickly, as outlined in its proposed amendments, until it has time to assess how caps on lipid feedstock biofuels are working. The recent rapid increase in renewable diesel production in the US spurred on by California's LCFS program has sent US soybean and soybean oil exports tumbling and global soybean oil prices climbing. Global soybean prices almost doubled from 2020-2022.[43]

CARB's proposal to lower the carbon intensity benchmark at a faster pace is irresponsible and unsustainable without safeguards in place. CARB's GTAP model, though frequently refined, has not been adapted to reflect the greater knowledge available about unsustainable land use conversion and its link to the greater use of crop-based alternative fuels.

Recommendation 6: Consider the negative environmental effects not taken into account by models used to estimate a fuel pathway's CI when deciding whether a pathway should receive LCFS credits

389.9 cont

Many negative environmental impacts of crop-based alternative fuels are not considered when carbon intensity scores are calculated by CARB. These effects should be identified, monitored, and measured. This exercise could help to clarify which pathways need to be removed from the LCFS.

Negative Environmental Effects of Biofuels on US agriculture:

(1) Crops grown for the production of ethanol (corn) and biodiesel and renewable diesel (soybeans) cover at least **20 percent of the entire US cropland acreage**, according to the USDA's Census of Agriculture 2017 (results from the 2022 Census are not yet available).[44] The 2017 Census indicated that 320 million acres of cropland were harvested in 2017. Over half of the harvested acres were planted in either corn (almost 91 million acres) or soybeans (90 million acres). According to the USDA's Economic Research Service 45 percent of corn harvested in the US is used to produce ethanol and about 21 percent of soybeans harvested is used to produce biofuels.[45] Hence, about 41 million acres are being used annually to grow corn to produce ethanol and 19 million acres to grow soybeans for biodiesel or renewable diesel, suggesting that 60 million acres, almost one fifth of cropland, is being used to grow crops for biofuels. The amount of US cropland acreage used to produce biofuels is currently increasing. While the US has historically exported about half of its soybean crop, soybeans and their derived product exports have dropped significantly recently, as domestic renewable diesel production has increased. Also, in mid 2023, for the first time over 50 percent of US produced soybean oil was

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[43] Statista, Average prices for soybean oil worldwide from 2014-2025.

[44] National Agricultural Statistics Service, "Table1. Historical Highlights: 2019 and Earlier Census Years", US Department of Agriculture.

[45] Economic Research Service, "Feed Grains Sector at a Glance", US Department of Agriculture.

used to produce biofuels.[46] Exports of soybean meal, the co-product of soybean oil, on the other hand reached record levels.

(2) Corn and soybeans grown to produce biofuels are major contributors to the **worsening biodiversity crisis in rural areas in the US**. The massive use of corn and soy output for biofuel production in the US has fostered a monoculture system of farming which has degraded soils and eliminated complex insect, bird and plant communities. Not only has this monoculture system reduced soil fertility it has reduced the ability of the ground to absorb water either for crops or aquifer recharge. Since corn and soy farmers do not require pollinators to produce their crops, the loss of bees and other pollinators in rural areas has not been a large concern to them, but has been a problem for other farmers. Crop-based biofuels and the monoculture they have encouraged have contributed mightily to the destruction of nature in our rural areas.

(3) Corn and soybeans grown to produce biofuels are major contributors to the **pollution of ground and surface water in the US.** Fertilizers are responsible for substantial ground and surface water pollution. The Farm Bureau estimates that about half of the fertilizer (nitrogen, phosphate and potash) consumed annually in the US is used to grow corn, another 10% is used to grow soybeans.[47] This suggests that 22 percent of the all the fertilizer used on crops in the US is used for corn to produce ethanol, and over 2 percent is used for soybeans to produce biofuels, i.e. **almost one fourth of synthetic fertilizer use in the US is used on crops grown to produce biofuels.**

389.9 cont

(4) In addition, recent USDA NASS Chemical Use Surveys showed that corn farmers applied almost 2 pounds of herbicides per acre in 2021 and soy farmers almost 1.5 pounds of herbicides per acre in 2020. Corn and soy have traditionally been the **greatest users of pesticides per acre** (including insecticides and fungicides as well as herbicides).

(5) Corn and soybeans grown to produce biofuels are major contributors to the **unsustainable withdrawal of water from US aquifers**. The 2017 Census of Agriculture reported that 54 million acres of cropland were irrigated in 2017. (See Historical Census Table 1: 2017 and earlier years, NASS, USDA) The crop with the most irrigated acreage was corn which accounted for 12 million acres of irrigated cropland. Soy acreage was second with 9 million acres irrigated.[48] This suggests that 5.4 million acres of corn were irrigated to produce ethanol and 1.9 million acres of soy were irrigated to produce biofuels; or 13.5 percent of total irrigated acreage was used to produce biofuels. Increasingly, the source of water for irrigation is groundwater rather than surface water. As droughts are forecast to increase, the US will need to rely more on irrigation for both corn and soybeans. The Ogallala-High Plains Aquifer extends from South Dakota to Texas and provides water for eight states, but it is being depleted at an unsustainable rate. **Irrigation is responsible for 90 percent of Ogallala groundwater withdrawals.**

(6) The production of ethanol, biodiesel and renewable diesel from corn and soybeans are also major users of water. The production of water requires more water than the production of gasoline, requiring 3 gallons of water for every gallon of ethanol produced, compared to 2-2.5

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[46] Bukowski, M. And Swearingen, B., "Oilcrops outlook: September 2023", Economic Research Institute, US Department of Agriculture.
[47] Myers, S., Too Many to Count: Factors Driving Fertilizer Prices Higher and Higher, Farm Bureau, 12/13/21.
[48] Economic Research Service, USDA, Irrigation and Water Use.

gallons for gasoline. Most ethanol producers are located in the Midwest and rely on the Ogallala-High Plains Aquifer for their water needs.

In conclusion, when all the negative environmental consequences of the LCFS are considered it is clear
that all credits for crop-based biofuels should be eliminated as soon as possible, but definitely no later
than 2030. Credits for digester biogas should also be eliminated. These credits are encouraging
389.10 expansion of the dairy industry which is responsible for substantial air and water pollution; the industry
should be fined, not subsidized. Liquid or gas transportation fuels should no longer be receiving large
subsidies. Rather subsidies should be reserved for accelerating the electrification of transportation,
389.11 expanding the grid to enable faster connection of solar and wind energy and protecting natural land so it
can better absorb carbon emissions.

Thank you for considering these comments. If you would like to discuss them on the phone or on Zoom, we would be very happy to meet with you.

Sincerely,

Pamela Brig McKown

Daniel Chandler

Comment Log Display

Here is the comment you selected to display.

Comment 399 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Angela
Last Name	Richards
Email Address	arichards@monarchtractor.com
Affiliation	
Subject	Comments in anticipation of the Public Hearing to Consider Proposed LCFS Amendments
Comment	Please see attached letter.
Attachment	www.arb.ca.gov/lists/com-attach/7084-lcfs2024-W2lXf1xvUzBQCVc7.pdf
Original File Name	2.20 LCFS Comments Monarch Tractor.pdf
Date and Time Comment Was Submitted	2024-02-20 23:47:19

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

MONARCH

Address: 151 Lawrence Dr., Livermore, CA 94551, USA
Website: www.monarchtractor.com
Phone Number: (833) AGRI-PWR

February 20th, 2024

Cheryl Laskowski, Ph.D.
California Air Resources Board
1001 I Street
Sacramento, CA 95814

Subject: Monarch Tractor Comments in anticipation of the Public Hearing to Consider Proposed Low Carbon Fuel Standard Amendments

Dear Dr. Laskowski,

390.1 Monarch Tractor appreciates the opportunity to submit comments regarding the potential transition of the Clean Fuel Reward to include heavy-duty vehicles not covered by the advanced clean fleets rule. While this is a step in the right direction, we believe that CARB should also consider expanding the Clean Fuel Reward to include zero-emission vehicles manufactured for use in the off-road sector.

Incentives and funding for driver-optional, electric tractors align with CARB priorities.
Like medium- and heavy-duty trucks, off-road vehicles like agricultural tractors are challenging to decarbonize. EV Tractors, like Monarch's MK-V and New Holland's recently introduced T4E, are not included in the current Advanced Clean Fleets regulations and are an ideal addition to Clean Fuel Reward eligibility.

While many off-road EVs, including agricultural tractors, are relatively new to the market, a considerable amount of funding is allocated to the early stages of commercialization for these technologies through demonstration and pilot programs. Recent changes to California's State Budget and CARB programming has greatly reduced the funds available for programs that encourage early market adoption – notably CORE.

The significant reduction of programs like CORE creates a gap in the adoption cycle for EV equipment. Consumers desire a chance to test out new technology before making a commitment to integrate it into their operations in place of legacy diesel. This is especially true in the agricultural sector. Farmers will only agree to scrap existing diesel equipment in their fleets once they've validated that EV equipment will work in their operations. This is why we urge CARB to consider including eligibility for electric off-road vehicles, including tractors, within the proposed Clean Fuel Reward regulations. This will help fill the gap and accelerate a shift towards utilization of scrap and replace programs like Carl Moyer and FARMER leading to greater decarbonization of California's medium- and heavy-duty fleets.

Address: 151 Lawrence Dr., Livermore, CA 94551, USA
Website: www.monarchtractor.com
Phone Number: (833) AGRI-PWR

About Monarch Tractor
Monarch Tractor is an innovative, mission-driven company headquartered in Livermore, California developing driver-optional electric tractors. We are committed to enabling clean, efficient, and sustainable farming practices by making them economically viable. The Monarch MK-V Tractor - which is commercially available today - brings together the benefits of electrification, smart technology, and insightful data to enable farmers to transition to more productive, precise, and sustainable farming practices. Providing a superior platform for farmers, Monarch Tractor is focused on delivering meaningful change for today's farmers and the generations of farmers yet to come.

Monarch's MK-V compact tractor is an attractive platform for significantly reducing criteria and greenhouse gas emissions in the agricultural sector. The compact tractor segment offers the opportunity for some of the most significant and cost-effective diesel emissions reductions due to its high volume, high utilization, and significant annual growth.

Monarch Tractor offers a zero-compromise solution, including equal or greater performance compared to even the most advanced diesel tractors. A swappable battery assembly enables near continuous operation and allows operators to recharge during non-peak rate hours. Autonomy adds the benefit of worker safety – from keeping humans out of the fields when air quality is hazardous to keeping workers safe with human detection and auto braking.

Thank you again for the opportunity to submit comments prior to this hearing and to provide input on potential changes to the LCFS program and Clean Fuel Reward. Please don't hesitate to contact us if you have any questions at impact@monarchtractor.com.

Thank you,

Praveen Penmetsa
CEO and Co-Founder
Monarch Tractor

Comment Log Display

Here is the comment you selected to display.

Comment 400 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Colin
Last Name	Murphy
Email Address	cwmurphy@ucdavis.edu
Affiliation	UC Davis Policy Institute

Subject	Comments on LCFS 45 Day Amendment Package

Comment

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Hello,

On behalf of my colleagues at the UC Davis Policy Institute, pleas
find attached a ZIP file with out comment letter, and three recent
reports on LCFS modeling.

Please do not hesitate to reach out if there are any questions.

Thank you,

Colin Murphy
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Attachment	www.arb.ca.gov/lists/com-attach/app-zip/7085-lcfs2024-Wi9QNQNdAzRXMAF3.zip
Original File Name	UC Davis LCFS Comments and Material - 20 Feb 2024.zip

Date and Time Comment Was Submitted	2024-02-20 23:54:04

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POLICY INSTITUTE FOR ENERGY, ENVIRONMENT, AND THE ECONOMY

20 February, 2024

State of California, Air Resources Board
Industrial Strategies Division, Transportation Fuels Branch
California Air Resources Board
1001 I St.
Sacramento CA, 95814

Re: Proposed Low Carbon Fuel Standard Amendments

Dear LCFS Staff:

Thank you for the opportunity to comment on the ideas and materials related to current rulemaking to amend the Low Carbon Fuel Standard (LCFS). The University of California, Davis Institute of Transportation Studies, and the Policy Institute for Energy, Environment, and the Economy have been engaged in research, policy analysis, and technical assistance relating to the LCFS since it was first developed, over 15 years ago. Since then, it has become a critical part of California's robust portfolio of climate policies 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 would continue 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]

2024 marks a critical juncture in the evolution of California's climate policy. Impacts of anthropogenic warming are being felt by Californians today and these will only intensify as time progresses. California's climate policy portfolio has been a global gold standard, and many policies around the world are modeled after concepts developed here, notably the LCFS. To maintain this leadership, California's policy portfolio must recognize that it is transitioning to a new phase in its journey to carbon neutrality. Efforts to date have largely sought to develop scalable, cost-effective alternatives to fossil fuels, and these efforts have had some success. Now, the critical task is to rapidly and efficiently deploy them, balancing the need to reduce GHGs as rapidly as possible with the desire to find the best pathway to achieving carbon neutrality. The approaches that have effectively guided California's climate policy through its first one and a half decades may need to be updated to ensure they're suited for the decade to come. The 2024 LCFS rulemaking is among the first opportunities for reflection and review of existing tools, California is ready to meet coming challenges, and to ensure that our model can continue to be emulated by others.

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

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. These comments are presented in the spirit of UC Davis' and the Policy Institute's mission to bring science into the policy process. Neither UC Davis nor the Policy Institute seek a specific policy outcome; these comments are offered to help California meet its climate, environmental, and equity goals.

The first part of these comments will relay conceptual or high-level thoughts, with an extensive discussion of the scientific and policy considerations that surround each. These issues may span many sections of the LCFS regulation and/or multiple proposed amendments. The second part will discuss specific proposed amendments or elements of existing code and discuss issues directly pertaining to those sections.

Part 1: Comments on General Program Design

Renewable Diesel Capacity Growth and 2030 Targets

Updates Since 2023 Report

Policy Institute researchers conducted several analyses of the LCFS, proposed target levels, program design scenarios, and market conditions over the last two years using our Fuel Portfolio Scenario Model (FPSM). This has led to the publication of two recent reports related to the LCFS and issues affected by this rulemaking, an initial report issued in late 2023, and an update released very recently.[2] These reports evaluated scenarios relating to a variety of program targets and other proposed amendments (in the case of the 2023 report, insufficient detail was available to evaluate some amendments) to help understand the likely impacts on the LCFS credit market, fuel supplies and emissions. Of particular interest was the decline in LCFS credit prices and the related accumulation of banked credits since late 2020. This is due to a combination of factors, including structural over-supply of the market, strong support for some biofuels from the Federal Renewable Fuel Standard, precipitous declines in gasoline consumption due to the COVID-19 pandemic, and the rapid deployment of hydrotreated renewable diesel (RD) into the California fuel market.

Significant data have emerged since the 2023 modeling work was completed that fundamentally altered the landscape in LCFS credit markets and led us to revise the conclusions of the 2023

[2] **Initial report**: Ro, J., Murphy, C. W, & Wang, Q. (2023). Fuel Portfolio Scenario Modeling (FPSM) of 2030 and 2035 Low CarbonFuel Standard Targets in California. *UC Office of the President: University of California Institute of Transportation Studies*. http://dx.doi.org/10.7922/G2S46Q8C Retrieved from https://escholarship.org/uc/item/6f2284rg
2024 update: Murphy, C., & Ro, J. (2024). Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking. *UC Davis: Policy Institute for Energy, Environment, and the Economy*. http://dx.doi.org/10.7922/G25719BV Retrieved from https://escholarship.org/uc/item/5wf035p8

report. These are laid out in depth in the 2024 modeling update paper published on February 16th.[3] In particular, the Department of Energy projections of the U.S. RD capacity deployment from 2021 turned out to be significant underestimates (Figure 1). The 2021 projection of RD capacity that served as the basis for our assumptions and modeling of RD turned out to underestimate actual 2022 capacity deployment by roughly 35%.[4,5] California has historically accounted for the vast majority of the U.S. RD consumption, and this trend continued through 2023, reflected in rapid increases in RD consumption under the LCFS. The most recent 4 quarters for which LCFS data are available (Q4 2022 through Q3 2023) show a 40% increase in RD consumption compared to the four quarters before that, from 1.3 billion to 1.8 billion gallons. It is especially noteworthy that this growth occurred during a period of historically low LCFS credit prices, and before two major California refineries finished conversions to process biofuels instead of petroleum. These projects have a total nameplate capacity of 1.7 billion gallons per year (one is currently operating at approximately 120 million gallons per year) and are expected to bring a large fraction of that capacity on-line in 2024. This, combined with continued growth elsewhere in the U.S. implies that the RD growth trend observed in recent data is likely to continue for at least the next several years.[5]

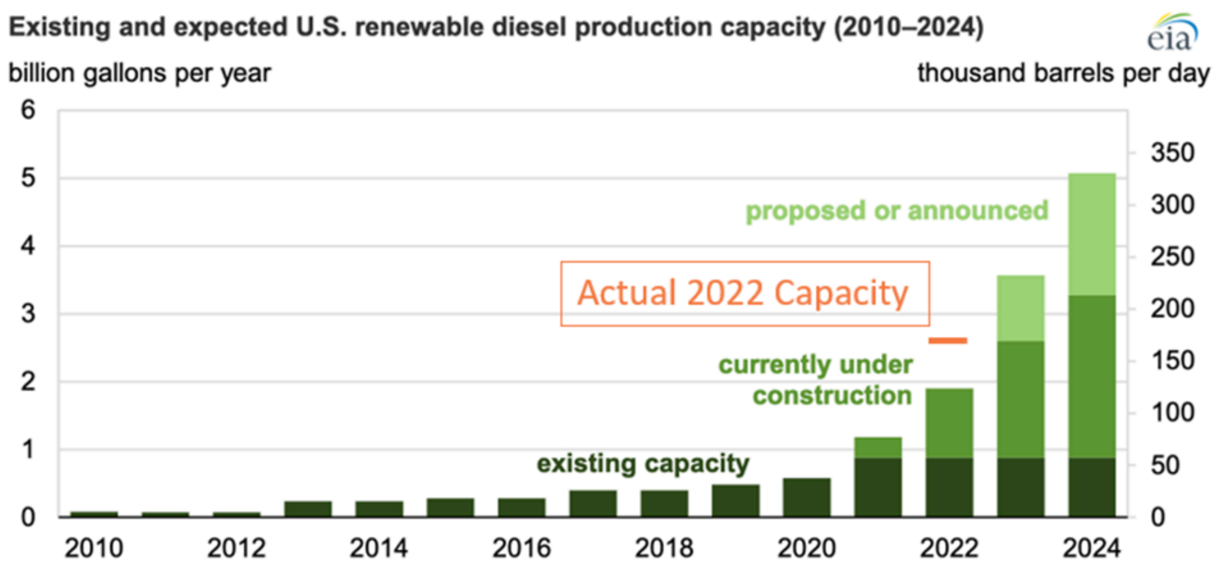

Figure 1. Source: 2021 Projection of renewable diesel deployment in the U.S. from the Energy Information Administration. EIA has since updated the information using 2023 data; actual 2022 capacity marker added by authors based on that source.[4,5] Renewable diesel capacity deployment has dramatically outpaced recent expectations. The majority is consumed in California due to the LCFS incentive.

[3] Murphy & Ro (2024) https://escholarship.org/uc/item/5wf035p8

[4] EIA, U.S. renewable diesel capacity could increase due to announced and developing projects - U.S. Energy Information Administration (EIA) (2021). https://www.eia.gov/todayinenergy/detail.php?id=48916.

[5] EIA, Domestic renewable diesel capacity could more than double through 2025 - U.S. Energy Information Administration (EIA) (2023). https://www.eia.gov/todayinenergy/detail.php?id=55399.

Taken together, these data paint a picture of an extensive pool of RD at the U.S. level, with capacity expected to significantly exceed 5 billion gallons per year by the end of 2025. This capacity can readily enter the California market, even with LCFS credits at relatively low levels. Obligated parties in the LCFS therefore have a readily available source of low-cost compliance credit via RD; absent a significant drop in RFS support or a significant increase in RD production costs. So long as low-cost RD is readily available, it will continue to enjoy a significant competitive advantage until either the supply available at low LCFS credit prices is exhausted or California's market for diesel is fully saturated. RD's strong growth trend indicates that the former condition is unlikely to occur in the near term (especially given incentives at the federal level), and the ability of RD producers to shift part of their output to hydrotreated alternative aviation fuels (commonly referred to as sustainable aviation fuel, or SAF, though not all forms of hydrotreated alternative jet fuels are truly sustainable) means the latter is unlikely to occur as well. So long as these conditions persist, and there is no restriction on the ability of RD and SAF to enter the California market and supply LCFS credit, these fuels will continue to set the prevailing market price for LCFS compliance credit. As long as this is the case, it is unlikely that higher LCFS targets will significantly increase the LCFS credit price.

For this reason, the conclusion we reached in the 2023 report, and articulated in previously submitted comment letters no longer holds.[6] Based on the revised data, the proposed 30% 2030 target, with 4.5% annual target increases, the implementation of the Automatic Acceleration Mechanism (AAM), and other proposed amendments are not likely to bring the credit market back into approximate balance between credit and deficit generation before 2030, or quickly enough to not likely trigger an additional AAM after 2030 . Without achieving a balance, it is unlikely that the LCFS credit price will significantly increase.

Results of Updated FPSM Modeling of Proposed Amendments

Figure 2 (next page) presents results of FPSM modeling of the proposed LCFS amendments, updated to reflect the recent data on RD deployment in the U.S. Given the ready availability of RD, discussed above, we project persistent annual credit surpluses in excess of 5 million credits until 2030. These surpluses would continue to expand the bank, leading to two AAM triggering events, at the earliest possible opportunities (2027 and 2029, resulting in additional target escalation in 2028 and 2030). This results in a 39% LCFS target in 2030. Despite this rapid increase of target levels, the credit bank remains high enough to meet the first AAM trigger criteria, with banked credits more than 3 times greater than average quarterly deficits, though not the second one, since projected deficits exceed credits for 2031-2035. With such a credit bank, if annual credits exceeded annual deficits in any of the years 2031-2035, the AAM would trigger the following year and cause another increase in target level.

[6] Including Policy Institute comments on the July 7, 2022, November 9, 2022, and February 22, 2023 workshop. Comments and material unrelated to target levels or projections of credit market balance remain unaffected.

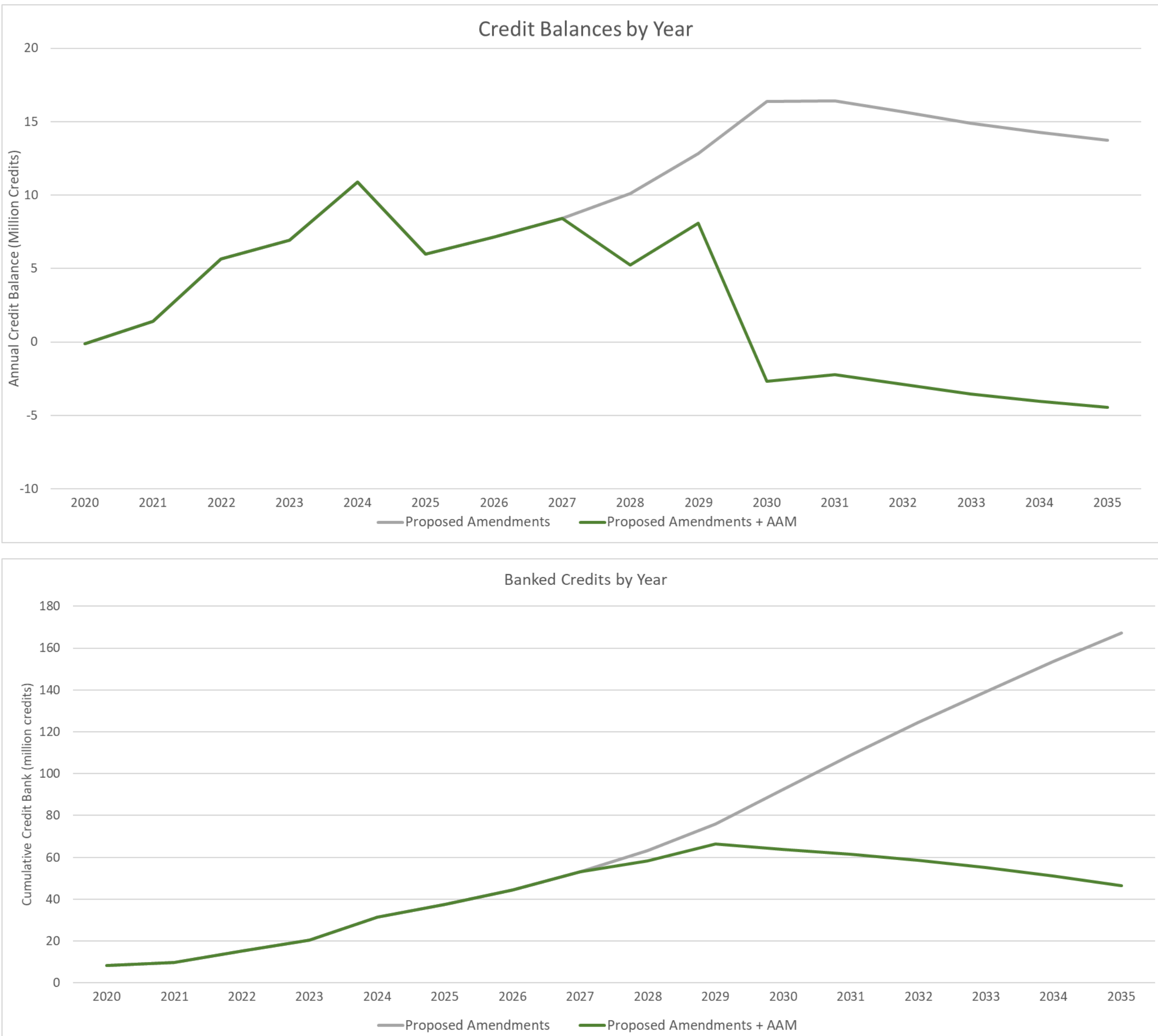

Figure 2: (a, above) Yearly net credit balances and (b, below) net banked credits from updated FPSM modeling of LCFS through 2035. The updated scenario with proposed amendments is projected to trigger the AAM twice, in 2027, and 2029. Source: Murphy & Ro (2024)

These results support the idea that the proposed amendments are unlikely to lead to a significant increase in credit price. In addition to RD effectively establishing a low marginal cost of compliance, as discussed above, the projections suggest aggregate banked credits in excess of yearly deficit generation through 2035; these conditions are not conducive to a significant recovery in credit price. The multiple AAM triggering events, however, could significantly increase the LCFS impact on gas prices to consumers. At a 39% target, the level implied in 2030 by FPSM modeling of the proposed amendments, and a $50 credit price (lower than present prices, which are widely regarded as too low to support needed deployment of innovative low-carbon fuels), the theoretical gas price impacts are around 21 cents per gallon. A $100 credit price would double that impact. In 2030, over three-quarters of California's light duty (LD) vehicles will rely on gasoline internal combustion engines (ICE), meaning that their owners will be exposed to any gas price increases. Given the common expectation that the transition to electric vehicles (EVs) will occur most rapidly among higher income earners, the greater gas price impacts implied by multiple AAM triggering events may magnify potentially regressive impacts on lower-income drivers.

Implications of Updated Modeling for Proposed LCFS Amendments

While a continually increasing LCFS target is necessary to support deep decarbonization of California's transportation fuel pool, an appropriate balance must be struck between arriving at the maximum feasible pace of decarbonization and minimizing the economic impacts of future target increases, especially where they may be regressive. Once consumers are able to switch to EVs or other low-carbon fuels, they are no longer exposed to policy-driven price impacts. Given the very rapid transition of California's LD vehicle fleet expected in the 2030's, due largely to the Advanced Clean Cars 2 rule and programs adopted by California to support EV deployment and clean mobility options in lower-income communities, the risk of regressive impacts from gas price increases would be expected to decline over time. As a result, delaying the onset of higher LCFS targets could mitigate the regressive cost risks. Previous modeling studies have demonstrated that a LCFS target level of 30% is compatible with California's long-run carbon neutrality goals.[7]

Based on the updated FPSM modeling, we now conclude that the proposed amendments are not likely to lead to stabilization of the LCFS credit market, or a recovery by the credit price. Increasing the program's target in 2030 and beyond may reduce annual credit surpluses, or marginally increase credit price, but are unlikely to support significant and sustained credit price recovery. The presence of a large pool of RD (and to a lesser extent, hydrotreated SAF) at the national level likely establishes a low minimum marginal cost of near-term LCFS compliance. So long as these fuels can freely enter the California market, this balance is likely to persist. By the time that the AAM becomes active, the growth of RD could create a credit bank of sufficient size that it will take many years to draw down, even with multiple AAM triggering events. Restricting
391.1 the ability of RD to maintain its present growth trend in California would likely return the market
to conditions more conducive to a stable LCFS credit market under LCFS targets at or around

[7] Brown, A. L; Sperling, D.; Austin, B.; DeShazo, JR; Fulton, L.; Lipman, T.; Murphy, C., et al. (2021). Driving California's Transportation Emissions to Zero. *UC Office of the President: University of California Institute of Transportation Studies*. http://dx.doi.org/10.7922/G2MC8X9X Retrieved from https://escholarship.org/uc/item/3np3p2t0

those suggested by the proposed amendments (see *Capping or Restricting the Continued Growth of Lipid- or Crop-based Fuels*, below).

Sustainability Challenges From Growing Consumption of Lipid-Based Biofuels

Sustainability Considerations Associated With Lipid Feedstocks

The extremely rapid deployment of RD into California's fuel market creates challenges for the stability of the LCFS credit market, as described above. In addition, this rate of growth poses significant sustainability risks as well, especially with regard to indirect land use change (ILUC). The LCFS includes a Land Use Change adjustment value applied to certain biofuels, this increases their CI score, thereby reducing the amount of incentive per gallon. Biofuels using wastes or residues, such as used cooking oil, tallow, or technical corn oil (a byproduct of ethanol production) receive significantly lower CI scores than those made from crop-based feedstocks, thereby increasing their typical per-gallon LCFS incentive. Despite this significant financial incentive to prefer non-crop based fuels, fuels made from soybean and canola oils have grown markedly in recent years. Consumption of biodiesel and renewable diesel from soybean and canola oils grew by over 45% between 2021 and 2022. The first three quarters of 2023 alone have seen total soybean and canola oil fuel consumption grow by over 30% compared to all of 2022; annualizing the 2023 data suggest a year-on-year growth rate in excess of 70%. This is significantly faster than the growth of biodiesel and renewable diesel as a whole.

To support these rates of growth, the availability of feedstock must rapidly grow as well. Biodiesel and current forms of renewable diesel are almost exclusively made from lipids - fats, oils, and greases - that are in some cases wastes or residues of other agricultural or industrial processes and in others, crop-based vegetable oil. These lipids, including most of the nominally waste or residue oils, were historically used in a variety of applications, including human consumption, animal feed, and the production of soap, cosmetics, or other industrial chemicals. Only a small fraction of wastes or residues is typically disposed of without some other value-generating use. Biofuel production can utilize almost any form of lipid, and since fuels using waste or and residue feedstock typically receive higher incentives per gallon in the LCFS and some other programs, they are often the preferred feedstock for biofuel producers. Previous users, who find their supply of wastes or residues now claimed by biofuel producers must turn to local or global markets for alternatives, creating additional demand. It is important to note that the demand caused by expanded biofuel production is often met by producers who also sell or previously sold to non-biofuel consumers, hence the "indirect" element of ILUC. Since the production rate of wastes and residues is effectively capped by the rate of activity in the sectors that generate them, most additional demand for lipids is satisfied by the production of additional vegetable oils; part of this increased production comes from intensification of production on existing cropland, through the adoption of improved farming practices or seed cultivars, double-cropping, etc. Some additional demand, however, for these crops or ones they displace, is satisfied by bringing additional land into cultivation. When land is converted from one use to another, there are often GHG emissions associated, due to the loss of above-ground biomass and the decomposition of soil organic carbon due to soil disturbance. These losses are especially severe when certain types of highly-fertile natural land are converted to cultivation.

ILUC Risk and ILUC Modeling Uncertainty

The rapidly increasing demand for lipids due to current RD growth trends suggest a significant and heightened ILUC risk. Quantifying ILUC risk is challenging, due to the complexity of the modeled systems, data limitations, and the dependence of ILUC models on subjectively determined assumptions regarding system boundaries, allocation methods, counterfactual specification, etc. The EPA recently examined ILUC models that claim to estimate ILUC impacts from biofuels and found that among the five models analyzed, ILUC impacts from soybean oil based biofuels produced in North America ranged from 11 to over 300 gCO_2e/MJ. This compares to the current LCFS ILUC impact factor for soybean oil of 29.1 $g/CO_2e/MJ$ and the total life cycle CI of gasoline of around 100 gCO_2e/MJ.[8]

Biofuel production is only one fraction of global vegetable oil demand, and California, though a major market for biofuels, is only a fraction of U.S. biofuel consumption. However, as the largest market for alternative fuels in North America, California's demand can have significant impacts on aggregate consumption. Additionally, given the state's role as a leader in global climate policy, policy design decisions made here are often replicated in other jurisdictions. This means that near-term decisions made about LCFS design and implementation have significant global impacts beyond the impacts of additional vegetable oil cultivation to satisfy its direct demand.

391.2 The current ILUC impact factors used by the LCFS were adopted in 2015 based on modeling done using the Global Trade Analysis Project (GTAP) model to project changes in agricultural commodity consumption and Agro-Ecological Zone (AEZ) model to estimate emissions from those changes in response to new demand for biofuel feedstock. The GTAP model simulated a supply shock based on anticipated impacts of the U.S. Renewable Fuel Standard, as it was structured at the time. They did not account for the rapid growth in lipid-based fuels, nor the more than doubling of Renewable Volume Obligations for biomass-based diesel under the RFS that has occurred since the modeling that informed the LCFS land use change impact values was conducted. Nor do they account for the current and anticipated impacts of climate change, geopolitical conditions, or recent advances in land use change data or modeling. We have highlighted the need to update the current ILUC factors on many occasions during the

[8] US EPA, "Model Comparison Exercise Technical Document" (EPA-420-R-23-017, 2023); https://nepis.epa.gov/Exe/ZyPDF.cgi?Dockey=P1017P9B.pdf.

pre-rulemaking process, echoing similar calls from other researchers and technical experts.[9,10] A more appropriately-sized supply shock would be more likely to increase the size of the assessed land use change impact adjustment, than to reduce it; other changes in agriculture or lipid biomass-based diesel production, such as any yield improvements, would be expected to work in the other direction. How the lipid markets under RD have evolved beyond historical patterns is key, but difficult to model.

Additionally, given the reliance of all ILUC models on subjective modeling assumptions regarding critical parameters like definition of counterfactuals, establishment of system boundaries, setting allocation methods, etc., no single ILUC model can provide a highly credible point estimate of future ILUC impacts. Using an ensemble of models with a variety of input parameters to assemble a range of possible impacts, and then selecting a value from that range that considers the risks entailed from different directions and magnitudes of estimation error is a more appropriate approach.[11]

Taken together, these issues reinforce the conclusion that the current ILUC risk mitigation protocols within the LCFS are insufficiently protective against the serious risks of harmful land conversion, competition with food crops, and excess GHG emissions relative to assessed CI scores. Updating this approach to better reflect more recent data and understanding on this issue is critical. Given the technical complexity and entrenched controversy surrounding ILUC, however, such an update would likely entail a multi-year process of research, policy analysis, and stakeholder consultation. Targeted research to develop and/or update models in this space, and work to support a robust technical discussion on the topic, with ample opportunities for stakeholder and public engagement will be required.

[9] E.g UC Davis Policy Institute comments submitted following the July 7, 2022, November 9, 2022, and February 22, 2023 workshops, as well as discussion in Brown, et al. (2021), Ro, Murphy & Wang (2023), and Murphy & Ro (2024)

[10] E.g. J. O'Malley, N. Pavlenko, S. Searle, J. Martin, "Setting a lipids fuel cap under the California Low Carbon Fuel Standard" (ICCT, 2022); https://theicct.org/publication/lipids-cap-ca-lcfs-aug22/.
J. Glauber, C. Hebebrand, Food versus Fuel v2.0: Biofuel policies and the current food crisis | IFPRI : International Food Policy Research Institute (2023). https://www.ifpri.org/blog/food-versus-fuel-v20-biofuel-policies-and-current-food-crisis.
J. Martin, A Cap on Vegetable Oil-Based Fuels Will Stabilize and Strengthen California's Low Carbon Fuel Standard, The Equation (2024). https://blog.ucsusa.org/jeremy-martin/a-cap-on-vegetable-oil-based-fuels-will-stabilize-and-strengthen-californias-low-carbon-fuel-standard/.

[11] C. W. Murphy, Making Policy in the Absence of Certainty: Biofuels and Land Use Change, ITS (2023). https://its.ucdavis.edu/blog-post/making-policy-in-the-absence-of-certainty-biofuels-and-land-use-change/.

Limitations of Proposed Alternative Approaches to ILUC Risk Mitigation

Proposed amendments to Section 95488.9 (g) of the LCFS would adopt feedstock sustainability guidelines on crop- and forest-based feedstocks, including the requirement for certification by an approved third-party certification body. These guidelines would be expected to help reduce the risk of feedstocks from recently-deforested, ecologically- or culturally- sensitive, or conserved lands entering California's fuel mix. In and of themselves, such sustainability
391.3 certifications are a valuable tool, however their inherent design makes it impossible for them to mitigate risks from indirect, market-mediated effects like ILUC. This can be clearly observed by looking at a current example. The U.S. is a major global exporter of soybeans, and their primary derivative products, soy meal and soybean oil, 49 million metric tons of soybean and soybean derivatives were exported in 2023, with China the largest consumer.[12] In order to supply growing demand for RD, significant new crushing capacity has come online in the U.S. in recent years, with more anticipated.[13] Where the U.S. was previously exporting whole soybeans (which include the oil), some fraction of that export is now limited to soy meal. Consumers who previously purchased whole soybeans typically crushed them upon receipt and used both the oil and meal. The shift results in a deficit of vegetable oil for those consumers compared to historical patterns. In the case of China, like most countries in the Eastern Hemisphere, palm oil is commonly the cheapest vegetable oil available on the market. Increased consumption of palm oil has been repeatedly linked to increased deforestation of ecologically-sensitive, high-carbon natural land.[14]

At present, the global oilseed markets are seeing a significant decline in U.S. whole soybean exports over the last 3 years, partially compensated by an increase in soy meal.[15] While it is impossible to conclusively assign causality, given the many socioeconomic forces that impact the global agricultural commodity market, these data are aligned with a reality in which biofuel policy is impacting global vegetable oil markets in the manner described above.

Feedstock sustainability certification only applies to the feedstock directly being used for biofuel production. It is blind to market mediated changes resulting from the use of said feedstock. If a U.S. soybean producer who historically exported whole beans elected to crush them and sell

[12] https://fas.usda.gov/data/commodities/soybeans
[13] https://www.world-grain.com/articles/19463-us-soybean-crush-capacity-on-the-rise
[14] C. Petrenko, J. Paltseva, S. Searle, "ECOLOGICAL IMPACTS OF PALM OIL EXPANSION IN INDONESIA" (ICCT, 2016);
https://theicct.org/sites/default/files/publications/Indonesia-palm-oil-expansion_ICCT_july2016.pdf.
S. Searle, "How rapeseed and soy biodiesel drive oil palm expansion" (ICCT, 2017);
https://theicct.org/publication/how-rapeseed-and-soy-biodiesel-drive-oil-palm-expansion/.
L. Reijnders, M. A. J. Huijbregts, Palm oil and the emission of carbon-based greenhouse gases. Journal of Cleaner Production 16, 477–482 (2008).
[15] See Table 10 https://apps.fas.usda.gov/psdonline/circulars/oilseeds.pdf

the oil for RD production, the feedstock they produce could be granted certification (assuming they met the relevant criteria) even if it could be conclusively demonstrated that the entity which previously imported those soybeans purchased palm oil from recently-deforested land to replace the lost soybean oil. Certification schemes cannot assess anything other than the specific lots of feedstock they are contracted to certify, and so have no opportunity to assess the feedstock grown by other producers in response to aggregate global demand signals. As such, the proposed feedstock sustainability certification requirements are also inadequate protection against ILUC risks.

Capping or Restricting the Continued Growth of Lipid- or Crop-based Fuels

Consideration of a Vegetable Oil Cap in the ISOR

As discussed in the previous two sections, the current rate of growth in the consumption of renewable diesel, combined with present and future demand for other lipid based fuels such as biodiesel or SAF, create significant market stability challenges for the LCFS in the near future, as well as sustainability risks. Neither the current system of ILUC impact adjustments to CI scores, nor the proposed feedstock sustainability certification protocols are capable of effectively mitigating either risk, and any solution that requires new ILUC modeling would not be ready for implementation soon enough to avert these harms. Successfully addressing these challenges will require an approach that can be adopted during the current rulemaking, provides high certainty of effect, and can be used by other jurisdictions that have adopted the LCFS as part of their climate policy portfolio. One such solution has been proposed, a cap on vegetable oil feedstocks, which was discussed in the SRIA as part of the Environmental Justice Alternative, and in the ISOR as Alternative 1.

Alternative 1 was rejected in favor of the proposed amendments for two primary reasons, less GHG reduction, largely due to lower LCFS target stringency (28% vs. 30%) and less air quality benefit. Our 2023 modeling report clearly demonstrates that a 30% LCFS CI target in 2030 is compatible with lower levels of lipid-based fuel consumption consistent with vegetable oil
391.4 feedstock caps. Our previous report found that with a 30% 2030 target, and total lipid-based fuel consumption less than 2022 levels, the LCFS program maintained positive credit balances throughout the 2020's; balances grew in 2028 and 2029 to the point where an AAM triggering event (under the proposed trigger criteria) was likely.[16] This indicates that even with binding caps on total lipid-based fuel development, under our assumptions LCFS market is projected to provide ample compliance credit to support a target of 30% or higher by 2030; the conclusion of fewer GHG benefits is therefore at least partly due to the selection of a lower 2030 target, which is not a necessary feature of a crop or lipid feedstock cap. Additionally, as discussed above, given a strong possibility that the current ILUC adjustment approach underestimates actual

[16] Murphy & Ro (2024) https://escholarship.org/uc/item/5wf035p8

391.5 ILUC impact, real world GHG emissions from these fuels could be significantly higher than their assessed CI scores, especially as lipid use for biofuels continues to grow.[17]

The estimate of fewer air quality benefits is likely due to assumptions on the impact of RD on emissions from diesel vehicles. While RD does provide significant air quality benefits in older vehicles that lack modern emission control devices, CARB's 2007 Truck and Bus Regulation requires virtually all on-road diesels in California to have PM and NOx control devices, typically diesel particulate filters and selective catalytic reduction systems.[18] A large, and increasing share of non-road diesels are subject to similar emission control regulations. Research supported by CARB found that RD provides no statistically significant emissions benefit when burned in diesels equipped with such devices.[19] UC Davis research on the impact of increased targets in Oregon's Clean Fuels Program found minimal air quality benefit from RD in 2030 due
391.6 to the prevalence of modern diesels with emission control devices in their fleet, and forthcoming work on the relative air quality impacts of hydrotreated RD and hydrotreated SAF arrives at a similar conclusion.[20] The ISOR does not provide sufficient detail about the methodology used to arrive at its conclusions related to air quality impacts, so we are unable to replicate them, or confirm whether the emissions factors account for the presence of newer diesel engines that meet current regulatory requirements in the California fleet. The air quality work we, and our UC Davis colleagues have produced suggests that appropriately accounting for these effects would dramatically reduce the purported air quality benefit of higher levels of RD in 2030 and beyond.

Alternative Approaches to ILUC Risk Mitigation - Caps on Quantities of Fuels From Specified Feedstocks

Recently-published FPSM modeling explores several options for cap design, with the caveat that FPSM has limited capability to represent differences in feedstock preference, conversion yield, and projected CI scores between different classes of feedstock when used for the production of lipid based fuels - RD, SAF, and biodiesel.[21] As such these results should be

[17] The ISOR reported only emissions benefits relative to an assumed baseline, and did not quantify aggregate emissions from transportation fuels for any of the analyzed scenarios. This prevents us from making a direct, quantitative comparison of GHG impact.

[18] https://ww2.arb.ca.gov/our-work/programs/truck-and-bus-regulation

[19] T. D. Durbin, G. Karavalakis, K. C. Johnson, C. McCaffery, H. Zhu, H. Li, "Low Emission Diesel (LED) Study: Biodiesel and Renewable Diesel Emissions in Legacy and New Technology Diesel Engines" (18ISD027, CARB, 2021); https://ww2.arb.ca.gov/sites/default/files/2021-11/Low_Emission_Diesel_Study_Final_Report.pdf.

[20] Y. Li, G. Wang, C. Murphy, M. J. Kleeman, Modeling expected air quality impacts of Oregon's proposed expanded clean fuels program. Atmospheric Environment 296, 119582 (2023).
Y. Li, C. Murphy, J.W. Ro, M. J. Kleeman, *Modeling the Differences Between the Air Quality Impacts of Renewable Diesel and Sustainable Aviation Fuel (SAF) in California*. Presentation to the Transportation Research Board's Standing Committee on Alternative Fuels in Aviation. TRB Annual Meeting, Washington DC, 8 January, 2024

[21] Murphy & Ro (2024) https://escholarship.org/uc/item/5wf035p8

considered approximate and additional research and modeling is needed to better understand nuances related to cap design. Still, given that the primary purpose of a cap is to prevent excessive consumption of fuels that present indirect land use change risks, so long as a cap is below the levels that would result in critical environmental harm, it can effectively accomplish its primary purpose.

Figure 3 (following page) presents the findings of several cap scenarios, including ones with restrictions on crop-based lipids (defined as soybean oil and canola oil), and ones with restrictions on total volume of lipid-based fuels.[22] Scenarios with a 1 billion GGE limit on fuels made from crop-based lipid feedstocks, or a 3 billion GGE limit on all lipid-based fuels demonstrate similar behavior to the uncapped scenarios, despite modest reductions in net credit generation. In both cases, the AAM was triggered twice, increasing targets in 2028 and 2030. The reduced credit generation did, however, reduce the aggregate bank to the point where the first AAM trigger criteria was no longer met during the period 2031-2035, meaning that a third AAM triggering event would not occur if credits exceeded deficits in one of these years. Scenarios with a 500 million GGE crop-based lipid fuels cap, or a 2 billion GGE lipid-based fuels cap show a more significant response, with the bank being gradually drawn down during the mid-2020's (more rapidly for the 2 billion GGE lipid-based fuel cap than the 500 million GGE lipid crop-based one), dropping it below the AAM triggering threshold by 2028. In these scenarios the bank is drawn down and an approximate balance between credit supply and demand is reestablished without the need for the 2030 target to increase beyond the 30% proposed in the amendments.

Previous modeling found that 30% targets and caps on aggregate lipid consumption were compatible with California's transition to carbon neutrality by 2045.[23] Additional unpublished analysis suggests that a 2.5 billion GGE lipid based fuels cap may also result in two AAM triggering events, though the second does not occur until 2034 (and it is important to note that model uncertainty increases as projections move farther into the future), while a 750 million GGE crop-based fuels cap is likely to only trigger the AAM once, in 2028. Taken together, these results suggest that adopting a lipid crop-based cap set below 750 million GGE annually
391.7 reduces the risk of multiple AAM trigger events, a lipid crop-based cap set below 500 million GGE may yield an approximately balanced credit market without the need for AAM triggering events entirely. Similarly, adopting a lipid-based fuel cap below 2.5 billion GGE annually limits

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[22] At present, the greatest risk of significant sustainability or ILUC related harms stem from the consumption of lipid-based biofuels. Corn ethanol is also a crop-based biofuel that plays a significant role in California's fuel portfolio and there are sustainability risks associated with excessive growth in corn consumption for biofuel production. While we focus on vegetable oil crops for the discussion in this section, this should not be taken as an indication that corn should be excluded from a crop-based feedstock cap, to mitigate potential risks if market conditions should change to support rapid expansion of corn-based ethanol.

[23] Ro, Murphy, & Wang (2023) https://escholarship.org/uc/item/6f2284rg, Brown, et al. (2021) https://escholarship.org/uc/item/3np3p2t0

the risk of multiple AAM triggering events, especially before 2030, while a 2 billion GGE cap may yield a balanced market through the 2020's and avoid AAM triggering entirely.

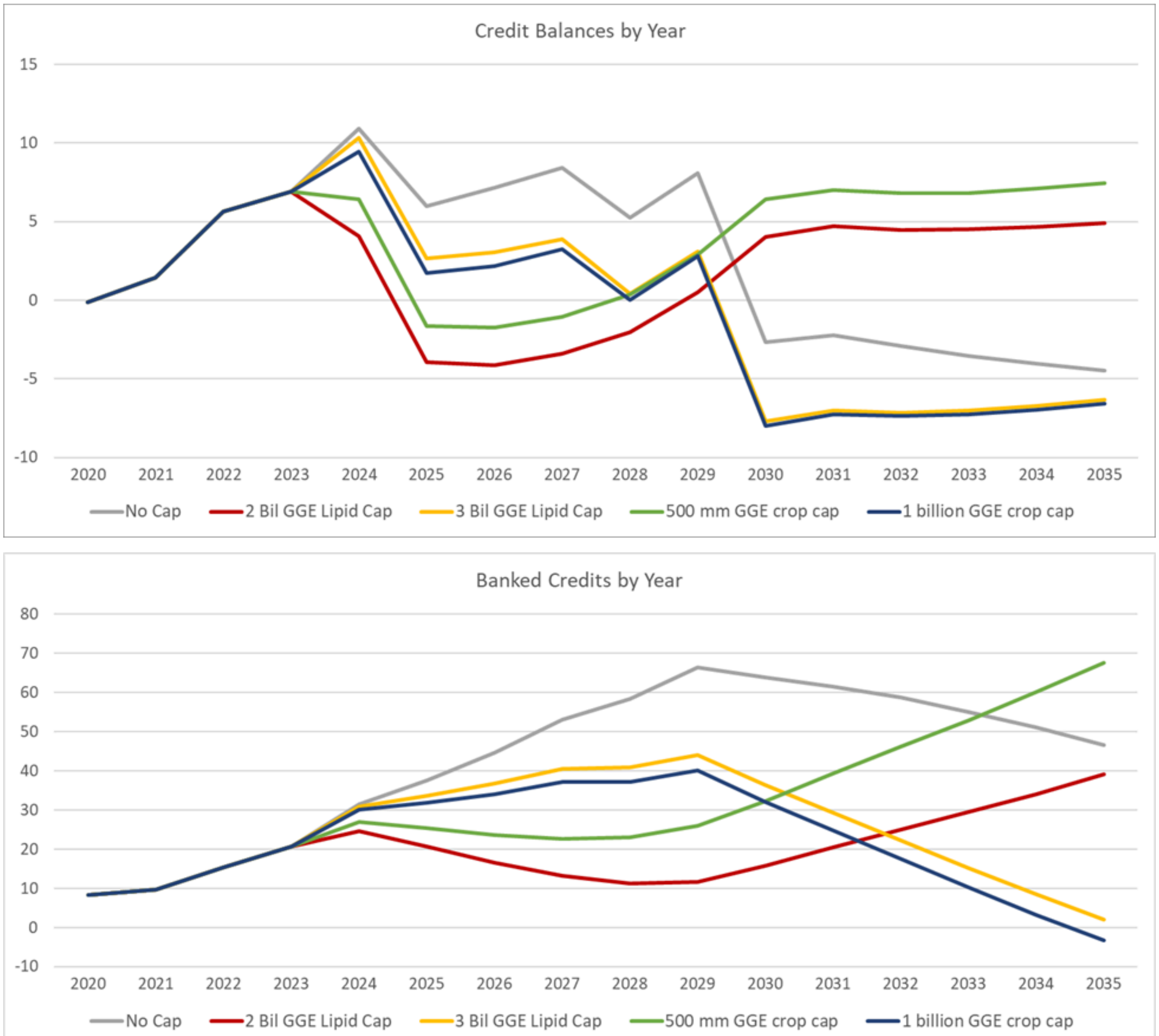

Figure 3: (a, above) Yearly net credit balances and (b, below) net banked credits from FPSM modeling of several lipid fuel scenarios. AAM-triggering events manually added when prior year banked credits exceed ¾ of prior year deficits and yearly deficits>credits. The gray "No Cap" line reflects modeled results for the LCFS amendments at the time of writing (February, 2024). Source: Murphy & Ro (2024)

Given that a cap on vegetable oil feedstock crediting in the LCFS would likely yield nearly equivalent, or possibly better, GHG and air quality impacts as an un-capped scenario, a critical question is: how should any such cap be designed? A number of concepts have emerged during our years of work on the LCFS and similar programs. We present a non-exhaustive list of options below, with the caveat that none of these options has been fully analyzed by ITS-Davis researchers and the presence of any option on this list should not be taken as an endorsement.

1. **Cease issuing LCFS credits for specified fuels once the cap has been reached.** This option risks creating market volatility as producers attempt to schedule deliveries early in the year to ensure they can access the limited supply of credits.
2. **Proportionately reduce credit issuance to all fuel providers once a specified threshold has been reached.** As total volumes approach the cap, begin proportionately reducing the LCFS credit issued per gallon to provide a more gradual transition from full crediting to zero than option 1.
3. **Hold a fraction of credits from capped fuels in a buffer account and retire them if caps are exceeded.** In this concept, a fraction of credits from capped fuel types would be retained by CARB and held in a buffer account. If total volumes of capped fuel types exceeded the specified caps, enough credits would be retired to ensure that only the capped amount was credited. The remainder would be returned to producers.
4. **Limit the ability of deficit-holding entities to submit a greater fraction of credits from capped fuels than their share of total deficits would imply.** For example, if an entity generated 25% of total deficits in the LCFS, they could submit credits from capped fuels to cover only 25% of that obligation. This would functionally create a secondary sub-market for credits from capped fuel types, which would be expected to trade at a lower price than uncapped ones.
5. **Adopt a transferable quota system to assign shares of the cap to specified producers.** Transferable quotas have often been used to allocate scarce capacity in competitive markets, e.g. fisheries. In this approach, the capped volume would be divided into blocks of quota to deliver fuels from the capped categories. These could be auctioned, distributed by lottery, or assigned by formula based on historical presence in the market. Producers could then deliver the volumes specified by their quota, or transfer the quota to other producers.
6. **Adopt a bid-in quota system similar to that used in electricity markets.** Producers would bid into a market to deliver specified volumes of fuel at prices of their choosing to fuel terminals or racks. A portfolio of bids equal to that year's cap would be assembled from the lowest-price bids and those bidders would receive transferable quotas for that delivery. This approach would have the additional benefit of applying downward pressure on diesel prices.
7. **Regulate outside of the LCFS.** The LCFS has not historically regulated or limited fuel volumes, instead focusing on fuel carbon intensity. An alternative to regulation within the LCFS program would be to adopt fuel quality or composition standards that effectively enforced the specified caps on crop- or lipid-based fuels, or establish a new stand-alone volumetric regulation for the purpose.

391.8 We are happy to work with CARB and other stakeholders to more fully develop and analyze possible cap design options. Given the rapid growth in RD, any delay in implementing a cap may result in the need to reduce aggregate lipid-based fuel demand in future years to bring it back under the capped level. The greater the delay, the greater the likely need to reduce aggregate consumption of such fuels in the near-term.

Deficit Generation from Intrastate Aviation Fuel Consumption

Estimating Intrastate Aviation Fuel Consumption

The proposed amendments would add fossil jet fuel used in intrastate flights, defined as those that take off and land inside California, to the LCFS as an obligated fuel starting in 2028. This would increase the incentive for aircraft operators to use alternative aviation fuels, such as hydrotreated esters and fatty acids (HEFA) made from lipid feedstocks. These fuels have received ASTM certification for use at blends of up to 50% with conventional jet fuel and many aviation industry stakeholders have demonstrated the feasibility of using such fuels in modern commercial aircraft without blending. Given the operational needs of commercial aircraft, low-carbon liquid fuels are widely viewed as the most feasible option for reducing GHG emissions from aviation. Zero-emission aircraft, powered by batteries or hydrogen have been proposed and some manufacturers are developing these technologies for commercial application, but they do not appear suited for larger aircraft, like those used in interstate and international air travel, the market segment that consumes the majority of jet fuel.

Data on the scope of fuel consumption for intrastate flights is limited. Because aircraft are typically required to carry reserve fuel on flights, and commercial flights often operate on multi-leg cross-border trips, no simple resource to quantify intrastate fuel consumption via direct measurement exists. Recent work by researchers at UC Berkeley and UC Davis models the flight profiles of most intrastate routes and aircraft types to arrive at an estimate of 403 million gallons of jet fuel for both commercial and general aviation in 2019. Projections for 2030 and 2035 are 475 million gallons and 488 million gallons respectively.[24] Staff suggested at a previous workshop an alternative definition of “intrastate” which includes all fuel consumed by flights departing from California while they are within the state’s airspace. Forthcoming work from the same research group suggests this would increase the amount of jet fuel subject to deficit generation to 879, 1137, and 1206 million gallons in 2019, 2030, and 2035 respectively.

[24] Y. Liu, M. Hansen, C. Murphy, *Advancing Sustainable Aviation Fuels in California* (2023). Presentation to Advisory Group for UCB-UCD RIMI Project. (unpublished)

Interactions Between SAF and Other Fuels Regulated by the LCFS

At present, virtually all SAF consumed in California is HEFA made from lipid feedstocks. This process utilizes the same lipid feedstock as renewable diesel, and is produced in a similar production process. Most renewable fuel hydrotreaters produce a blend of SAF, and RD, along with lower-value byproducts such as renewable naphtha and propane, during typical operation. In most cases, producers can alter operational parameters to emphasize the production of RD or SAF, with SAF typically requiring additional energy and hydrogen as compared to RD. This means that the existing capacity to produce RD could shift some of its output to SAF instead. Given the massive amount of hydrotreating capacity in the U.S. (see *Renewable Diesel Capacity Growth and 2030 Targets,* above) we anticipate that the vast majority of SAF entering California's market through 2030 will be HEFA. While some alternative approaches have been proposed, including e-fuels (which synthesize CO_2 and hydrogen into hydrocarbons using renewable electricity to power the process) or advanced forms of cellulosic biofuel, these have yet to demonstrate success at commercial scale. Alcohol-to-jet (AtJ) synthesis has also been proposed, and a pioneer plant (10 million gallons per year SAF plus RD capacity) recently opened in Georgia; however this technology has also not been demonstrated at full scale, nor has it demonstrated operational cost competitiveness.[25] As such, it is premature to make quantitative projections of the availability, characteristics (including CI score) or cost of such fuels, especially given the history of novel alternative fuels struggling to achieve commercial success.

As a result, expansion of SAF consumption in California through 2030 is likely to be driven by increased use of lipid-based HEFA, and as such, all the cautions and concerns related to RD apply here as well. To be clear: this is not meant to imply that all SAF consumption will be harmful or that it should be excluded from the LCFS. Given the lack of alternatives to significantly reduce GHG emissions from aviation, in contrast to on-road transportation where ZEVs can satisfy most applications using zero- or near-zero GHG energy, it could be argued that deployment of SAF might appropriately take priority over on-road RD from a policy perspective. UC Davis researchers have modeled the expected air quality impacts of SAF deployment in CA, compared to equivalent volumes of RD and found slight, though non-significant improvements in regional air quality in scenarios that prioritize SAF over RD.[26] SAF may have a particular benefit in reducing the exposure of airport workers to particulate matter and other air pollutants as well.

[25] https://www.ajc.com/news/lanzajet-celebrates-opening-of-greener-sustainable-aviation-fuel-plant-in-georgia/EVQGJDNUZBEDFGJATQABEJOVIU/

[26] Y. Li, C. Murphy, J.W. Ro, M. J. Kleeman, *Modeling the Differences Between the Air Quality Impacts of Renewable Diesel and Sustainable Aviation Fuel (SAF) in California*. Presentation to the Transportation Research Board's Standing Committee on Alternative Fuels in Aviation. TRB Annual Meeting, Washington DC, 8 January, 2024

391.9 These benefits must be taken in context with the fact that HEFA SAF draws from the same pool of feedstock, and therefore is subject to the same sustainability risks and challenges as RD. Unrestricted growth of HEFA SAF would likely result in the same negative environmental impacts as equivalent growth in RD. Policies that seek to limit these harms must apply to both SAF and RD (as well as biodiesel, which also is made from lipid feedstocks, though its aggregate volumes are now smaller than RD), which is why the proposals we discuss above focus on limiting the quantities of feedstock used rather than finished fuels.

391.10 Given the lack of alternatives to liquid fuels to decarbonize aviation, and the lack of commercially-deployed alternatives to HEFA within the SAF market at present, prioritizing SAF over RD may be a defensible choice. We adopt that mindset in FPSM via the prioritization of fuels during allocation of preferred waste and residue lipid resources, where SAF demand (assumed to be equivalent to projected intrastate jet fuel demand) is satisfied before RD. We project growth in total volumes of SAF consumption until intrastate demand is satisfied in 2028. This means that when the SAF deficit obligation becomes active in 2028, it has already been integrated into California's total demand for alternative fuels over the preceding years; this explains why no obvious inflection points in the credit balance or bank trend lines are visible in 2028. This approach effectively shifts the deficits that would accrue to SAF into the diesel pool in scenarios where total lipid consumption is capped below total liquid diesel consumption plus intrastate jet fuel consumption. This approach ultimately yields comparatively little difference in FPSM estimates of LCFS crediting trends or estimated emissions between scenarios in which SAF is preferred to RD or ones in which the opposite is true. In reality, there are small but significant distinctions between the production of SAF and RD that would yield different credit and GHG outcomes depending on which feedstocks ultimately went into which fuels. These distinctions are outside the scope of FPSM's ability to effectively characterize or project; additional research into this area is recommended to better understand the trade-offs involved.

Fractional Displacement Crediting Approach for Fuels with EER>1

Assumptions Embedded in Current Method Leads to Increasing Credit Quantification Error

391.11 In our previously submitted comment letter on 21 Dec 2022, we argued for the need for a more accurate crediting approach to better align LCFS crediting with real-world emissions as more efficient vehicles come to make up a larger share of California's total vehicle fleet.[27] Research published shortly before the letter was submitted identified and characterized a likely future quantification error in the LCFS credit generation method due to assumptions around the GHG impact of displaced fuel.[28] As higher-efficiency powertrains saturate a market segment, the

[27] Comment #142 for Public Workshop to Discuss Potential Changes to the Low Carbon Fuel Standard (lcfs-wkshp-nov22-ws)
[28] C. Murphy, "Improving Credit Quantification Under the LCFS: The Case for a Fractional Displacement Approach" (2022); https://escholarship.org/uc/item/0px4m8hz

current crediting method will become increasingly less accurate at matching LCFS credits to actual GHG impacts over time, within that segment. This is because the current LCFS credit quantification method assumes that each new high efficiency (EER>1) vehicle will fully replace the travel activity provided by a fossil-fueled ICE vehicle. Over time, this assumption becomes less reflective of actual behavior. While the credit quantification error caused by this inaccurate assumption applies to all vehicles with an EER>1, it will yield its greatest impact on estimates of emissions from EVs. In early years, when the fleet is overwhelmingly composed of ICE vehicles, the assumption of constant and complete displacement of ICE travel is quite defensible, but as EVs come to make up an increasing fraction of the fleet, it is increasingly likely that the travel activity provided by each charging event would otherwise have been done in a different EV, in which case no additional gasoline was displaced. In this case, the credits issued for EV charging would overestimate the actual GHG benefits of such charging, giving LCFS credits for emissions benefits that are not occurring and with costs passed on to gasoline consumers.

Resolving Credit Quantification Error With Fractional Displacement Crediting

Updating the outdated assumptions regarding fuel displacement can be accomplished by algebraically rearranging the existing LCFS quantification equation to separate it into two terms, one reflecting GHG impacts of fuel displacement and another reflecting GHG impacts of lower fuel CI on an equal-energy basis, this allows a displacement fraction term to be added. This term accounts for the fact that as new technologies come to make up larger fractions of a fleet or market segment, each additional vehicle will, on average, displace less travel by an older-technology one. The fraction of the vehicle fleet or market segment still made up of older-technology vehicles can serve as a useful approximation for this displacement fraction term, possibly with a temporal lag to account for the fact that old-technology vehicles are more likely to retire out of the fleet than new ones due to their relative ages.

We recognize that this problem is outside the scope of this rulemaking, as identified by CARB during the pre-rulemaking workshop. Adopting the fractional displacement approach in the next few years, however, would help ensure that medium- to long-term credit quantification matches real-world emission benefits, and helps mitigate potential LCFS credit oversupply in the 2030's that FPSM modeling projects to arise due, in part, to this credit overestimation error, without the need for precipitous action that could cause market disruption.[29]

[29] Brown, et al. (2021) https://escholarship.org/uc/item/3np3p2t0

Reevaluating Previous Assumptions Around Additionality

Rationale for Updating Frameworks for Additionality Determination

391.12 As the LCFS moves deeper into its second decade of operation, some assumptions and methods that have served it well in the past may need to be reevaluated. This is especially true in the case of additionality, which is the determination around whether a specified emission impact would have occurred without the product of activity being analyzed. Appropriately determining additionality is a critical element of any consequential life cycle analysis (LCA), and is particularly relevant to GHG accounting in the case of biofuels, and carbon dioxide removal via natural or working lands.[30] The LCFS assesses additionality at the project level, to a limited degree; emissions benefits from a project are assessed in comparison to a counterfactual in which the project did not exist. Specific exemptions are provided for factors that would normally render the LCFS impact on emissions partially or entirely non-additional. These include explicitly allowing the crediting of ethanol produced at facilities built prior to the adoption of the LCFS, which would normally be non-additional due to temporal sequencing. Similar exemptions to policy additionality requirements exist in the case of receiving financial incentives from the RFS, cap and trade program, or the Inflation Reduction Act (the latter being proposed amendments in the current rulemaking), allowing LCFS crediting as if it were responsible for the full emission benefits of a project that receives benefits from those sources as well. The LCFS assumes that in absence of the biofuel production or EV charging event in question, an equivalent amount of transportation activity would occur using conventional vehicles fueled by petroleum. The primary factor upon which the LCFS would find cause to deny the additionality of emissions benefits is legal or regulatory requirements; if a law or policy in a jurisdiction requires a specified action, then any GHG impacts arising from projects supported by the LCFS are considered non-additional. For example, if a jurisdiction required anaerobic digesters for manure management, digesters located there could not claim credit for the avoided methane emissions.

[30] R. J. Plevin, M. A. Delucchi, M. O'Hare, Fuel carbon intensity standards may not mitigate climate change. Energy Policy 105, 93–97 (2017). https://www.sciencedirect.com/science/article/pii/S030142151730112X
S. T. Sanchez, J. Woods, M. Akhurst, M. Brander, M. O'Hare, T. P. Dawson, R. Edwards, A. J. Liska, R. Malpas, Accounting for indirect land-use change in the life cycle assessment of biofuel supply chains. Journal of the Royal Society, Interface / the Royal Society 9, 1105–19 (2012). http://rsif.royalsocietypublishing.org/cgi/content/abstract/9/71/1105
A. Zamagni, J. Guinée, R. Heijungs, P. Masoni, A. Raggi, Lights and shadows in consequential LCA. The International Journal of Life Cycle Assessment 17, 904–918 (2012). http://www.springerlink.com/index/10.1007/s11367-012-0423-x
http://dx.doi.org/10.1007/s11367-012-0423-x
J. Earles, A. Halog, Consequential life cycle assessment: a review. The International Journal of Life Cycle Assessment 16, 445–453 (2011). http://dx.doi.org/10.1007/s11367-011-0275-9

This project-level accounting approach, with consideration of legal and/or regulatory requirements, and specified exemptions creates a set of assumptions around additionality, establishment of baselines, and counterfactuals that shape a wide variety of processes and determinations within the LCFS. For example, fueling EVs or hydrogen fuel cell vehicles generates credits for displaced gasoline based on the assumption that such fueling displaces an amount of petroleum governed by the EER applied to the fueled vehicle. Similarly, avoided methane credits are quantified based on the assumption that in absence of the LCFS incentive, manure would be collected and stored in an open lagoon, with uncontrolled release of methane.

In many cases, the specific assumptions implied by the current approach to additionality were appropriate at the time when the LCFS was first developed and implemented, in the late 2000's and early 2010's. At that time, virtually all vehicles on the road were ICE, so the assumption that any fueling activity by a non-ICE vehicle displaced equivalent ICE vehicle travel was appropriate. Similarly, awareness of the importance of agricultural methane emissions on climate change was only just beginning to be reflected in climate policy making, so in many jurisdictions, lagoon management of manure was ubiquitous.

Rationale for a Comprehensive Review of Additionality and Related LCA Assumptions

Given the changes in technology, policy, and behavior that have occurred, a comprehensive review of LCFS additionality provisions and applied assumptions is warranted. This needs to be comprehensive, across all regulated fuels and technologies in order to maintain technology neutrality and an equitable, competitive market for GHG reducing solutions. Three particular areas stand out as likely to be identified as outdated during such a review (though this should not be considered an exhaustive list).

391.11 First, as discussed in the section *Fractional Displacement Crediting Approach for Fuels with EER>1,* above, are assumptions embedded in the current method for assessing emissions benefits arising from the displacement of fossil fuel by use of vehicles with an EER>1. An increasing share of California's vehicle fleet is now composed of vehicles other than ICE; by 2030, UC Davis modeling predicts around 23% of total vehicles will be ZEVs, if projections hold, we predict that the majority of the fleet will be ZEVs sometime in the mid-2030's. Under those conditions, the assumption that any travel by an alternative fueled vehicle displaces an equivalent amount of petroleum-fueled ICE travel will clearly no longer hold.[31]

391.13 Second are assumptions around avoided methane credits from livestock digesters. A range of factors including policy, consumer preference, improved technology, voluntary agreements, legal settlements, and others is contributing to broad change across the livestock industry. Assuming

[31] This issue is discussed in depth in C. Murphy, "Improving Credit Quantification Under the LCFS: The Case for a Fractional Displacement Approach" (2022); https://escholarship.org/uc/item/0px4m8hz

that uncontrolled lagoons are, and will always be the alternative to LCFS-supported digesters is similarly problematic.

391.12 Finally, as described above, are the exemptions to additionality considerations relating to policy support for alternative fuels from the U.S. Renewable Fuel Standard, California's cap and trade program, and proposed exemptions in the current amendments for support from the Inflation Reduction Act. In the past, when alternative fuel technologies were immature, stacking multiple streams of revenue was necessary to make alternatives to petroleum cost-competitive. Given advancements in technology and the implementation of alternative fuel policy at a variety of jurisdictional levels, stacking multiple streams of policy-driven revenue may not be required to bring these fuels to market.

A comprehensive review does not necessarily mean that the current standards necessarily will, or should, change. In some cases the rationale for adopting assumptions or approaches to additionality assessment in the past may still hold. The LCFS should not, however, assume that all assumptions around additionality will continue to be appropriate more than a decade after they were first adopted. Analytical assumptions that are effective in early phases of a technological and economic transition do not always maintain their effectiveness in later phases. The LCFS is not immune from this effect. At its earliest opportunity, CARB should conduct a comprehensive review of assumptions around additionality and other LCA modeling parameters used by the LCFS to determine whether current ones are likely to meet the program's needs in the decades to come.

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

From the start of the workshop and engagement process that led up to this rulemaking, Staff were extremely 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 recent significant decline in LCFS credit prices, this focus on corrective measures is understandable.

391.14 The limited scope, however, meant that many critical and complex structural topics that, when fully explored, might offer avenues to improve the efficiency, resilience, and effectiveness of the LCFS as decarbonization proceeds were excluded from this rulemaking. 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 program revenues begin declining due to reduced gasoline consumption, expanding the LCFS to cover air, water, and rail fuels, and integrating vehicle or transportation-system effects into fuel CI assessment, differentiation between so-called "bridge" fuels and those with the capacity to achieve carbon neutrality, etc. As discussed in earlier sections of this comment, several of these -out-of-date EERs, estimation error due to fuel displacement assumptions, ILUC risk mitigation, and additionality considerations - 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 and LCFS program staff.

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 the LCFS market. 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 now to a follow-up LCFS rulemaking, without any limitations to its scope, at the earliest possible opportunity.

Part 2: Comments on Specific Elements of the Proposed Amendment Package

Appendix A-1. Proposed Regulation Order

Section 95481 - Definitions.

The following definitions may leave unwanted ambiguity around their interpretation, or create the risk of unwanted outcomes. Except where specifically noted, clarifications of language or intent are likely to be sufficient to address these issues.

"Break ground" - The definition is reasonable, but there is a chance of gaming the system if no additional limitations are added. For example, someone could 'break ground' before a specific date to claim benefits under the LCFS (or other regulatory incentive programs), but might not advance the construction of a facility further than having broken ground. This could allow for projects to qualify for eligibility in protocols that have a specified end date for new pathways,

e.g. HRI or FCI, even if no other construction activity other than ground breaking occurs until after the cut off date. Clarifying that 'breaking ground' implies subsequent construction activity
391.15 should begin shortly thereafter, or setting a maximum allowable period of time between ground-breaking and subsequent construction activities could resolve this problem. In addition, 'digestor' may be a typo of 'digester'.

391.16 "Byproduct" - The expression, 'marginal economic value', is insufficiently defined. A quantifiable threshold is required to avoid confusion and gaming the system. Recent Policy Institute research on classification of wastes and residues in LCA set a threshold of 15% of the total economic value for the definition of 'byproduct'.[32] If a product created more than 15% of the total economic value of the extended system, it was a coproduct, not a byproduct. The quantitative threshold at which to set this cut-off is not adequately discussed in literature, the choice of 15% may not be appropriate for all cases. Adopting a more specific, ideally quantitative definition of 'byproduct' offers more certain guidance than the proposed language.

"Carbon capture and sequestration (CCS) project" - The current definition specifies transport and injection of CO_2, it is therefore unclear regarding whether mineralization, such as enhanced
391.17 weathering (in which CO_2 reacts with certain minerals to form solid carbonates likely to remain solid for centuries or more) would satisfy the definition of "sequestration" in this use. Given the anticipated durability of solid CO_2 we suggest that it should be considered a valid form of CCS for the purpose of eligibility or quantifying LCFS credits.

"Clean Fuel Reward" - Incentives for light duty EV (LDEV) purchases or leases have been removed from the program, with its focus now exclusively on medium- and heavy-duty vehicles.
391.18 It may be premature to stop supporting the purchase of LDEVs, however. While current EV market trends indicate increasing availability and declining purchase costs for many EV models, the majority of vehicles sold in California remain ICE powered, and significant consumer awareness deficits exist between EVs and conventional ones.[33] Additionally, if the per-vehicle level of incentive plays a critical role in affecting individuals' vehicle purchase decisions, conventional economic theory would suggest that higher levels of incentive may be required to reach higher sales fractions. While the Advanced Clean Cars 2 rule sets binding targets for LDEV sales and registration, it may be premature to assume that they can be simply or

[32] J. W. Ro, Y. Zhang, A. Kendall, Developing guidelines for waste designation of biofuel feedstocks in carbon footprints and life cycle assessment. Sustainable Production and Consumption 37, 320–330 (2023) https://www.sciencedirect.com/science/article/pii/S2352550923000532

[33] K. Hoogland, K. S. Kurani, S. Hardman, D. Chakraborty, If you build it, will they notice? public charging density, charging infrastructure awareness, and consideration to purchase an electric vehicle. 101007 (2024). https://www.sciencedirect.com/science/article/pii/S2590198223002543
K. S. Kurani, 2021 Zero Emission Vehicle Market Study: Volume 2: Intra-California Regions Defined by Air Districts. (2022). https://escholarship.org/uc/item/8738w7m3

efficiently met without continued, or even increasing levels of incentive.[34] The definition proposed in the draft amendment text forecloses any future use of Clean Fuel Reward incentives to support continued progress in LDEV market penetration.

391.19 "Conservative" - This term is used to define "Alternative Method," and it is appreciated that the intent of these sections is to ensure that estimated GHG impacts, per LCFS methods, do not overstate actual GHG benefits, and that LCFS incentives actually reflect emissions reductions at least as great as their CI score or the quantity of credits they are issued would imply. Conservative estimation, in this sense, is appropriate in a regulatory environment focusing on reducing GHG emissions like this and can help avoid the worst end of asymmetric impacts from inaccurate estimation in some circumstances.[35] However, the definition needs to be clarified. It is not entirely clear what value or parameter the references to 90th percentile or 10th percentile are meant to apply to. As long as the intent of the definition is clear, and in the case of "conservative" we find it to be, the additional clarity may be effectively provided in a subsequent guidance document, that can be updated over time as needed, rather than through exhaustive specification in the rule text itself, in which case clearer conceptual guidance an a requirement for occasional review and/or revision may be advisable. .

391.20 "Co-product" - Similar to "Byproduct," 'significant market value' is insufficiently defined. A quantifiable threshold or other more objective test would help ensure efficient implementation and send a clearer signal to market participants.

391.21 "Food scraps" - It is defined using the expression, 'predominantly disposed by landfilling', but this is a historical practice and may change as a result of state policy, voluntary action, etc. It would be better to specify in the definition that it is a historical reference to past disposal practice. This is particularly important in light of the way historical practice is accounted for in consequential LCA, where emissions from a proposed product, or activity are compared against a counterfactual scenario without the product of activity. If a definition in regulatory text asserts current or past behavior that does not match reality, quantitative values, including LCFS CI scores, can be affected.

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[34] D. Chakraborty, A. W. Davis, G. Tal, The cost of aggressive electrification targets – Who bears the burden without mitigating policies? Transportation Research Interdisciplinary Perspectives 23, 101006 (2024). https://www.sciencedirect.com/science/article/pii/S2590198223002531
G. Tal, A. Davis, D. Garas, California's Advanced Clean Cars II: Issues and Implications. (2022). https://escholarship.org/uc/item/1g05z2x3
A. Mandev, F. Sprei, T. Gil, Electrification of Vehicle Miles Traveled and Fuel Consumption within the Household Context: A Case Study from California, U.S.A. World Electric Vehicle Journal 13, 213 (2022). https://www.proquest.com/docview/2748382187
[35] C. W. Murphy, Making Policy in the Absence of Certainty: Biofuels and Land Use Change, ITS (2023). https://its.ucdavis.edu/blog-post/making-policy-in-the-absence-of-certainty-biofuels-and-land-use-change/.

391.22 "Forest" - The attempt to specify concrete quantitative criteria for the definition of 'forest' is helpful, however different state or federal authorities in the United States may have different definitions for 'forest'. For example, the Natural Resources Conservation Service under USDA characterizes forest land use as land with at least 10 percent cover by trees that will be at least 13 feet (4 meters) tall at maturity, and the land also shows evidence of natural tree regeneration. The LCFS definition should generally align with prevailing definitions in regulatory or scientific literature, unless there is a reason to pick an alternative.

391.23 "Fugitive methane" - The definition specifies quantifying using standard values, or a site-specific energy balance of methane within the system boundary. 'Standard values' is vague, and simply because a value is 'standard' does not mean it is accurate, nor even that it reflects the most up-to-date scientific understanding. Moreover, novel approaches for site-scale fugitive methane emissions measurement are being developed; this definition should be expanded to allow such direct measurement, once it has been appropriately validated.[36]

391.24 "Hydroprocessed Ester and Fatty Acid (HEFA) Fuel" - A definition of 'lipid feedstock' is required to avoid misinterpretation. We assume that the intent is to limit the definition of lipids to mean non-fossil lipids produced from biomass, such as vegetable oil, tallow, used cooking oil, etc. The proposed definition is not entirely clear whether something like pyrolysis oil made from non-edible cellulosic biomass would be considered a lipid for the purpose of this definition.

391.25 "Renewable Diesel" - The definition only includes hydrotreated lipids, biocrudes, or the products of the Fischer-Tropsch process within its definition. Other chemical synthesis approaches other than F-T may become feasible sources of feedstock for hydrotreating in the future, and thus, the present definition may overly limit the scope to exclude them.

391.26 "Renewable Naphtha" - Similar to "Renewable Diesel", the definition may overly limit the scope of potential feedstock sources and exclude relevant future chemical synthesis processes.

391.27 "Residue" - While the intent of this definition is clear, the lack of any testable significance threshold leaves it open to a variety of competing interpretations. Similar to the definitions of 'byproduct' and 'coproduct' (discussed above) a specific quantitative significance threshold could enhance the clarity of this definition.

Additionally, the proposed definition of 'residue' limits its scope of applicability to biofuel production, excluding other uses in bioenergy or bioproduct systems that could be relevant to future LCFS pathway certification or broader trends in the development of a circular economy. It

[36] Z. Zhu, J. Gonzalez-Rocha, Y. Ding, I. Frausto-Vicencio, S. Heerah, A. Venkatram, M. Dubey, D. Collins, F. Hopkins, Toward on-demand measurements of greenhouse gas emissions using an uncrewed aircraft Aircore system. Copernicus GmbH [Preprint] (2023). https://doi.org/10.5194/egusphere-2023-1527.

would seem that this definition could classify something as a residue when it's used for biofuels, but not if it were combusted to produce electricity, or used as a feedstock for bioplastics.

Finally, the definition relies on establishing that a given material either has no significant value, apart from that which it could gain as biofuel feedstock, or that there would be significant costs for alternative management or disposal costs for fates other than use as a biofuel feedstock. Without a clearly identified significance threshold, this definition may be open to multiple competing interpretations.

This definition also omits a significance threshold for the term 'secondary,' which would allow for a variety of products or activities to be classified as residues inappropriately. If a producer creates a product that is used as a biofuel feedstock from which they obtained 49% of their total revenue stream, it could be classified as a 'residue' under this definition, provided that it had no market value outside of its use as feedstock and that alternative disposal would entail 'significant' cost, despite the fact that producers would certainly optimize their production process to maximize the value of something that provided nearly half of their revenue. For example, if a soybean producer demonstrated that there was no market available for their soybean oil, due to local dietary preferences or lack of appropriate food-grade shipping capacity, they could claim that such oil was a residue for the purpose of LCFS pathway certification under this definition, despite that claim seeming to contradict the intent of this provision. Clarifying a significance threshold around the term 'secondary' and aligning that with definitions for 'byproduct' and 'coproduct' would provide additional clarity.

391.28 "Shared MHD-FCI charging site" - Requiring at least two MHD EV fleets under different ownership does not strongly distinguish it from a private station especially given that 'ownership' is undefined and does not recognize the wide variety of ownership, leasing, joint-venture, holding company, franchise or other management structures. A single holding company that creates two independent subsidiary entities for the purpose of vehicle ownership would seemingly qualify as two fleets under this definition. Clarifying the meaning of 'ownership' could help ensure that the intent of this provision is accomplished.

"Shared MHD-HRI station" - The same concern as in 'Shared MHD-FCI charging site' applies here.

Section 95482 Fuels Subject to Regulation

391.29 §95482 (f) - Depending on characteristics related to the method of palm oil production and conversion, transportation fuel derived from palm oil or palm derivatives may have a higher carbon intensity than fossil ULSD. Assigning it the CI score of ULSD may therefore underestimate its actual impacts.

391.30 §95482 (g) - As discussed in the definition of "Break ground," above, the current proposal could allow projects to perform a minimal amount of earthmoving during a period while a given class of pathway is open to new applications, but delay the majority of construction (along with completion and commissioning) by a significant amount of time. Provisions in the HRI and FCI protocols that allow, but do not require, a pathway application to be canceled if the project is not operational within 24 months of pathway approval offer (e.g. § 95486.3 (a)(4)(F)) offer some assurance that delayed construction can not allow a pathway to be certified after it would otherwise be ineligible, however delays during the pathway approval process plus the 24 month allowed window between pathway approval and the station becoming operational mean projects may not actually go online until significantly more than 2 years after the window of eligibility has nominally closed. Not all potential pathways with limited temporal windows of eligibility have equivalent limitations, as well. Specifying the need for groundbreaking to be shortly followed by continuous construction, or extending requirements for prompt completion of pathways could reduce this risk.

Section 95483 Fuel Reporting Entities

§95483 (c)(1)(A) 5. - The proposed amendments to this section would eliminate the eligibility of "Multilingual marketing, education, and outreach designed to increase awareness and adoption of EVs, clean mobility options, and including information about: the environmental, economic, and health benefits of EV transportation…." as an acceptable use of EDU holdback credits. Developing the EV market in California to the point where it is fully self-sustaining, and no longer needs policy support is a goal of California's decarbonization policies, including the Advanced Clean Cars 2 rule. There are still significant gaps in consumer awareness of EVs, as well as the personal and/or environmental benefits they offer. Recent surveys by the UC Davis Electric Vehicle Research Center find the majority of California consumers still cannot correctly
391.31 name a single model of EV, indicating a massive need to improve awareness of EVs.[37] Eliminating marketing and outreach activities from eligibility to be supported by EDU holdback credits may delay resolution of this problem. While it is important to ensure that EDU holdback credits are spent efficiently, and the value of marketing and outreach can be difficult to quantify, current evidence indicates such outreach may still have a role in California's policy portfolio.

391.32 §95483 (c)(5)(b)(i) - Proposed amendments would create a new category of projects which utilities can support using revenue EDU holdback credits; among them are investments in grid-side distribution infrastructure for EV charging. While there are clearly critical needs to upgrade the grid to support expanded EV charging, EDUs already have mechanisms to fund these upgrades, through utility rate-basing under authority, subject to CPUC regulation and

[37] Hoogland, et al. (2024). https://www.sciencedirect.com/science/article/pii/S2590198223002543
Kurani (2022). https://escholarship.org/uc/item/8738w7m3

approval. Investor-owned utilities (IOUs) are granted the right to claim a rate of return on capital investments made on approved project types. The proposed amendments would make some EV-related projects eligible to be supported by a new revenue stream. It is uncertain, and not explored in the ISOR, how this revenue would interact with CPUC regulation, and whether IOUs will be able to claim an equivalent rate or return on capital projects funded by holdback revenue. If they can, this raises questions about whether LCFS revenue (which predominantly comes from credit acquisition costs passed on to gasoline consumers) is an appropriate source of utility revenue and potential profit for IOUs. Similarly, care should be exercised to ensure that this revenue actually results in additional EV charging infrastructure, rather than having utilities compensated twice (once by normal CPUC approved methods and once by EDU holdback revenue) for the same work.

Section 95484 Annual Carbon Intensity Benchmarks

391.33 §95484 (b)(2)(A) defines *Deficits*$_{20xx}$ as “the total number of deficits generated under the program…”. This could be misinterpreted as cumulative program deficits rather than total annual deficits for year *20xx*. This should be clarified.

391.34 §95484 (b)(2)(B) - The proposed auto acceleration mechanism relies on two trigger criteria being simultaneously true: the Credit Bank to Average Quarterly Deficit Ratio exceeding three, and credits exceeding deficits for the given year. These conditions could be simultaneously true under market conditions that would not otherwise warrant an AAM triggering event, such as an anomalous net credit surplus year during a multi-year period of credit bank decline. For example, in the analysis of the proposed impacts of current amendments presented in the *Renewable Diesel Capacity Growth and 2030 Targets* section above, we show projections of credit balance and bank for the proposed amendments through 2035. After the second projected AAM triggering event increased the 2030 target to 39%, the credit bank began a period of gradual decline, though the Credit Bank to Average Quarterly Deficit Ratio remained above 3 through 2035. Under these conditions, if a single year in this period happened to yield a net credit surplus, as could happen due to another pandemic-driven temporary drop in gasoline consumption, a third AAM event would be triggered and the gradual decline in banked credits could turn into a precipitous drop into profound credit insufficiency.

391.35 This outcome could be prevented through the adoption of a longer look-back period, such as the prior three years. This would reduce the chance that one anomalous year during a multi-year period of declining credits could not trigger an unadvised AAM event.

391.36 Additionally, the proposed AAM action mechanism, advancing two years on the compliance schedule rather than one, can risk pushing the market into credit insufficiency in certain conditions, as we described during our presentation at the May, 2023 workshop on Auto

Acceleration mechanisms.[38] This risk magnifies as the yearly increase in CI target goes up, as it does after 2030 in the proposed compliance schedule. These risks could be mitigated by adopting an automatic relaxation mechanism in addition to the AAM; this mechanism would return to the previous compliance schedule when certain criteria were met, such as the Credit Bank to Average Quarterly Deficit Ratio dropping below 1.

391.37 §95484 (d) Table 1 - The CI values shown in the table are slightly different from the CI values shown in Table 1 of the Initial Statement of Reasons.

391.38 §95484 (f) Table 3 - The CI benchmarks for 2019 to 2022 for SAF have been updated, but it is not clear whether these would be applied retrospectively or whether they imply any changes to past crediting. We assume no retroactive adjustments are implied, however this should be clarified.

Section 95486 Generating Credits and Deficits

391.39 §95486 (b)(1) Table 4 - “Renewable Gasoline” has been added to the table, but its definition has not been provided. A definition of “Renewable Gasoline” should be included in section 95481.

391.40 §95486 (b)(2) - After 2028, fossil jet fuel will start generating deficits, however the equation for total deficit generation *Deficits*^{Gen}*(MT)* does not include a term for deficits from jet fuel.

Section 95486.1 Generating and Calculating Credits and Deficits Using Fuel Pathways

391.41 §95486.1 (a) - The equations specified in sub-parts (1)-(3) embed an assumption related to emissions benefits due to the displacement of fossil fuel by vehicles with an EER>1. As discussed in the section *Fractional Displacement Crediting Approach for Fuels with EER>1,* this assumption will become less appropriate over time given the growing presence of ZEVs and other vehicles with EER>1 in the fleet. Algebraically rearranging this set of equations to separate GHG reductions from fuel displacement effect from GHG reductions due to the lower CI of fuels on an equal energy basis provides a more clear and transparent representation of the GHG reductions being evaluated. Separating the terms also allows for a new term to be introduced, *Displacement Fraction*, that allows the replacement of the previous assumption of fuel displacement determined by EER ratio under all conditions, at all times. Equation 1, below, describes the proposed replacement for the equations in §95486.1 (a).

$$Credits_i^{XD}(MT) = \left(CI_{standard}^{XD} - CI_i\right) \times E_i \times C + \left(EER^{XD} - 1\right) \times CI_{standard}^{XD} \times E_i \times F_{displaced}^{XD} \times C$$

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

Where $CI^{XD}_{standard}$ CI_i, E_i, EER^{XD}, and C are unchanged from their current definition and $F^{XD}_{displaced}$ —"Displacement Fraction"—is the fraction of theoretical displacement to be credited under the given pathway. The fraction of the fleet still using the incumbent, higher-emitting technology (e.g., ICE) is a reasonable approximation here. Note that when $F^{XD}_{displaced}$=1, this equation gives identical results as the equations currently used in §95486.1 (a). These issues are discussed in depth in Murphy (2022)[39]

Section 95486.2 Generating and Calculating Credits for ZEV Fueling Infrastructure Pathways

391.42 §95486.2 (a)(7) - The proposed amendments would delay implementation until 2026. This would seem to allow a number of new proposals to be certified under the existing protocols as specified in §95486.2 (a). The new LD-HRI protocols have enhanced requirements relating to disadvantaged community benefit, limitations against crediting in excess of 1.5 times net capital expenditure, and improved financial transparency. No justification for the delay in implementation is given. Presumably, the delay is meant to allow projects that have begun work under the expectation of being governed by the existing HRI protocols to finalize and submit their applications. Given the highly public nature of the LCFS rulemaking and the fact that HRI project developers are typically in contact with LCFS program staff at multiple points in the pre-application process, we are not aware of any significant benefit from this delay. A more rapid implementation would more quickly bring the improvements in the amended protocols into action. Additionally, given the reduced cap on LD HRI and FCI credit generation, delaying implementation allows more projects to apply under the existing protocols and as a result, a greater fraction of credits from this class of pathways would go to projects approved without the additional disadvantaged community benefit, cost containment, and transparency requirements. Maximizing the number of projects subject to the new rules could improve total benefits from the program, especially as they relate to disadvantaged communities.

391.43 §95486.2 (a)(7)(F) - These amendments indicate that if estimated LD-HRI credits (i.e. those approved under the rules added by the proposed amendments, after January 1, 2026) exceed 0.5% of prior quarter deficits, then no new LD-HRI pathway applications will be accepted or approved. It is not clear, however, what happens if LD-HRI credits are less than 0.5% of prior quarter deficits but HRI credits (those approved under the existing protocol) are greater than 0.5% of prior quarter deficits, or if the sum of HRI and LD-HRI credits exceed 0.5% after January 1, 2026. Clarifying this behavior, especially regarding the possibility of the sum of HRI and LD-HRI credits exceeding 0.5% of prior quarter deficits would be helpful.

[39] Murphy (2022); https://escholarship.org/uc/item/0px4m8hz

391.44 §95486.2 (a)(7)(J) - The proposed amendments would require annual financial reporting by LD-HRI operators to the Executive Officer. Publishing anonymized versions of this data, or averages of all LD-HRI projects would provide additional transparency for the program and help researchers better understand revenue dynamics in this policy domain, while still protecting project operators confidential business information

391.45 §95486.2 (b)(1)(C) - The proposed amendments specify protections against non-additionality of infrastructure capacity. These same conditions would also help guarantee the additionality of LD-HRI pathways as well, we suggest staff consider applying them to both LD-HRI and LD-FCI,

391.46 §95486.2 (b)(7)(E) - There is a potential typo, which uses the "MHD" subscript in an equation for LD-FCI. If this subscript is intentional, then the descriptions following the equation should be updated.

391.47 §95486.2 (b)(7)(J) - Similar to §95486.2 (a)(7)(J) (see above) publication of anonymized data or averages across all approved pathways would help improve program transparency and support research into this topic.

Section 95488.1 Fuel Pathway Classifications

391.48 §95488.1 (c) and (d) - Hydrogen pathways have been removed from the list of Tier 2 classification and moved to the Tier 1 list. Although hydrogen produced from steam methane reforming of methane and electrolysis are comparatively well understood and may appropriately belong in the Tier 1 classification, other methods for hydrogen production may emerge over time, and if so, would be most appropriately assessed by a Tier 2 classification.

Section 95488.3 Calculation of Fuel Pathway Carbon Intensities

391.49 §95488.3 (d) Table 6 - As discussed earlier in the section *Sustainability Challenges From Excessive Consumption of Lipid-Based Biofuels*, existing Land Use Change Values, as shown in the table, are likely out of date, since they rely on now-dated ILUC modeling methods. The models used to generate them were based on the assumption of a biofuel-demand shock that does not accurately reflect current market conditions. As a result, they are insufficiently protective against significant ILUC impacts, particularly critical for crop-based oils like soy and canola. Updating the Land Use Change Values presented in Table 6 to reflect current scientific understanding of the natural and economic factors surrounding ILUC, or developing a new, more robust approach would protect against these risks, however either of these approaches are likely to require multi-year research, development, and consultation processes. A cap on lipid- or crop-based feedstocks can be more quickly implemented, would provide certainty that ILUC risks could be appropriately mitigated, and could be used as a temporary measure until the development of a more flexible and robust approach.

Section 95488.8 Fuel Pathway Application Requirements Applying to All Classifications

391.50 §95488.8 (g)(1)(A)(3) - The proposed amendments intend to protect against the risk that use of forest residue for biofuel production could lead to expanded clear-cutting or other unsustainable forest management methods. This intent reflects an important consideration when leveraging forest resources for this purpose. Referencing existing code or statute related to sustainable forest management, such as the California Forest Practice Rules, or applicable US Forest Service guidance, could improve the clarity and transparency of this section. In particular, the proposed amendments require ascertaining the intent of management interventions in order to ensure only residue biomass subsequent to activities for the "purpose of forest fire fuel reduction or forest stand improvement" can be used. Providing an objective criteria by which to ascertain this intent could be helpful, provided it does not open new loopholes leading to unsustainable practices.

391.51 §95488.8 (i)(1)(B)(3) - Proposed amendments seek to ensure claimed GHG benefits satisfy tests of additionality by specifying that environmental attributes or certificates credited or used for compliance under any programs other than the RFS or the cap and trade program would be ineligible. As discussed in the section *Reevaluating Previous Assumptions Around Additionality*, above, existing approaches to additionality determination may deserve reconsideration, including the explicit eligibility of environmental instruments credited under the RFS and cap and trade programs, effectively exempting them from the requirements specified in this provision. As technologies, markets, and consumer behavior evolve, GHG assessment methodologies may need to evolve as well, particularly as it pertains to subjective determinations like system boundary establishment, counterfactual specification, and additionality determination. A comprehensive review of additionality in LCA contexts, including their use to inform policy, would help determine whether changes to this or other LCFS provisions is appropriate.

391.52 §95488.8 (i)(1)(C) - The proposed provisions would set limitations on the characteristics of low-CI electricity used for direct air capture (DAC) projects or hydrogen used as a transportation fuel. First, §95488.8 (i)(1)(C) should specify "hydrogen made by electrolysis" since these requirements predominantly only apply to electricity.

391.53 More substantively, while they provide some clear guidance that will help ensure that GHG reductions from electrically-powered projects match those predicted by the project's CI score, they do not align with current best practices in this space. A potentially superior approach was developed in Europe's Delegated Acts on hydrogen, and proposed in draft regulation regarding the U.S. Section 45V tax credits. Known as the "three pillars" approach to sustainable low-carbon electricity, they require low-CI electricity to be additional to existing regulatory requirements, deliverable to the point of demand, and time-matched at hourly time scales to avoid exacerbating grid peaks or indirectly expanding the use of fossil fueled power generation.

[40,41] The proposed language in §95488.8 (i)(1)(C) 1. captures deliverability, and §95488.8 (i)(1)(C)5. offers a limited approach to additionality requirements, with several specified exceptions. Hourly time matching is, however, excluded. Fully implementing hourly time matching may be beyond the capability of electricity tracking, certification, and accounting systems at present. The EU Delegated Acts offer a delay, until 2030, before the hourly matching provisions are fully enforced. Adopting a similar approach may be advisable in this case. Committing to such an adoption now sends a strong signal to the market to ensure such capabilities are developed, and allows project developers ample time to prepare for the new requirements. Adopting them into the LCFS would align it with best practices from around the globe on this issue and ensure that expanding demand from electrolysis, e-fuel production, or other electrically-powered GHG reduction measures do not cause fossil fueled power plants to be used more than they otherwise would.

391.54 §95488.8 (i)(3) - Proposed amendments specify the protocols by which hydrogen can be injected into a pipeline system and subsequently used to fuel vehicles, or as an input to other fuel production. This section omits requirements to regularly assess and report the leakage rate of hydrogen from pipelines and associated equipment. An extensive body of research has documented routine leaks from existing natural gas pipelines. Hydrogen, a much smaller molecule than methane, is likely to pose equal or greater risk of leakage from pipelines or related infrastructure. Given hydrogen's status as a secondary GHG, accurate assessment of the GHG impacts of fuels using pipeline-transported hydrogen requires accurate data about leakage rate.

391.55 §95488.8 (i)(3)(B) - The proposed provisions specify minimum GHG thresholds to be met in order for pipeline-transported hydrogen to be eligible for credits. The proposed language specified "well-to-wheel" carbon intensity. This means that different hydrogen vehicles could yield different carbon intensity scores, even when fueled by identical fuel, due to the effect of the EER on well-to-wheels CI. To match the presumed intent of this provision, the proposal should either specify well-to-tank CI, or specify an EER to use when calculating well-to-wheels CI.

Section 95488.9 Special Circumstances for Fuel Pathway Applications

391.56 §95488.9 (g) - The proposed provisions would adopt sustainability requirements for feedstocks coming from crops or forest biomass. In general, sustainability requirements like those proposed in this section provide increased assurance that biofuel, bioenergy, or bioproduct feedstocks do not cause excessive environmental harm and that their real GHG benefits match their assessed

[40] http://data.europa.eu/eli/reg_del/2023/1184/oj

[41] See: https://energy.mit.edu/wp-content/uploads/2023/04/MITEI-WP-2023-02.pdf, https://iopscience.iop.org/article/10.1088/1748-9326/acacb5/meta, and https://www.evolved.energy/post/45v-three-pillars-impact-analysis for additional description and analysis on the three pillars approach.

values. That general conclusion applies in this case as well, however several specific considerations and cautions apply to their application in the LCFS as proposed by this section.

First, as discussed in the section *Sustainability Challenges From Excessive Consumption of Lipid-Based Biofuels*, above, sustainability requirements like those proposed here are not capable of effectively mitigating indirect risks, like ILUC, which is a primary vector for GHG and ecosystem risk *vis a vis* current biofuel production systems. Regardless of the specific merits of any sustainability certification system, additional precautions are required to address ILUC.

391.57 Second, the scope of sustainability certification excludes used cooking oil and other waste lipid feedstocks. These feedstocks present very high risk of mislabeling or other fraudulent activities due to the higher value of the biofuels produced from them. While such feedstocks do have chain-of-custody requirements per §95488.8 (g) these are limited to chain-of-custody and record retention requirements meant to aid in audits of feedstock flow. Integrating these particularly risky feedstocks into certification requirements provides additional structure and empowers third-party certification bodies to more effectively identify and respond to examples of mislabeling, feedstock adulteration, or other fraud.

391.58 Third, §95488.9 (g) specifies the requirements apply to "land that was forested after January 1, 2008," however it is unclear whether "forested" is being used as a verb or adjective in this sentence, which determines whether the scope is any land that had forest cover after the specified date, or land that was *afforested* or transitioned from some other land cover to forest after that time. Given the context, the adjective use appears more likely, but additional clarification could resolve any ambiguity.

Section 95488.10 Maintaining Fuel Pathways

391.59 §95488.10 The proposed amendments to this provision may result in reduced credit flows to and/or increased credit flows from the administrative buffer account used to protect against some forms of credit invalidation risk, and to help facilitate certain administrative transactions. No analysis is provided to characterize the anticipated changes to credit flows through the buffer account, the risk of buffer account insufficiency, or the impacts of such insufficiency. It is difficult to evaluate the likely impact of these amendments without such analysis.

Section 95489 Provisions for Petroleum-Based Fuels

391.60 §95489 (c) and (e) - Existing provisions to generate LCFS credits from the reduction of GHG emissions during crude production and transport or at petroleum refineries align with the intent of the LCFS, and support continued incremental decarbonization of California's transportation fuel portfolio, provided that the credited reductions actually match real-world GHG impacts. These provisions may be improved however, by stronger requirements to demonstrate the additionality of approved projects, such as a requirement that emission-reducing projects provide emissions benefits in excess of industry standards, or by requiring facility-level mass/energy flow assessment instead of the current requirement that system boundaries for these assessments include only direct and first-order indirect impacts.

391.61 §95489 (c)(1)(A)2. - Capturing anthropogenic carbon for sequestration or reuse aligns with the intent of the LCFS, however the proposed language may allow producers to create a new stream of CO_2 in order to subsequently capture it for credit generation. Limiting the eligible sources to those that existed at the time these provisions were adopted would help ensure that captured CO_2 provides additional GHG benefits.

391.62 §95489 (c)(1)(D) - On page 189 of Appendix 1 of the rulemaking package is a reference for which it is difficult to interpret which section of the proposed code it falls under. It states "The innovative method must achieve an emission reduction of at least 1,000 metric tons of CO_2e per year". It appears that this is intended to be part of §95489 (c)(1)(D), but this should be clarified to prevent confusion. Moreover, we could ascertain no reason for reducing the threshold for crediting from the previous 5,000 metric tons to 1,000.

391.63 §95489 (c)(1)(G) - As discussed in the section *Reevaluating Previous Assumptions Around Additionality,* above, a comprehensive review of existing considerations around additionality is warranted. The specified exemptions from the usual practice that prevents the use of environmental attributes credited under the cap and trade system from supporting claims of emissions reductions should be reevaluated as part of that review.

391.64 §95489 (e)(1)(D)1. - Proposed language specifies capturing anthropogenic sources for the purposes of LCFS crediting. Similar to §95489 (c)(1)(A)2. above, this may allow sources created for the purpose to gain LCFS credits in a way that would render the claimed emissions benefits non-additional..

391.65 §95489 (e)(1)(D)3. - Existing language specifies that use of lower-CI process energy, such as biomethane, can be credited for GHG reductions from the displacement of fossil fuels. It is unclear from this provision whether book-and-claim accounting can be used to provide this biomethane or if it must be directly supplied.

391.66 §95489 (e)(1)(D)5. - Existing language specifies that curtailment "exclusively for the reduction or cessation" of fuel production is excluded. This definition relies on ascertaining the facility operator's intent behind any curtailment or capacity reduction, and the use of the word "exclusively" further limits the degree to which this provision is protected against issuing credits for curtailment. Providing objectively determinable criteria for determining whether reduced production should qualify for crediting would improve the clarity and actionability of this provision.

Additionally, as California continues along its path to carbon neutrality, demand for petroleum fuels will necessarily decline, meaning that some refinery capacity may no longer be needed, especially as other jurisdictions that may previously have been markets for refined products exported from California advance along the same trajectory. It may be worth considering
391.67 whether there is a role for the LCFS in facilitating the shutdown of older, less efficient refineries, or those in or near disadvantaged communities to help California achieve its climate and equity goals. This would entail leveraging the LCFS in a novel way with a wide variety of tradeoffs that would require diligent consideration prior to action, however using the LCFS to help manage the wind-down of California's refining sector may offer significant long-term efficiency advantages. Exploration of this concept is outside the scope of the present rulemaking, however and would require a new rulemaking to fully implement, at which point the provisions in this section could be modified to accommodate the new application of the LCFS.

391.68 §95489 (e)(1)(K) - As with §95489 (c)(1)(G) and other sections, the exclusion of environmental attributes credited under the cap and trade or other climate programs may represent an opportunity to improve the treatment of additionality in the LCFS and should be reviewed as part of a comprehensive reevaluation of additionality provisions.

391.69 §95489 (f) - As with §95488.8 (i)(1)(C), aligning LCFS requirements on electricity used for hydrogen production with the "three pillars" approach better aligns it with global best practices in this space.

391.70 §95489 (f)(1)(E) - As with §95489 (c)(1)(G) and other sections, the exclusion of environmental attributes credited under the cap and trade or other climate programs should be part of a comprehensive review of additionality provisions. .

Section 95490 Provisions for Fuels Produced Using Carbon Capture and Sequestration

§95490 (a)(1) - This section proposed changes to the LCFS provisions on carbon capture and
391.71 sequestration (CCS), however it retains previous language which limits the definition of CCS to applications in which CO_2 is geologically sequestered. Emerging options for carbon removal may exist that do not sequester CO_2 geologically, such as being converted into non-consumable products including concrete or building materials, or absorbed into carbonaceous minerals via enhanced weathering. The present provision may overly limit the scope of sequestration options; defining sequestration to include conversion to a solid form stable over geologic time scales could resolve this oversight and support innovative approaches to CO2 sequestration.

391.72 §95490 (b)(8)(B) - As with §95488.8 (i)(1)(C), above, aligning requirements for low-carbon electricity with the "three pillars" approach reflects global best practices and minimizes the risk on unwanted GHG emissions.

391.73 §95490 (c)(2)(A) - Proposed amendments require that if a CCS project uses CO_2 that was previously being captured for industrial use, any replacement for that lost gas comes from new or expanded capture of anthropogenic CO_2 sources. Given that CO_2 is regularly captured for industrial use (e.g. soda carbonation or dry ice production) it is appropriate that CCS projects the deploy new CO_2 capture capacity receive more credit for the additional reduction of net GHG emissions than a project that simply redirects existing captured CO_2 and overlooks measures taken by industrial entities to replace the lost supply. This is especially true given that the intent of the CCS Protocol in the LCFS was to support the deployment of novel technology.

Section 95500 Requirements for Validation of Fuel Pathway Applications; and Verification of Annual Fuel Pathway Reports, Quarterly Fuel Transactions Reports, Crude Oil Quarterly and Annual Volumes Reports, Project Reports, and Low-Complexity / Low-Energy-Use Refinery Reports

391.74 §95500 (c)(1)(A)8. - Proposed LCFS amendments would add fossil jet fuel used for intrastate travel to the LCFS as an obligated, deficit-generating fuel starting in 2028. Recordkeeping for aircraft entails several additional considerations compared to ground-based transport. Aircraft operators may fuel aircraft with more fuel than required while in jurisdictions that do not regulate or tax fuel, in order to reduce costs. Carrying the extra fuel over a full leg of a flight entails extra weight on the aircraft, and therefore, higher fuel burn. Preventing this behavior, known as "tankering," therefore not only helps ensure that the regulatory intent is fully executed, but also reduces emissions. Tankering may be a strategy used by some aircraft operators to minimize costs associated with jet fuel deficit obligations under the LCFS. To mitigate this risk, the ReFuel EU protocol, for example, requires that at least 90% of fuel needed for all intrastate routes be loaded in the EU otherwise additional deficits to achieve 90% equivalence will be assigned. Adopting this approach, or similar ones may require additional fuel transaction records. Recordkeeping requirements as specified in this, or other provisions, should ensure adequate recordkeeping and transparency to allow effective action to prevent tankering.

Appendix A-2. Proposed Regulation Order

Section 95486.3 Generating and Calculating Credits for ZEV Fueling Infrastructure Pathways

391.75 §95486.3 (a)(1)(B)2. - The proposed amendments require an MHD-HRI station be "or on or adjacent to a property used for medium or heavy-duty vehicle overnight parking," this is insufficiently defined or described. It could refer to a parking lot in which only a very small number of vehicles park, or even personal property on which an owner-operator parks their vehicle. Such small-scale parking would conflict with the intent of the HRI and FCI provisions to support the deployment of capacity that can serve all, or at least significant fractions of future

MHD ZEV fleets. As the MHD-HRI application must be approved by the Executive Officer before generating credits, empowering the Executive Officer to reject or demand amendments from applications that attempt to circumvent the intent of these LCFS provisions could mitigate this risk.

391.76 §95486.3 (a)(1)(D) - Clause (D) appears to contain redundant sub-clauses (D)2. and (D)3. Editing or clarification could improve this section.

391.77 §95486.3 (a)(3)(A) - Proposed language limiting the total credit generation from MHD-HRI provisions aligns with previous HRI provisions by testing to ensure that the sum of issued credits plus potential credits from approved pathways does not exceed the specified level. If the Executive Officer approves multiple installations simultaneously, the aggregate cap could be exceeded. This protocol should clarify that approvals happen one at a time in sequence, rather than simultaneously in batches, for the purpose of assessing whether the credit generation cap has been exceeded.

391.78 §95486.3 (a)(3)(A)2. - This provision proposes to limit the credits generated by any one applicant to 1% of prior quarter deficits. Limiting credits to any single entity can help ensure equitable, competitive access to LCFS support. The proposed provisions, however, may not achieve this goal. As discussed in our comments on the definition of "Shared MHD-FCI charging site," a variety of corporate structures exist that could allow a single entity to control multiple nominally independent entities, thereby becoming eligible to receive credits in excess of 1% of prior quarter deficits.

Additionally, FPSM modeling of the LCFS credit market indicates that the program will generate 40 million or more deficits per year in the early 2030's. 1% of this implies 400,000 or more credits could be issued to one entity. Assuming a credit price of $100, this would allow up to $40 million or more to go to an individual entity. We question whether this outcome is intended, or if it aligns with LCFS program goals. It also differs from comparable requirements for MHD-FCI shown in §95486.3 (b)(3)(A)2.

391.79 §95486.3 (a)(4)(G) - The concept of limiting capacity credit revenue to a specified fraction of total capital minus grant revenue seems appropriate to avoid additionality issues. However, this section appears to be referencing wrong sections. Instead of §95486.3 (a)(6)(B)1, 95486.3 (b)(6)(B)5 and 95486.3 (b)(6)(B)6, it may have intended to reference §95486.3 (a)(6)(C)1, 95486.3 (a)(6)(C)5 and 95486.3 (a)(6)(C)6.

391.80 §95486.3 (b)(1)(B)2 - Proposed language adopts the same definition of eligibility for MHD-FCI sites as §95486.3 (a)(1)(B)2, and the same concerns apply.

391.81 §95486.3 (b)(2)(F) - The proposed language seeks to set requirements for project developers to disclose total site power, however it makes no distinction between instantaneous power or that which can be sustained for any length of time. In order to prevent stations with limited ability to sustain charging operations under heavy use from receiving LCFS incentive, a minimum sustained time for maximum or near-maximum charging could be specified.

Initial Statement of Reasons

391.82 On page 116 during the discussion of the EJ alternative, a statement referring to the proposal to "Cap the use of lipid biofuels (commonly known as crop-based biofuels)," was made. In the context of biofuels and the feedstocks used for them, crop-based biofuels and lipid biofuels share a subset, namely crop-based vegetable oil biofuels, but they are not synonyms. Some crop-based biofuels are not made from lipids and some lipid biofuels are not crop-based. References to various lipid-based fuels in the proposed amendments suggest that this sentence in the ISOR is simply an imprecise choice of words, rather than evidence of any fundamental misunderstanding or conflict with other provisions, but this should be clarified.

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. We attach to this submission copies of the three recent reports from our research group related to research and modeling the LCFS, they are also available at the links cited in this letter. 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,

Colin Murphy, Ph.D.
Deputy Director, Policy Institute for Energy, Environment, and the Economy
Co-Director, Low Carbon Fuel Policy Research Initiative
University of California, Davis, California, USA

Jin Wook Ro, Ph.D.
Postdoctoral Scholar, Policy Institute for Energy, Environment, and the Economy
University of California, Davis, California, USA

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Improving Credit Quantification Under the LCFS: The Case for a Fractional Displacement Approach

Author
Murphy, Colin W

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Colin Murphy
Deputy Director
UC Davis Policy Institute for Energy, Environment and the Economy
Co-Director
Low Carbon Fuel Policy Research Initiative

UCDAVIS
Policy Institute for Energy,
Environment, and the Economy

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Acronyms

CI	carbon intensity
EV	electric vehicle
FD	Fractional Displacement
GHG	greenhouse gas
ICE	internal combustion engine
ICEV	internal combustion engine
LCA	life cycle analysis
LD	light-duty
LCFS	Low Carbon Fuel Standard
RNG	renewable natural gas
ZEV	zero-emission vehicle

Introduction

California has set ambitious targets for decarbonizing its transportation system and adopted a variety of programs to support the transition toward carbon-neutral vehicles and fuels.[1] The Low Carbon Fuel Standard (LCFS) is a critical element of the policy portfolio; it provides incentives for reducing the carbon intensity (CI, measured across a fuel's full life cycle) of transportation fuels, via the generation and trading of LCFS credits. Since its inception, the LCFS has successfully reduced greenhouse gas (GHG) emissions from transportation in the state and led to a doubling of the fraction of transportation energy coming from lower-carbon, non-petroleum sources.[2]

A core strength of the LCFS has been the way it correlates the amount of incentive offered to a given fuel with GHG reductions.[3] This allows the program to provide strong, focused support for innovative low-carbon technology.

Going forward, one concern is that the current method used to quantify LCFS credits in California as well as in similar policies in Oregon and Washington, relies on assumptions that reflect conditions in early phases of a transition from petroleum internal combustion engine vehicles (ICEVs) to alternative fuel vehicles, including zero-emission vehicles (ZEVs). But as ZEVs and other advanced technology vehicles saturate a market, these assumptions become increasingly flawed. In particular, the current LCFS approach embeds fixed assumptions about the amount of fuel displaced by advanced technology vehicles.[4] These assumptions tend to overestimate fuel displacement in middle and later years of the transition away from conventional vehicles; this overestimation could create LCFS credit market imbalances, drive down the LCFS credit price, or simply create a noticeable gap between GHG savings credited and those achieved.

This paper proposes an alternative approach to quantifying credit generation under the LCFS, called Fractional Displacement (FD) crediting. Fractional Displacement crediting is a minimally disruptive, technologically neutral modification to existing LCFS credit quantification methods. It allows the use of more appropriate assumptions about how much fuel is displaced by advanced technology vehicles. It maintains the core conceptual framework of the LCFS and improves the correlation between actual emissions reductions and crediting under the LCFS. The FD crediting approach can be adopted for virtually all LCFS technologies and pathways, and doing so would cause little, if any impact to credit generation under the LCFS for the next 5 years in all but one sector of California's transportation system. The only sector that could see near-term impacts would be electric forklifts (e-forklifts)**—**a market segment that has already largely converted from conventional ICEVs to ZEVs and one for which LCFS program staff sought input regarding options to phase down credit generation. As more sectors of the fleet move through their transition, a program-wide switch to FD crediting could prevent the emergence of future credit market imbalances, reduce the need for future rulemakings to correct such imbalances,

[1] Muratsuchi, Bill Text - AB-1279 The California Climate Crisis Act.

[2] Mazzone, Witcover, and Murphy, "Multijurisdictional Status Review of Low Carbon Fuel Standards, 2010–2020 Q2."

[3] All references to LCFS-incentivized GHG reductions, emissions, and carbon intensities in what follows refer to carbon intensity scores reductions as assessed by the program's carbon intensity rating system.

[4] For the purposes of this paper, "advanced technology vehicles" are those with an energy economy ratio (EER) greater than 1. At present, all ZEVs, including electric and hydrogen fuel cell vehicles would meet this definition.

and preserve the LCFS' ability to support the transition to lower-carbon transportation technologies, in addition to improving the accuracy of quantified GHG reductions due to the program.

This concept is presented as the starting point for discussion, and feedback from the stakeholder community is welcomed.

Opportunities to Better Align Advanced Vehicle Technologies' LCFS Credit Generation with Emissions Impact

Quantitatively representing complex systems requires making a number of analytical assumptions that often do not have an objectively or empirically verifiable basis, that is to say, assumptions for which there is no single "correct" or "incorrect" choice. For example, life cycle analysis (LCA) of biofuel systems requires making numerous assumptions about system boundaries, coproduct allocation, and counterfactual outcomes, including indirect impacts like land use change. Quantifying life cycle impacts requires making these assumptions, and the analyst has no alternative other than to select one set of assumptions on an at least partially subjective basis, yet these assumptions can have a significant impact on the quantitative outcomes of the analysis in question.[5] In the absence of an objective basis for making these analytical assumptions, most scholarship (especially as it pertains to LCA) emphasizes transparency, the use of consensus-based standards, and aligning assumptions with the best possible understanding of the system being analyzed.[6] The core problem that FD crediting would solve is that the assumptions underpinning current LCFS quantification methods do not align with expected emissions impacts of advanced technology vehicles in the middle and later parts of a transition from conventional ICEVs to advanced technology vehicles, like ZEVs.

One of the strengths of the LCFS is the strong relationship between the amount of incentive received per unit of a given fuel, and its assessed GHG reductions. This relationship helps ensure that incentive revenue flows to fuels that provide the greatest emission reduction value to the program, and that producers have an incentive to continually seek opportunities for incremental reduction in carbon intensity of their fuels. Clearly, the assumptions made to allow quantitative analysis have the potential to substantially impact the amount of incentive received under the LCFS, and therefore, the ability of the program to achieve its goals. Ensuring that these assumptions match reality, to the greatest extent possible, is therefore critical to supporting the LCFS as it fills an important role in California's climate policy portfolio.

[5] Murphy and Kendall, "Life Cycle Inventory Development for Corn and Stover Production Systems under Different Allocation Methods."

[6] ISO, *ISO 14040*; ISO, *14044 Environmental Management — Life Cycle Assessment — Requirements and Guidelines*; Ekvall and Finnveden, "Allocation in ISO 14041—a Critical Review."

Under the LCFS, the number of credits generated by each unit of fuel provided to the market is determined by the following formulas for most credit generating pathways:[7]

$$\boldsymbol{Credits_i^{XD}/Deficits_i^{XD}(MT)} = \left(\boldsymbol{CI_{standard}^{XD}} - \boldsymbol{CI_{reported}^{XD}}\right) \times \boldsymbol{E_{displaced}^{XD}} \times \boldsymbol{C},$$

*(**Equation 1**)*

$$\boldsymbol{E_{displaced}^{XD}} = \boldsymbol{E_i} \times \boldsymbol{EER^{XD}},$$

$$CI_{reported}^{XD} = \frac{CI_i}{EER^{XD}},$$

where $CI_{standard}^{XD}$ is the LCFS target for the fuel category, CI_i is the reported CI for a given fuel, E_i is the amount of fuel energy consumed by the advanced technology vehicle, EER^{XD} is the energy economy ratio, and *C* is a unit conversion factor, $10^{-6}\ tonnes/gram$. The *EER* is a dimensionless unit that reflects the relative efficiency of some powertrains compared to their closest internal combustion engine equivalent (gasoline, diesel, or jet fuel); this represents differences in fundamental efficiency of some powertrains as well as the effect of other efficiency-enhancing technologies like regenerative braking. For an advanced technology vehicle (with *EER* > 1), the *EER* reflects the emissions benefit provided by reducing the total amount of energy needed to provide mobility in that vehicle as compared to a conventional ICEV (Figure 1).

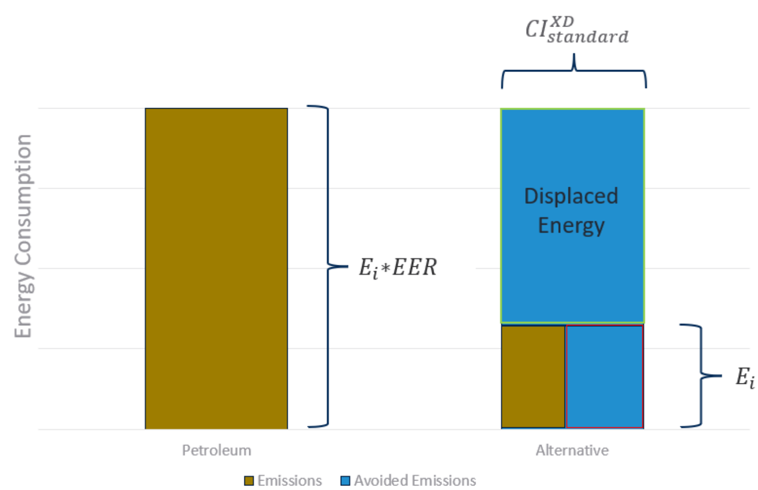

Figure 1. Illustration of energy consumed vs. energy displaced for the purposes of LCFS credit calculation. The height of the bar represents the amount of energy consumed, the width represents carbon intensity, meaning shaded areas represent emissions (brown) or avoided emissions (blue). Note: this figure omits petroleum emissions in excess of the CI standard. Without the displacement term, advanced technology vehicles would be credited only for the lower carbon intensity of the consumed energy but not for using less energy to accomplish the same transportation activity.[8]

[7] Source: LCFS Regulation Order § 95486.1 (a) (1)

[8] For simplicity, this figure omits the effect of the changing LCFS carbon intensity target, effectively assuming that the target is equal to the carbon intensity of the "petroleum" bar. Note that the petroleum fuel's actual carbon intensity score lies above the standard for any CI reduction target by design; this gap is central to incentivizing the fuel mix change for compliance.

This approach to crediting under the LCFS functionally embeds two key assumptions into the calculation of LCFS credits for fuel displacement.

1. The fuel being displaced always has a carbon intensity equal to the LCFS target for the reference fuel, represented as $CI^{XD}_{standard}$ in § 95486.1 (a) (1).
2. The amount of fuel displaced by vehicles with an *EER* > 1 is a fixed multiple of their energy consumption, set by the *EER*, under all conditions.

The first assumption is appropriate, since the specific fuel being displaced in a given year is unknown and likely to change over time, as the transportation sector transitions toward carbon neutrality. Additionally, the LCFS structure focuses on crediting emissions relative to the declining program target. Maintaining this assumption for avoided emissions due to displacement is a consistent application of this policy design premise.

The second assumption structurally locks fuel displacement as a fixed multiple of the amount of energy used by the advanced technology vehicle. It implies that for every X units of energy used by an advanced vehicle, the alternative would have been to use $EER \times X$ units of energy in a conventional one. This functionally locks the displaced fuel assumption at its maximum theoretical value, under all market conditions. Early in transitions to a ZEV-dominated fleet, this assumption is reasonable; if the new technology vehicle were unavailable, the travel would likely have occurred in a conventional one. While the precise amount of displacement has been the subject of considerable study,[9] the assumption that electric vehicle (EV) travel activity (measured in vehicle miles traveled) displaces an equivalent amount of gasoline vehicle miles traveled provides a reasonable approximation in California's on-road vehicle market, given the amount of ZEV adoption to date.

As a jurisdiction transitions to a fleet increasingly dominated by ZEVs, this assumption regarding displaced energy loses its alignment with real-world impacts. ZEVs purchased by drivers who had previously driven ICEVs and would have otherwise continued doing so still displace significant amounts of petroleum. However, some fraction of ZEVs are likely purchased by drivers who would otherwise have owned a ZEV, e.g., replacement of a ZEV by a newer ZEV.[10] Early in the ZEV transition, it is reasonable to assume that EVs used in California would displace travel that would have otherwise occurred in an ICEV. During the middle and later phases of a multi-decade transition to ZEVs, however, this assumption does not universally hold true. Some more substantial proportion EVs purchased in the 2030s for example, will likely replace old EVs that are being scrapped, and perhaps a greater fraction of EVs sold in the state will move out of the state or be sold into other jurisdictions on the used vehicle market. A comprehensive quantification of the actual petroleum displacement by each new ZEV sold could be prohibitively complex, and dependent on numerous assumptions regarding the counterfactual being compared to. If one assumes that the total amount of travel across the entire economy is largely exogenous to decisions regarding fuel policy, then the fraction of conventional vehicles remaining in the fleet serves as a useful high-level approximation of displacement occurring. That is, if the fleet is 75% ICEVs and 25% ZEVs, then of the travel displaced by each additional ZEV, on average 75% of it would

[9] Gohlke and Zhou, "Assessment of Light-Duty Plug-in Electric Vehicles in the United States, 2010 – 2019"; Davis, "How Much Are Electric Vehicles Driven?"

[10] Additionally, some fraction of ZEV purchases would be by owners who would have purchased the ZEV even without the incentive offered by the LCFS. While this would not meet most tests of additionality, it is prohibitively difficult to assess within a regulatory context, so the LCFS makes no attempt to do so.

otherwise have been done in an ICEV. There are alternative methods for estimating the amount of displaced petroleum that may offer improved accuracy or other advantages; some of these will be discussed later in this paper.

As the fraction of ZEVs in a fleet increases, the fraction of conventional vehicles decreases, meaning that over time, the average additional ZEV displaces a smaller proportion of ICEV travel and a greater proportion of travel that would have otherwise occurred in a ZEV. This means that as the fleet shifts from ICEV to ZEV, the underlying assumption of complete displacement of ICEV travel becomes an increasingly poorer approximation of real-world impacts. If the fleet is composed entirely of ZEVs, and all new vehicle sales are of ZEVs, it is hard to argue that new ZEVs displace any petroleum at all, however the current LCFS crediting method would assign credits as if each ZEV were still displacing the full theoretical amount of fuel used by conventional vehicles.

Improved Representations of Credit Generation Can Mitigate Future Market Imbalances

Close alignment between credit generation and emission reduction allows the technology-neutral, market-driven effect of the LCFS to maximally guide the flow of incentives to lower emitting technologies and reduces the need for regulatory intervention to correct imbalances in the market. At present, few vehicle classes have seen sufficient penetration of ZEVs to require regulatory intervention, however this is likely to occur more frequently as California progresses through its transition.

In a July 7, 2022 workshop, CARB staff identified electric forklifts (e-forklifts) as a vehicle class for which LCFS incentives may no longer be necessary to achieve state targets and solicited feedback regarding phase-down approaches.[11] The e-forklift fleet is over 50% electrified at present and, as a result, e-forklifts generate 27% of total EV credit under the LCFS, enough to cover around 7% of total deficit generation of the LCFS. This level of credit generation seemed disproportionate to the amount of energy use or emissions forklifts generate, and there were questions about whether the incentive revenue supporting e-forklifts might yield better results if redirected to other technologies.

E-forklifts represent the most immediate challenge that could be addressed by revising the assumptions around displacement for credit generation, but it is increasingly likely that this will apply to other fuel and technology pathways over time as well. For example, sometime in the mid-2030s, the number of ZEVs in California's on-road light duty vehicle fleet will exceed the number of conventional ones. While this is a necessary step towards a zero-emission future, it may make it difficult to balance the LCFS credit market. These risks are described in the Fuels section of the 2021 report *Driving California's Transportation Emissions to Zero by 2045*.[12] The LCFS credit generation by the ZEVs will require very rapid increases in the program target to keep pace and maintain a credit price sufficient to support the deployment of new technologies in difficult-to-electrify applications; such rapid increases would drive up conventional gasoline price impacts and increase the risk of credit shortfalls in future years. Balancing the need to support continued deployment against the risk of onerous fuel price impacts on remaining ICEV drivers could be challenging. As discussed in the previous section, current LCFS credit quantification methods tend to overstate fuel displacement effects for advanced vehicle technologies in

[11] https://ww2.arb.ca.gov/sites/default/files/2022-07/LCFSWorkshop_Presentation.pdf

[12] Brown et al., "Driving California's Transportation Emissions to Zero."

the middle and later phases of a fleet transition; a more accurate representation of these effects better aligns credit generation with real-world emission impacts and reduces the potential market imbalance.

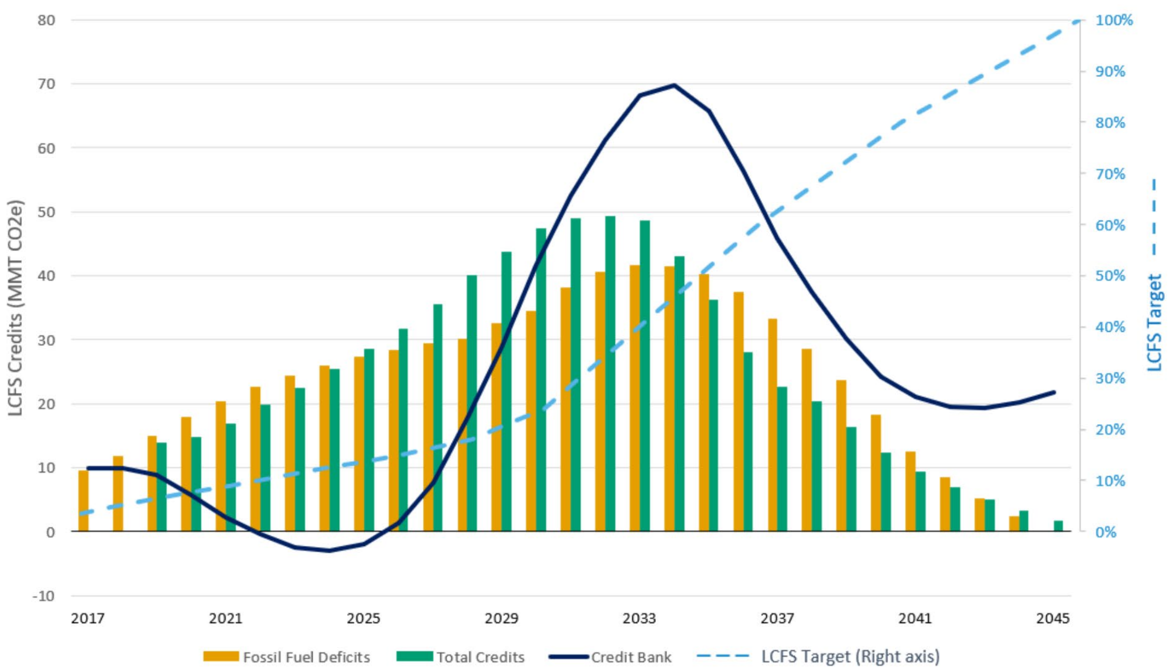

Figure 2. LCFS credits, deficits, aggregate bank and LCFS target (right axis) under the primary compliance scenario modeled in the *Driving to Zero* report. (Source: Brown, et al. 2021)

Figure 2 shows credit and deficit generation under the ZEV scenario (the one most closely aligned with ZEV deployment under the Advanced Clean Cars 2 rule) studied in *Driving California's Transportation Emissions to Zero*, and under the current LCFS 2030 target of 20% CI reduction from 2010 levels. Credit generation (green bars) rises quickly, predominantly driven by rapid light-duty EV credit growth. As a result, the credit bank (dark line) rapidly rises to 175% of yearly deficits and then rapidly falls again. While market response to those conditions is difficult to predict, this would likely lead to substantial downward pressure on LCFS credit prices. 2022 LCFS credit prices have declined by over 70% from their 2020 peak, due in part to the accumulation of a bank of credits in the range of 50-60% of prior year deficits, as well as anticipated credit growth from renewable diesel. The expectation of an even greater amount of growth in the bank of credits from light duty EVs would be expected to put similar, if not greater, downward pressure on LCFS credit prices. Any compensatory action by CARB to stabilize prices would risk creating uncertainty and price volatility in the credit market.

While LCFS targets in the mid-2030s must be increased to generate more deficits in any circumstance, compensating for the effect of current fuel displacement assumptions increases the magnitude of target correction needed. This has three key impacts. First, increasing the target to add additional deficits increases the price impact for consumers who still drive an ICEV. Since a significant fraction of the credits generated by advanced technology vehicles would have been issued on the basis of outdated assumptions regarding the magnitude of fuel displacement, that fraction of the incentive would not be effectively supporting California's effort to reduce GHG emissions. Essentially, it would require a higher impact on gasoline prices, without providing correspondingly higher emissions reductions. Second, the need to ramp up targets even more quickly, makes market balance in the mid to late 2030s even more difficult. There will be sectors of the transportation portfolio that will still be struggling to decarbonize, even as the light and medium duty on-road fleets transition to ZEVs. If the LCFS target must be high to compensate for inaccurate fuel displacement assumptions, this reduces the flexibility CARB will have to optimize LCFS target levels to support a transition in the hardest-to-decarbonize sectors of the fleet. Third, overstating emissions benefits from fuel displacement means that the LCFS will be delivering fewer actual emissions cuts than its nominal credit generation level would indicate. This could require additional emissions cuts in other areas of the transportation sector or the economy as a whole to make up the difference.

A more gradual escalation of credit growth in the 2030s, based on more accurate quantification of emissions impacts, would facilitate a more measured escalation in LCFS program targets and reduce the risk of another sustained period of depressed LCFS credit prices. A stable market, based on accurate quantification of emissions benefits, would reduce the need for regulator intervention and the volatility such intervention could introduce, and it would ensure that actual emissions reductions match what program data would nominally indicate.

Proposed Alternative: Fractional Displacement (FD) of Conventional Fuel

Currently, most LCFS credits are generated using fuel pathways according to the formulas presented in § 95486.1 (a) of the regulation and presented in *Equation 1* earlier in this paper.

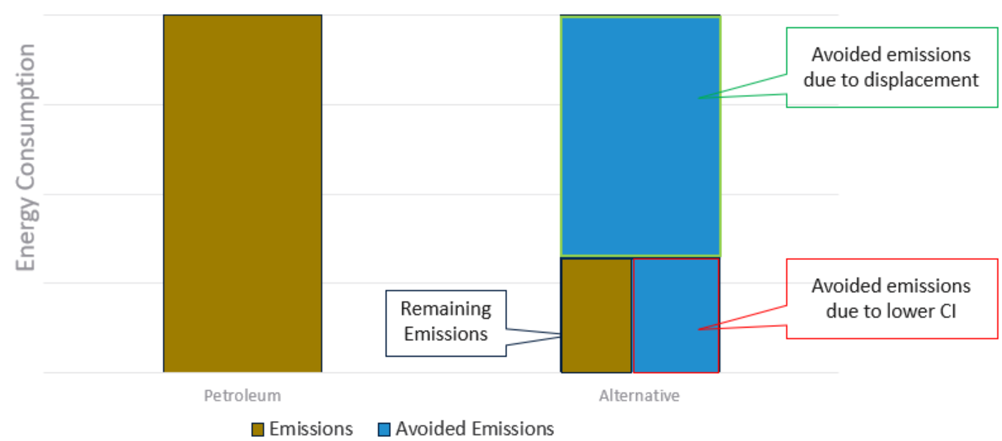

Figure 3. Representation of emissions from ICEV activity being displaced by an advanced technology vehicle (left) and the avoided emissions that will become the basis for credits under the LCFS. This representation includes two separate effects, avoided emissions due to displacement, and avoided emissions due to lower-CI of consumed fuel. The program currently represents these effects as a single equation, assuming fuel displacement is always present at the indicated level.

This equation attempts to mathematically represent two independent effects, reduced emissions due to lower carbon intensity fuel, and reduced fuel consumption due to switching to a more efficient power train (fuel displacement), illustrated in Figure 3.

The conceptual foundation of a Fractional Displacement is simple: change the mathematical representation of emissions under the LCFS to allow separate treatment of the lower-CI effects and the fuel displacement effects. This creates the opportunity to adjust the displacement credit of technologies to more accurately represent the actual displacement of the incumbent fuel by advanced technology vehicles (defined as those with an *EER* > 1). The adjustment factor for the displacement should match real-world displacement behavior as closely as possible. Since the displacement fraction may be difficult to precisely quantify, the fraction of the fleet still using the incumbent, higher-emission technology (typically petroleum) can serve as a useful approximation. (Alternative approaches to the displacement fraction will be discussed below, additional options may be forthcoming from the stakeholder community as well.) For example, if we base the displacement fraction on the fleet fraction of the incumbent technology, displacement credits in a sector that was evenly split between petroleum and ZEV technologies, would be multiplied by 50%. Credits generated due to the lower CI score of the consumed fuel would remain unchanged.

This approach builds on a conceptual understanding of displacement already reflected in the LCFS in its approach to credit quantification for e-forklifts and fixed-guideway vehicles (e.g., passenger rail and light rail). § 95486.1 (a) (4) distinguishes between equipment deployed prior to the implementation of the LCFS in 2011 as opposed to after. Pre-2011 deployments do not receive displacement credit, while post-2011 deployments do. The Fractional Displacement approach builds upon this by adding an additional layer of detail: recognizing that fuel displacement is not a binary effect, but rather scales in proportion to fleet composition and other factors.

Applying the FD approach would require some modest amendments to § 95486.1 to differentiate between credits generated from fuel displacement and those generated by lowering CI in consumed fuel. For example, changing § 95486.1 (a) (1)—as shown in *Equation 1*—for the purposes of credit generation to:

(Equation 2)

$$Credits_i^{XD}(MT) = \underbrace{\left(CI_{standard}^{XD} - CI_i\right) \times E_i \times C}_{\textit{CI Term}} + \underbrace{\left(EER^{XD} - 1\right) \times CI_{standard}^{XD} \times E_i \times F_{displaced}^{XD} \times C}_{\textit{Displacement Term}},$$

where $CI_{standard}^{XD}$, CI_i, E_i, EER^{XD}, and C are unchanged from their current definition and $F_{displaced}^{XD}$—"Displacement Fraction"—is the fraction of theoretical displacement to be credited under the given pathway. The fraction of the fleet still using the incumbent, higher-emitting technology (e.g., ICE) is a reasonable approximation here. For *EER*s < 1, $F_{displaced}^{XD}$ is always equal to 1; this exception will be discussed below.[13]

This alternative quantification method decomposes the credit generation from § 95486.1 (a) (1) into two terms, one quantifying emissions reduced due to lower CI fuel, and one quantifying emissions reduced by displacement of fuel due to higher efficiency.

For conventional vehicles, defined as those with an *EER* of 1, the displacement term is equal to zero and the CI term is equivalent to the current crediting equation described in § 95486.1 (a) (1). This is to say, when *EER* = 1, the FD approach makes no change to credit or deficit generation.

Under an FD approach, the CI term in *Equation 2* would not be affected by any changes in the displacement fraction; the credits generated for lower CI would continue to be generated as long as the

[13] Omitting the displacement fraction term for *EER*s < 1 is mathematically equivalent to setting it equal to 1.

CI of the consumed fuel was lower than that year's target. Only the displacement term would change as the fleet converted from the incumbent technology to the new one.

Impacts on Credit Generation

The FD approach scales down displacement credits in proportion to the $F^{XD}_{displaced}$ term, leaving credits generated through lower CI fuels unchanged. This results in total credit generation that is identical to the current approach when $F^{XD}_{displaced}$ = 1 but scales down to $1/EER^{XD}$ of current credit generation when $F^{XD}_{displaced}$ = 0. Once the fleet has completely shifted to the advanced vehicle technology in question and no additional displacement occurs, the remaining CI term still provides credit generation, as long as the fuel consumed has a lower CI score than the target in a given year.

Table 1. Credit generation for 1 GJ of fuel under current LCFS method and with FD for a hypothetical EV with *EER* = 3.8, where the petroleum CI = 100 gCO2e/MJ and the electricity CI = 30 gCO2e/MJ. All numbers are author's assumptions, for illustrative purposes.

Year	**0**	**5**	**10**	**15**	**20**	**25**	**30**
LCFS Standard	0	10%	20%	30%	40%	50%	60%
Incumbent Fraction	100%	100%	80%	60%	40%	20%	0%
Credits with current method	0.38	0.342	0.304	0.266	0.228	0.19	0.152
Credits from CI	0.100	0.090	0.080	0.070	0.060	0.050	0.040
Max Potential Displacement	0.280	0.252	0.224	0.196	0.168	0.140	0.112
Total Credits w/FD	0.380	0.342	0.259	0.188	0.127	0.078	0.040
% of current	100%	100%	85%	71%	56%	41%	26%

Table 1 (above) shows the expected credit generation of an EV with an *EER* of 3.8 (the value currently assigned to E-forklifts). While the fleet is completely composed of incumbent vehicles, no change in displacement crediting occurs. As the fraction of incumbent vehicles decreases, so does the displacement term. The CI term declines due to the increasing LCFS target, which is the same as in the current approach. At the end of the transitional period (assumed to be 30 years in this case), only the CI term produces credits, equal to $1/EER^{XD}$, or 26%, of what would have been generated by the status quo method.

Fractional Displacement Crediting Impacts for Vehicles with *EER* < 1

FD crediting resolves issues related to fuel displacement assumptions that will be increasingly out of date as the market progresses through its transition to ZEVs and other advanced technology vehicles (those with *EER* > 1). The method has less effect on quantification of emissions in vehicles with *EER* < 1 (such as spark-ignition natural gas engines substituting for diesels), though the impacts it has generally improve the accuracy of crediting relative to real-world emission impacts and reduce potential market volatility.

While *EER*s reflect a fundamental relationship between the relative efficiency of two powertrains regardless of their assessed value, *EER*s < 1 represent a very different mechanism of impact on aggregate fuel consumption than *EER*s > 1. As discussed above, an *EER* > 1 represents the use of fuel in a more efficient powertrain, and therefore less aggregate fuel consumption required for an equivalent amount of vehicle activity. The precise amount of fuel displaced is not known with high precision or confidence, and the FD approach seeks to better accommodate this uncertainty. An *EER* < 1 represents a powertrain that is less efficient than the reference one. In this case, additional energy is required to accomplish the same amount of vehicle travel or work. The key difference between *EER*s above and below 1 is that in almost every case for an *EER* < 1, the quantity of additional energy being consumed is known with relatively high confidence and precision. When a diesel truck is displaced by a renewable natural gas (RNG) truck with *EER* 0.9, the RNG truck consumes more energy in the form of RNG to do the same work, with the additional energy consumption following the ratio of $(1\ /\ EER)$. The additional energy needed by a vehicle with *EER* < 1 does not vary depending on the technologies used by other vehicles in the fleet around it or on any factors other than the relative efficiency of the two powertrains. As such, $F^{XD}_{displaced}$ should be omitted or set equal to 1 for *EER*s > 1.

When applying the fractional displacement approach to vehicles with an *EER* < 1, the standard assumption of the displaced fuel having CI equal to $CI^{XD}_{standard}$ would remain appropriate, however given the fact that the fuel being used to make up for the lower efficiency of the powertrain is known with high certainty in most cases, substituting CI_i for $CI^{XD}_{standard}$ in the displacement term could be appropriate as well. In this instance, the displacement term represents the additional fuel required due to the use of a lower-efficiency powertrain and becomes a penalty, reducing the credits that would otherwise be generated by a lower-CI fuel.

FD crediting also provides for more accurate representation of complex fuel systems that create fuels with a negative CI score, such as those from electricity generated by the combustion of carbon-negative RNG. At present, the LCFS recognizes and credits avoided fugitive methane emissions from the installation of anaerobic digesters when there is no regulatory requirement to do so. In some situations, the avoided methane emission is substantial, yielding a fuel that achieves a negative CI score, implying that every unit of consumed fuel results in an absolute reduction of GHGs from the atmosphere. The LCFS also recognizes pathways in which RNG with a negative CI score is combusted to generate electricity, and that electricity is used to charge EVs. This means that the multiplier effect from the *EER* is applied to the negative CI score, implying that more methane is avoided by the use of RNG-derived electricity in an EV than if the RNG had been directly used as vehicle fuel. In truth, the quantity of avoided methane is a function of the amount of RNG produced and has no relation to the efficiency of the vehicle in which the RNG is consumed. FD crediting effectively prevents this erroneous representation from occurring. The negative CI of the RNG is fully reflected in the CI term of the *Equation 2*. Emissions benefits from displacement are quantified using $CI^{XD}_{standard}$, which would not be carbon-negative under any foreseeable circumstance, meaning that the counterintuitive multiplication of avoided methane credit by *EER* would no longer be possible under the FD crediting approach.

Alternative Methods to Estimate the Displacement Fraction

The core change the FD approach makes to the current LCFS crediting method is to decompose the equation currently used by credit generating pathways, represented in *Equation 1* above, into CI and Displacement components, so that the Displacement component can be scaled to better match actual fuel displacement. This functionally liberates LCFS credit generation from the assumption that every advanced technology vehicle displaces the maximum theoretical potential amount of fuel possible for a given *EER* under all market conditions. This allows more precise assumptions, incorporating a wider variety of policy considerations to provide a better reflection of real-world vehicle market and activity dynamics.

Setting $F_{displaced}^{XD}$ to equal the fraction of the fleet using the incumbent technology, typically petroleum-fueled ICEVs, is a useful high-level approximation that better represents actual fuel displacement. It assumes that if a fleet is 50% ICEV and 50% ZEV, then on average, 50% of the travel that ZEV displaces would have been done by an ICEV and 50% by another ZEV. In this case, regulatory staff would establish the value of $F_{displaced}^{XD}$ on a regular basis, as they do annually for the average CI of the California electricity grid.

The suggested approximation, where $F_{displaced}^{XD}$ is equal to the fraction of the fleet using the incumbent technology is admittedly imperfect. During the transition from conventional to advanced technologies, the age of incumbent technology vehicles would, on average, be greater than that of the advanced technology ones replacing them. This implies that incumbent technology vehicles would be somewhat more likely to be retired out of service in any given year than advanced ones, meaning that each additional advanced technology vehicle would be expected to displace slightly more of the incumbent fuel use than would be expected by simply relying on the fleet fraction. To be clear, approximating $F_{displaced}^{XD}$ as the incumbent technology fleet fraction yields displacement credits that much more closely align with real-world behavior across the full temporal scope of a fleet transition than the binary approach used in the status quo, but further improvements are possible.

If research or modeling on fleet turnover behavior provides a superior alternative value of $F_{displaced}^{XD}$, one that better matches real-world fuel displacement, such a value can be used while still aligning with the underlying logical and quantitative representation described in the FD approach.

For example, if research and/or modeling were available to more precisely quantify marginal displacement rates for advanced technology vehicles, those rates could be substituted for $F_{displaced}^{XD}$ and result in a representation of displaced emissions that would support even closer alignment with real-world performance.

Alternatively, $F_{displaced}^{XD}$ can be set to equal the incumbent fleet fraction with a lag of one or more years. This provides an imprecise but directionally correct accommodation for the tendency of the incumbent fleet fraction to slightly underestimate likely real-world fuel displacement.

All approaches that base $F_{displaced}^{XD}$ on the incumbent fleet fraction require the regulator to know with reasonable precision what the incumbent fleet fraction actually is. For vehicle types that are regularly surveyed, or require registration with a regulatory body, this data should be available (though there may be a significant delay before they are collected, verified, and made available to regulators). There may be vehicle classes for which the incumbent fleet fraction cannot be known with acceptable accuracy, such as where a significant fraction of the fleet consuming fuels that are subject to credit or deficit generation under the LCFS are based and registered outside the regulating jurisdiction, or where no good survey data exist upon which to base an estimate. In these cases, a number of less precise alternatives would still be expected to better represent displacement credit effects than the current approach, such as assuming the fleet transition happens over a predetermined number of years, and setting $F_{displaced}^{XD}$ according to that assumption; e.g., if the transition from conventional to advanced technology vehicles were expected to take 20 years, $F_{displaced}^{XD}$ could be approximated by starting at 1 in year zero and declining by five percentage points per year. Alternatively, if the jurisdiction has established policy requiring sales of vehicles with the incumbent technology to discontinue by a given point in time, the incumbent fleet fraction could be estimated using models of vehicle retirement and replacement, based on the targets set in regulation.

The value of $F^{XD}_{displaced}$ can be modified to reduce administrative burden and increase predictability by specifying trajectories or values over certain time periods or setting a maximum year-to-year change in $F^{XD}_{displaced}$. One such approach would be to establish a significance threshold before Fractional Displacement crediting is applied, which could help ensure that advanced technologies are more firmly established in their market before their credit generation starts to degrade as well as reduce the administrative burden associated with quantifying fleet composition during very early phases of a technological transition. For example, specifying that FD crediting does not begin until a given advanced vehicle technology makes up 25% of the fleet would preserve near-term support for the technology, and spare program staff the need to accurately quantify very small changes in fleet composition. Similarly, specifying a trajectory for $F^{XD}_{displaced}$ during the final years of a transition can accomplish the same goals, e.g., once the incumbent fraction in a given fleet is less than 10%, $F^{XD}_{displaced}$ could be set to decline to zero over a specified number of years.

Most of the examples discussed in this paper have focused on situations where only two technology classes are present in a market. There may, however, be situations where more than two technology types each make up significant fractions of a given market segment. The FD crediting approach is still applicable in these cases. Basing $F^{XD}_{displaced}$ on the incumbent fraction means that each vehicle will only be credited for displacing the incumbent fuel, not fuel used by vehicles with *EER* > 1. This may slightly underestimate real-world displacement, such as if heavy duty EVs with an *EER* of 5 entered a market with a significant proportion of heavy-duty hydrogen fuel cell vehicles, with an *EER* of 2.1, displacing some of them as well as incumbent ICEVs. Under most plausible market conditions, this underestimate would be relatively small due to the broad decrementing of displacement credits overall. Moreover, if this did occur, an appropriate adjustment factor could be added to the $F^{XD}_{displaced}$ term for each technology type.

In all cases, careful modeling should be performed to fully understand the implications of any decision and to ensure an appropriate balance between maximizing the accuracy of LCFS displacement credit representation, minimizing administrative burden, and sending appropriate and effective market signals.

Deficit Generation Under a FD Approach

The current equation in § 95486.1 (a) (1), reported as *Equation 1* in this paper, applies to both credit and deficit generation in the LCFS, with deficits resulting when $CI^{XD}_{standard} < CI^{XD}_{reported}$. For fuels with *EER* = 1, the displacement term drops out of the FD crediting method presented in, leaving it equal to the current approach, as shown in *Equation 1*. For *EER*s other than 1, the FD approach improves the representation of deficit generation relative to the current practice.

Deficit generation via pathways with *EER* > 1 could occur if, for example, an EV consumes electricity with CI higher than that year's LCFS target or a hydrogen FCEV consumes hydrogen made from fossil sources. Both of these conditions, and others like them, are extremely unlikely given expected market, technology, and policy dynamics, as well as the availability of book-and-claim accounting to purchase environmental attributes of low-carbon energy.

In those cases, however, the FD approach would continue to more accurately represent the real-world emission impact of such occurrences. The current approach obtains $CI^{XD}_{reported}$ by dividing the CI of the fuel used in a given pathway, CI_i, by the appropriate *EER*. This is required by the current quantification equation, which simultaneously estimates the CI and Displacement terms in one step. For the unusual case of *EER* > 1 and $CI_{standard}^{XD}$ < $CI_{reported}^{XD}$, dividing CI_i by the *EER* will tend to mute the effect of excess emissions caused by the use of above-target fuel in a high-*EER* pathway. Table 2 describes a hypothetical example of this occurrence, building on the same general market dynamics as in Table 1, but with more ambitious targets at the end year, and electricity with a hypothetical grid electricity CI around that of California's in 2010. In this case, the EV pathway shifts from credit to deficit generation earlier than under the current approach, to a more accurate representation of the actual emissions impact from displaced fuel in such vehicles. If the electricity used as vehicle fuel could not reduce its emissions beyond 2010 levels, then it would be unsuitable as a fuel in a carbon-neutral transportation system. The fact that the fuel shifts from credit generation to deficit generation earlier in the transition under FD crediting represents improved alignment between LCFS crediting and overall program goals, in the unusual case of deficit generation in high-*EER* vehicles.

Table 2. Credit generation for 1 GJ of fuel under current LCFS method and with FD for a hypothetical EV with *EER* = 3.8, but in which electricity had CI = 80 g CO2e/MJ through the entire period. Petroleum CI – 100 g CO2e/MJ. FD crediting provides earlier and stronger push-back against fuels with higher carbon than the given year's target. All numbers are illustrative.

Year	**0**	**5**	**10**	**15**	**20**	**2S**	**30**
LCFS Standard	0	10%	20%	50%	60%	70%	80%
Incumbent Fraction	100%	100%	80%	60%	40%	20%	0%
Credits with current method	0.3	0.262	0.224	0.11	0.072	0.034	-0.004
Credits from Cl	0.020	0.010	0.000	-0.030	-0.040	-0.050	-0.060
Max Potential Displacement	0.280	0.252	0.224	0.140	0.112	0.084	0.056
Total Credits w/ FD	0.300	0.262	0.179	0.054	0.005	-0.033	-0.060
% of current	100%	100%	80%	49%	7%	-98%	1500%

In the case of *EER* < 1, which is a more likely condition for deficit-generating pathways, much of the same logic holds true. With $CI_{standard}^{XD}$< $CI_{reported}^{XD}$, the CI term of the credit generation under the FD approach will invariably be negative, as will the displacement term due to the *EER* < 1. The current LCFS practice of obtaining $CI_{reported}^{XD}$ by dividing CI_i, by the relevant *EER* may slightly overstate the excess emissions - which are the basis of deficits - in vehicles with *EER* < 1, which implies that the FD approach slightly improves the correlation between actual emissions and deficit generation in these cases.

FD Impacts on e-Forklift Credit Generation

At the July 7th, 2022, workshop, LCFS staff asked for input regarding possible phase-down approaches for e-forklifts. This class of vehicles is already well-advanced in its transition from ICEVs to ZEVs, and future CARB rulemaking will likely set a date after which all new forklifts in California must be ZEVs.[14] In

[14] At the time of writing, data on the size and composition of the CA forklift fleet were not available. These data appear to have been collected by CARB as part of ongoing rulemaking and vehicle survey activity, but multiple requests for access to this data did not receive a response.

2021, e-forklifts generated almost 1.3 million credits, accounting for 7% of total LCFS credit generation, despite making up a smaller share of the total fleet, or transportation energy consumption. This outsized credit generation is likely due to the overestimation of displaced fuel by advanced technology vehicles that occurs under the current LCFS approach. Each e-forklift is assumed to displace one conventional forklift's worth of energy, under all conditions, even when the market has predominantly switched to ZEV technology already. While the precise composition of the California forklift fleet was unavailable at the time of writing, conversations with stakeholders in this space indicate that the overwhelming majority of sales of forklifts at present are for e-forklifts, and the fleet as a whole is more than half electric. E-forklifts are, as mentioned above, the only vehicle class for which switching to the FD crediting method and using the incumbent fraction to approximate $F^{XD}_{displaced}$ would result in significant and immediate changes in credit generation (Table 3).

Table 3. LCFS credit generation for e-forklifts under current, FD, and a “gradual catch-up” approach. *EER* is 3.8 for e-forklifts, and total fuel consumption by this class is assumed to grow at 3% per year from 2021 data. Incumbent fractions are the author’s estimates.

	2022	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**2031**	**2032**	**2033**	**2034**	**2035**
Incumbent Fraction	40%	35%	30%	25%	20%	18%	15%	13%	10%	8%	6%	4%	2%	0%
LCFS Target	90.4	89.1	86.4	84.4	82.4	79.4	76.3	73.3	70.3	65.3	60.3	55.2	50.2	45.2
Grid CI	72.7	69.6	66.4	63.3	60.1	56.9	53.8	50.6	47.4	44.3	41.1	38.0	34.8	31.6
e-Fork fuel consumed (million GGE)	42	44	45	46	48	49	50	52	54	55	57	58	60	62
e-Fork Credits (Current method)	1.4	1.5	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.3	1.3	1.2	1.1	1.0
e-Fork Credits w/FD (million)	0.60	0.56	0.50	0.44	0.39	0.36	0.33	0.30	0.27	0.23	0.20	0.16	0.13	0.10
% of base	42%	38%	35%	31%	27%	25%	23%	21%	19%	17%	16%	14%	12%	10%
Difference in credits (million)	0.8	0.9	0.9	1.0	1.0	1.1	1.1	1.1	1.1	1.1	1.1	1.0	1.0	0.9
Gradual Catch-Up method														
F_displaced value	100%	100%	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%	2%	0%
e-Fork Credits - Gradual Catch-up (millions)	1.4	1.4	1.4	1.3	1.2	1.0	0.9	0.8	0.7	0.5	0.4	0.2	0.1	0.1
% of base	95%	96%	100%	91%	82%	73%	64%	55%	46%	37%	28%	19%	12%	10%
Difference in credits (millions)	0.1	0.1	0.0	0.1	0.3	0.4	0.5	0.6	0.8	0.8	0.9	1.0	1.0	0.9

Based on the assumption of a 40% incumbent fraction, immediate application of FD crediting would result in a precipitous drop in LCFS credit generation from this category, compared to the current method. While this would more accurately reflect anticipated emissions benefits, it could have a disruptive effect on the progress of this sector toward carbon neutrality. To mitigate this, a gradual catch-up approach that limited the maximum rate of change for the $F_{displaced}^{XD}$ term to no more than 10% per year was adopted. This guaranteed a phase-down period for credits from fuel displacement of no less than 10 years (Figure 4). The gradual catch-up approach brings e-forklift credit generation into line with the default FD approach shortly before the fleet completes its transition, in this hypothetical example.[15]

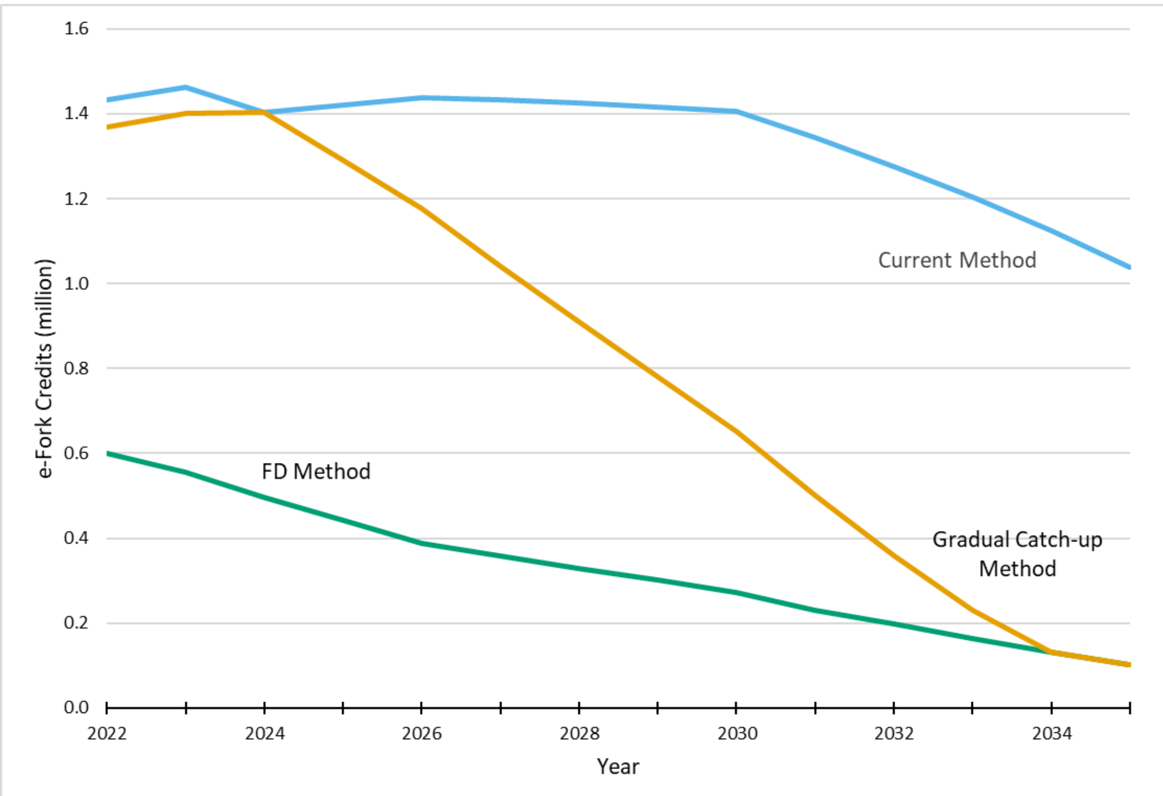

Figure 4. Credit generation by e-forklifts under current, FD crediting, and "Gradual Catch-up" methods. Data taken from Table 3.

FD Impacts on Light-Duty EV Credit Generation

The FD crediting approach is suitable for application across all credit generation pathways that currently use the equation § 95486.1 (a) (1) (reported as *Equation 1* in this paper). At present, only e-forklifts would see a significant change in credit generation under this approach, though as more fleets transition from ICE to ZEV, the effect of FD crediting would become more widespread. Light-duty EVs, specifically

[15] The current approach to LCFS credit generation may need to be retained for LCFS credit pathways that have already been granted. This paper takes no position on legal or contractual limitations or expectations implied by the LCFS and does not suggest any action that would violate existing law, policy, or contracts.

battery-electric vehicles, would be the technology class in which the greatest impact would ultimately be felt by the change to FD crediting. As reported in *Driving California's Transportation Emissions to Zero by 2045*, and discussed above, the massive amount of credits expected from light-duty EVs in the mid-late 2030s may make it difficult to maintain LCFS credit prices high enough to support needed fuel deployment in difficult-to-decarbonize sectors of the economy. Scaling down credits to light-duty EVs could not only improve alignment between credit generation and emission reductions but also promote more stable LCFS credit market and pricing behavior, and it could ensure that LCFS credit revenue would support measures that continue to reduce fleet-wide emissions during the middle and later phases of the transition to ZEVs.

Table 4 and Figure 5 show three potential scenarios for application of the FD crediting approach to light-duty EVs. The incumbent fraction was projected based on fleet composition, specifically ICE and non-plugin hybrid electric vehicle components of the car and light truck fleet in the ZEV scenario from the *Driving to Zero* report. Grid electricity CI was interpolated from present values to an assumed 0 CI in 2045, and the *EER* was assumed to remain at 3.4 for the full period.

The "LD [light-duty] EV Credits w/FD" line represents application of the FD approach using the incumbent fraction for the given year; it is, in essence, the most direct and straightforward application of the FD crediting approach. "LD EV Credits w/ lag-2" adopts FD crediting, with the displacement fraction based on the incumbent fraction in the fleet, lagged 2 years. This delays the impact of FD crediting slightly and helps compensate for the slight mismatch between the incumbent fraction and theoretical displacement behavior due to the relative age of ICEVs during middle and later years of the transition to zero emissions. The "Threshold approach" delays implementation of FD crediting, by setting $F^{XD}_{displaced}$=1 until EVs represent 10% of the fleet, then applying a 2% per year catch-up factor until the $F^{XD}_{displaced}$ equals what it would be under the 2-year lag approach. This threshold crediting approach holds displacement credits stable until the advanced technology vehicle fleet is sufficiently large to ensure it has a market foothold (sales rates would have to be well in excess of 10% before the fleet fraction reaches that level) before starting to decrement displacement credits. As discussed above, the threshold approach can also be applied to the final years of a fleet's transition to ZEVs, however, in this case the transition to ZEVs was still far from complete in 2045, so no end-year transition strategy was applied.

Table 4. Credit generation from light-duty (LD) EVs under current LCFS methods and three different approaches to FD crediting. LCFS targets are 30% in 2030, and 90% in 2045, with the incumbent vehicle fraction taken from the ZEV scenario of *Driving California's Transportation Emissions to Zero by 2045*. (The highlighted colors of the rows correspond to the colors of the curves in Figure 5.)

	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043	2044	2045
Incumbent Fraction	96%	95%	95%	94%	93%	91%	88%	86%	82%	79%	75%	70%	65%	60%	55%	50%	46%	42%	37%	34%	30%	27%	24%	21%
LCFS Target	89.5	88.3	85.5	83.5	81.5	78.6	75.6	72.6	69.6	64.6	59.7	54.7	49.7	44.7	41.3	37.8	34.3	30.8	27.3	23.9	20.4	16.9	13.4	9.9
Grid CI	72.7	69.6	66.4	63.3	60.1	56.9	53.8	50.6	47.4	44.3	41.1	38.0	34.8	31.6	28.5	25.3	22.1	19.0	15.8	12.7	9.5	6.3	3.2	0.0
LD EV fuel consump (million GGE)	130	157	185	232	298	381	478	590	708	835	969	1110	1256	1390	1512	1625	1727	1821	1903	1975	2036	2088	2131	2166
LD EV Credits (Current method)	3.6	4.3	5.0	6.1	7.7	9.6	11.6	13.8	16.0	17.5	18.7	19.6	20.2	20.0	20.2	20.0	19.5	18.7	17.6	16.2	14.6	12.8	10.8	8.8
LD EV Credits w/FD (million)	3.48	4.13	4.72	5.78	7.22	8.77	10.41	12.05	13.50	14.19	14.51	14.42	13.95	12.92	12.21	11.32	10.32	9.27	8.21	7.19	6.22	5.34	4.56	3.87
% of base	96%	96%	95%	94%	93%	92%	90%	87%	84%	81%	77%	73%	69%	65%	60%	56%	53%	50%	47%	44%	43%	42%	42%	44%
Difference in credits (million)	0.1	0.2	0.2	0.3	0.5	0.8	1.2	1.8	2.5	3.3	4.2	5.2	6.2	7.1	8.0	8.7	9.2	9.4	9.3	9.0	8.3	7.4	6.3	4.9
LD EV credits w/ Lag-2 (million)	3.53	4.19	4.78	5.87	7.37	9.04	10.85	12.69	14.37	15.27	15.79	15.90	15.60	14.69	14.01	13.03	11.90	10.71	9.48	8.27	7.11	6.04	5.08	4.22
% of base	98%	97%	97%	96%	95%	95%	93%	92%	90%	87%	84%	81%	77%	73%	69%	65%	61%	57%	54%	51%	49%	47%	47%	48%
Difference in credits (million)	0.1	0.1	0.2	0.3	0.4	0.5	0.8	1.1	1.6	2.2	2.9	3.7	4.6	5.3	6.2	7.0	7.6	8.0	8.1	7.9	7.5	6.7	5.7	4.5
Threshold approach F_frac value	100%	100%	100%	100%	100%	100%	100%	100%	97%	91%	85%	79%	72%	65%	58%	51%	46%	42%	37%	34%	30%	27%	24%	21%
LD EV Credits - Threshold & Lag (millions)	3.6	4.3	5.0	6.1	7.7	9.6	11.6	13.8	15.6	16.2	16.3	15.9	15.2	13.8	12.7	11.4	10.3	9.3	8.2	7.2	6.2	5.3	4.6	3.9
% of base	100%	100%	100%	100%	100%	100%	100%	100%	97%	92%	87%	81%	75%	69%	63%	57%	53%	50%	47%	44%	43%	42%	42%	44%
Difference in credits (millions)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.4	1.3	2.4	3.7	5.0	6.3	7.5	8.6	9.2	9.4	9.3	9.0	8.3	7.4	6.3	4.9

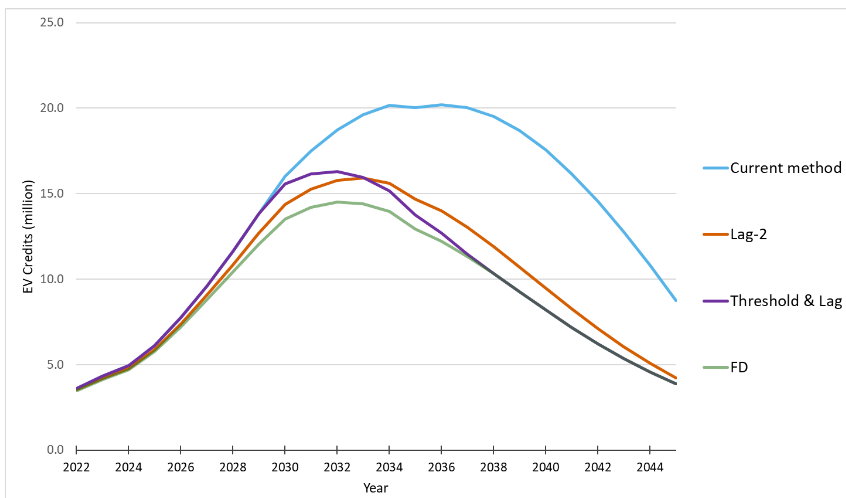

Figure 5. Light-duty EV credit generation under the current LCFS approach (blue line) as well as the FD crediting approaches laid out in Table 4.

Figure 5 presents these effects graphically, showing a lower peak credit generation potential from light-duty EVs, as well as the peak being attained earlier. Given the expectation that most light-duty EVs will be price-competitive with ICEVs by the early 2030s, beginning to decrement LCFS credit support at that point may allow better alignment of program incentives with its underlying intent. While EVs will continue to receive LCFS credits as long as the electricity they are charged with has lower CI than the program target, phasing down credits starting in the early 2030s shifts the program's focus to fuel pathways that may still be struggling to achieve commercial scale deployment.

Adopting the FD credit approach will reduce aggregate credit generation from advanced technology vehicles, which may require the LCFS program target to be set lower than it would be under the current crediting approach. While this may make the pace of decarbonization seem nominally slower than if the current approach were maintained, the difference between the two approaches is that FD crediting better reflects the emissions impact of fuels used in advanced technology vehicles. Meeting a nominally higher LCFS target with credits reflecting overstated estimates of fuel displacement does not mean GHG emissions are actually reduced. Lower LCFS targets in the 2030s and early 2040s reduce the price impact on consumers still using gasoline and allow a more gradual LCFS target trajectory, which will contribute to a stable LCFS credit market.

Conclusion

Current mathematical representations of fuel displacement under the LCFS embed the assumption that advanced technology vehicles, those with $EER > 1$, always displace fuel at their maximum theoretical level, no matter the market conditions. This assumption means that for the purposes of LCFS crediting the first advanced technology vehicle sold into a market displaces precisely as much as the one-millionth such vehicle, or the one that replaces the final incumbent vehicle. Under the present method, credits would be generated for fuel displacement even after a fleet had completely shifted to ZEV technology. This assumption of complete displacement reasonably approximates real-world behavior during the early phases of a vehicle transition but would likely lead to significant overestimation of displacement as the fleet converts to new, more advanced technologies.

The Fractional Displacement crediting approach resolves this overestimation by disaggregating the current credit quantification equation into two components, one that reflects credits from lower-CI fuel on an equal-energy basis, and one that reflects displacement of additional fuel due to higher efficiency powertrains. The displacement component can then be reduced over time, such as in proportion to the fraction of vehicles using the incumbent technology that remain in the fleet. This change is technology-neutral and is built on the same conceptual and mathematical foundation as the current quantification method.

The FD approach offers the opportunity to more accurately represent credits generated by advanced technology vehicles as they become more prevalent in the fleet, which would strengthen the connection between actual emissions benefits and the amount of incentive. This connection has been a strength of the LCFS to date, and reinforcing it helps support effective program function moving forward. The FD approach would also reduce the potential for future destabilization of the LCFS credit price by large-scale fleet turnover to advanced technology vehicles, such as is expected to happen in the 2030s as the on-road LD vehicle fleet transitions to EVs. Switching to FD crediting would mitigate the risk of downward price pressure on LCFS credits and reduce the need for regulatory intervention as technologies mature. The FD approach never completely cuts a technology out of the LCFS; if the fuel consumed by a vehicle has a lower CI than the target for a year, it will receive appropriate credit. While

FD crediting can be adopted piece-meal, comprehensive adoption would create a stronger and more durable foundation for the LCFS and reduce the risk of market disruptions in the future.

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Authors

Murphy, Colin

Ro, Jin Wook

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Updated Fuel Portfolio Scenario Modeling to Inform 2024 Low Carbon Fuel Standard Rulemaking

Colin Murphy, Ph.D. and Jin Wook Ro, Ph.D.
University of California Davis, Policy Institute for Energy, Environment, and the Economy

Executive Summary

California's Low Carbon Fuel Standard (LCFS) has been a critical part of its climate policy portfolio and has helped reduce greenhouse gas (GHG) emissions from its transportation sector since 2010. The LCFS sets an annually declining target for the average carbon intensity (CI) of transportation fuels and uses a system of credits (for emissions reductions from fuels with CI scores lower than the target) and deficits (for excess emissions from fuels with higher CI scores than the target) to facilitate compliance. Producers who receive deficits must procure an equal number of credits; this creates a market for those credits, generating revenue to support lower-carbon transportation fuel providers. Generation of credits has significantly exceeded that of deficits since late 2020, leading to a marked decline in credit price that threatens to undermine the incentives needed to continue innovation and deployment of lower-carbon fuels and technologies needed for carbon neutrality targets. The California Air Resources Board (CARB) initiated a rulemaking in January, 2024, to make amendments to the LCFS with the primary goal of setting new targets that would stabilize the credit market, which in turn could increase credit prices. UC Davis Policy Institute for Energy, Environment, and the Economy researchers have been engaged in this process since its beginning, and published a report in late 2023 evaluating several potential target and program design options for the upcoming rulemaking using the Fuel Portfolio Scenario Model (FPSM).

This report provides updates to that work, primarily in two key areas. First, it incorporates the impacts of proposed LCFS amendments, the details of which were released after our previous publication in 2023. Second, and more importantly, it accounts for new data that have emerged since the previous work that significantly changed expectations around developments in the fuel market. Deployment of renewable diesel (RD) production capacity in the U.S. has greatly exceeded even very recent projections, and the majority of the production continues to flow to California. Current evidence indicates that this trend of rapid RD capacity growth is likely to continue through the mid-2020's, creating a massive pool of relatively low-cost biofuel (given incentives beyond the LCFS) produced with an established technology that could enter California's market. Under these conditions, it is unlikely that the proposed LCFS amendments will achieve their goal of stabilizing the credit market and supporting significantly higher credit prices. Moreover, the new RD capacity trend makes it likely that the proposed Automatic Acceleration Mechanism (AAM) will trigger multiple automatic increases in the LCFS program

target trajectory in the late 2020's, which will significantly increase costs to gasoline consumers. While this RD could allow for additional near-term GHG reductions as calculated by the LCFS, significant uncertainty exists around its actual GHG impacts at the scales implied by the current growth trend; it comes with significant sustainability risks related to indirect land use change (ILUC), and competition with food crops. Neither existing measures (e.g. current ILUC impact adjustments on applicable fuel pathways) nor proposed measures (feedstock sustainability requirements) provide adequate protection against these risks. The anticipated growth in RD will predominantly rely on crop-based vegetable oil feedstocks, which may struggle to achieve the deep CI reductions required to be compatible with California's long-term goal of carbon neutrality by 2045.

Several options exist to address these emergent problems. Higher LCFS targets could marginally increase credit prices, but would also increase the incentive to use crop-based RD; as long as that compliance option is available, it could out-compete more innovative, but uncertain ones. Other approaches, such as improving upon LCFS ILUC impact accounting protocols entail an extensive (multi-year) development process, by the time they took effect the current rate of RD growth could have resulted in significant negative impacts, including land conversion. Implementing a cap on consumption of lipid- or crop-based biofuels (which would cover RD as well as biodiesel and hydrotreated sustainable aviation fuels) was discussed in pre-rulemaking workshops, but excluded from the proposed amendments. In this paper we model some plausible cap designs, and find they could effectively limit the growth of potentially risky biofuels and bring aggregate credit supply and demand back into balance. By restricting the supply of low-cost RD, the credit price would be more likely to rise to levels capable of supporting California's long-term transition to carbon neutrality, by supporting the deployment of innovative fuels that could achieve deep GHG reductions with less risk of negative impacts from ILUC. We present several scenarios with different cap designs and levels; a 500 million gasoline gallon equivalents (GGE) cap on crop-based fuels, or a 2 billion GGE cap on lipid-based fuels are projected to result in an approximately balanced supply of credits and deficits through the remainder of this decade.

Introduction

The Low Carbon Fuel Standard (LCFS) is a critical part of California's portfolio of policies to reduce greenhouse gas (GHG) emissions from transportation. The California Air Resources Board (CARB), the program's administrator, has opened a rulemaking to amend the LCFS to address a number of issues. The most important among them is the decline in LCFS credit prices since late 2020. This decline reduces the value of LCFS incentives to low carbon fuel producers; low LCFS credit prices may make it difficult for the state to maintain the pace of decarbonized technology innovation necessary to meet statutory goals. CARB began pre-rulemaking workshops in late 2022, and released draft amendment text along with the Initial Statement of Reasons in December 2023. The initial rulemaking period closes February 20, 2024, and a public hearing for the board to consider amendments will be scheduled sometime in 2024.

This report updates modeling published in 2023 by researchers with the UC Davis Policy Institute for Energy, Environment, and the Economy (Policy Institute) to reflect the impact of proposed amendments on future LCFS credit supply and demand and explore the implications of significantly faster-than-expected deployment of hydrotreated renewable diesel in California (*1*).

The previous round of FPSM modeling was predominantly conducted in Spring and Summer of 2023, at which point only 2022 LCFS program data were available. Now, LCFS quarterly data through Q3 of 2023 are available. These data show a nearly 40% increase in consumption of renewable diesel (RD) to 1.8 billion gallons consumed in the most recent four quarters for which data are available (through Q3 2023) from 1.3 billion gallons consumed in the four quarters prior to that (*2*). This mirrors trends at the national level where RD capacity deployment greatly exceeded levels projected by the EIA (*3*, *4*) (Figure 1). Other independent evaluations of RD production capacity, and their impacts on feedstock markets, corroborate the updated DOE data and reinforce the conclusion of exceedingly rapid growth in this space (*5*–*7*).

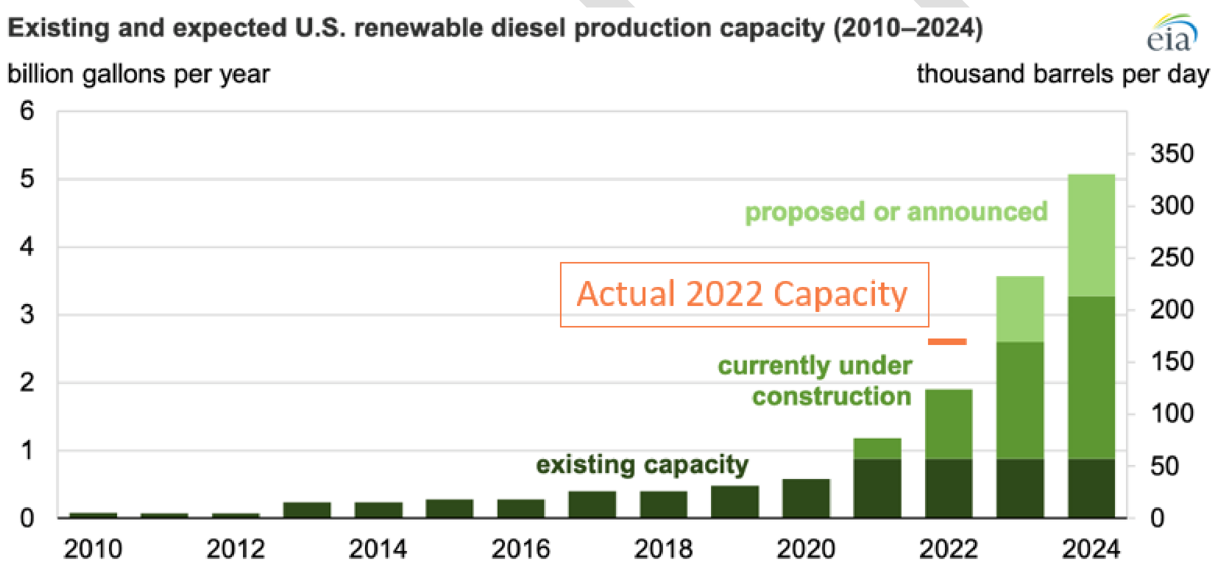


Figure 1. Source: 2021 Projection of renewable diesel deployment in the U.S. from the Energy Information Administration. EIA has since updated the information using 2023 data; actual 2022 capacity marker added by authors based on that source.(*3*, *4*) Renewable diesel capacity deployment has dramatically outpaced even recent expectations. The majority is consumed in California due to the LCFS incentive.

While U.S. RD production lagged behind capacity deployment in 2022 (as would be expected with facilities coming online throughout the year), data from the first 10 months of 2023 show aggregate production on a similarly rapid growth trajectory, already 40% above total 2022 levels (*2*). California consumption of RD has similarly grown. Annualized 2023 data project total consumption around 1.9 billion gallons, compared to around 1.4 billion in 2022. It is noteworthy that this occurred during a period of low LCFS credit prices, when conventional wisdom would suggest that lower incentive levels might not foster rapid growth. Federal policy provided a significant amount of support with historically high renewable identification number (RIN) prices; however, these have been gradually declining since a peak in mid-2022. This decline has not slowed the pace of growth. We lack access to producer-level economic data with which to verify the profitability of current or anticipated RD capacity projects, and the level of aggregate demand from RD, not only from California but from other jurisdictions with similar LCFS-like programs is also uncertain. So, while we cannot conclusively speak to how future market conditions will impact supply, the trend is broadly supportive of the idea that policies other than the LCFS (like the federal RIN and biomass-based diesel tax credit) make U.S. RD production cost effective, leaving the CA LCFS incentive to cover any gap and transport cost to California. Market forces theoretically could halt this capacity growth if policy support in aggregate proves inadequate to cover RD production costs, but current evidence supports continued growth in capacity to produce RD and hydrotreated SAF for the next several years and the continued ability of large fractions of this new capacity to come to market in California.

This major change in the landscape of California's low carbon fuel market requires updating several assumptions made in previous versions of FPSM, as well as evaluating how the continuation of this trend would affect LCFS credit markets going forward. Driven by the rapid expansion of RD, aggregate consumption of lipid-based fuels has already exceeded the maximum volumes projected in Brown *et al.* (2021) (*8*) and has almost matched the maximum volumes expected in the late 2020s from Ro, Murphy, and Wang (2023) (*1*). More importantly, the implied trajectory of hydrotreatment capacity growth in the U.S. suggests a much higher potential supply of RD than previously assumed in these studies. The fact that the Phillips 66 and Marathon refinery conversions in the Bay Area are expected to come online at significant fractions of their nameplate capacity, around 1.7 billion gallons/year in aggregate, in 2024 suggests that the availability of RD to California will continue to grow rapidly in the near future. The rapid rise in RD consumption reflected in more recently available 2023 data indicates that large volumes can and could be expected to enter the California market even during periods of historically low LCFS credit prices. As such, the assumptions made around limits to both the pace of RD growth and the maximum amount of hydrotreated fuel capacity available to California must be reevaluated.

Methods

The modeling presented in this report used the Fuel Portfolio Scenario Model (FPSM). This spreadsheet-based scenario analysis tool was developed by Policy Institute researchers. It builds on the illustrative compliance scenario modeling methods used to inform previous LCFS rulemakings. Full methodology for FPSM, as well as analysis of other LCFS scenarios, can be found in Ro, Murphy and Wang (2023), and Chapter 9 of Brown *et al.* (2021) (*1*, *8*). This section will only describe changes made to FPSM to enable the specific analyses presented here. Details of proposed amendments are taken from Appendices A-1 and A-2 of the LCFS rulemaking document package, with additional explanation derived from the Initial Statement of Reasons (*9*–*11*). In what follows, we describe each changed provision or situation modeled, followed by our modeling approach, in turn.

Amended ZEV Infrastructure Capacity Credit Provisions

Proposed amendments would significantly reduce the scale of protocols to provide LCFS credits for specified zero-emission vehicle (ZEV) fueling infrastructure capacity. Current protocols allow hydrogen refueling infrastructure (HRI) and fast charging infrastructure (FCI) installations for light-duty (LD) vehicles to generate credits, up to an amount equal to 2.5% of prior quarter deficits for each program. These provisions are generating significantly fewer credits than previous models anticipated, however, and they have not approached their maximum values (*1*, *12*). HRI pathways have, on average, generated credits equal to 0.55% of prior quarter deficits from 2021Q1 to 2023Q3 (the most recent quarter for which data are available). FCI pathways have generated an average of 0.38% of prior quarter deficits over the same period, with both numbers growing slowly over time. Proposed amendments would reduce the cap for each protocol significantly, in favor of similar medium- and heavy-duty options discussed below, and make other operational changes. Under proposed amendments, both LD HRI and FCI capacity credit provisions would be limited to generating 0.5% of prior quarter deficits. HRI provisions are already generating more credits than this. However, because the number of deficits increases over time as LCFS program targets increase (until such point that fuels generating the most deficits – petroleum fuels – decline sufficiently in volume), continued growth would be necessary to maintain this share of credit generation.

Updated Approach. We elect to assume that [1] HRI provisions, including both projects certified under the existing rules and those certified under the proposed amendments generate credits at their capped level until eligibility for new pathways closes at the end of 2030, and [2] credits decline to zero over the following 10 years. While FCI protocols are still below 0.5% of prior quarter deficits, their current rate of growth would have them hit that mark by late 2024. As such, we make the same assumption as HRI: that they will generate credits equal to 0.5% of prior year deficits through 2030 and decline from there.

New Medium- and Heavy-Duty ZEV Infrastructure Capacity Credits

CARB proposes adopting new infrastructure capacity credit provisions targeted at medium- and heavy-duty (MHD) electric vehicles (EVs) and hydrogen vehicles. These proposed provisions largely follow the same design as existing infrastructure capacity credits for LD electric and hydrogen vehicles, with a cap for each FCI and HRI of 2.5% of prior quarter deficits, or 5% in aggregate.

Updated Approach. Given the similarity in structure to initial LD provisions, the proposed changes were integrated into FPSM by duplicating the approach used for LD HRI and FCI protocols and updating with appropriate caps and targets. Table 24 of the Standardized Regulatory Impact Assessment provides an estimate of total credit revenue generation through 2046 (*13*). However, this value appears to assume maximum utilization of the provisions throughout their entire period of activity. This assumption appears to have been made to assess the maximum potential financial impacts of the program and is exceptionally unlikely to occur in practice. No other sources of guidance for expected utilization have been identified and, given the short timeframe for public comment on the proposed provisions, development of a predictive model was impractical. Given the stronger fundamental need for fueling infrastructure in the MHD space, we assume that these provisions will ultimately generate half of their maximum potential credits, or 2.5% of prior year deficits in aggregate. Of these credits, 60% are distributed to HRI and 40% to FCI. This follows the approximate distribution of credits in existing LD HRI and FCI pathways, reflecting the expectation of lower utilization for HRI and, therefore, a greater opportunity for capacity credit generation. We assume that these pathways will reach their cap in 2028, then decline over 10 years once the window for new pathways closes at the end of 2030.

Changes to Direct Air Capture Project Eligibility
The LCFS allows crediting of direct air capture (DAC) anywhere globally. The proposed amendments seek to restrict eligibility for crediting of DAC to projects located in California, only. Previous versions of FPSM assumed limited LCFS crediting of DAC through the 2030s, with 100,000 metric tons credited in 2030 and 5 million in 2045. This does not include DAC integrated into fuel production, the impacts of which are reflected as a reduction in certified fuel carbon intensity (CI) score. This is significantly less than the aggregate carbon capture and storage (CCS) goal articulated in Californa's Scoping Plan, though that goal considers all CCS applications not just DAC (*14*).

Updated Approach. Given the relatively low anticipated generation of DAC credits through the period of this analysis ending in 2035, the previous assumptions were left unchanged.

Changes to e-Forklift crediting
Proposed amendments would eliminate the ability of utilities or other e-forklift owners to generate credits for e-forklift charging through estimation of charging activity based on population data. Instead, reporting of charging activity from the fueling station would be required. We expect this to reduce the aggregate amount of credit generation from e-forklift pathways due to the increased stringency of reporting requirements.

Updated Approach. At present, we have no data or models from which to quantitatively predict the impact of these changes. We carry forward the previous assumption of static credit generation, maintaining yearly credits from the most recent historical data point.

Updating RD Deployment Assumptions
As discussed at the outset, RD U.S. production capacity, and consumption in California and nationally, is on a rapid growth path. For this reason, relaxing prior constraints around RD deployment in FPSM and assuming that large amounts of RD can enter the California market in the next 5 years is critical.

Updated Approach. We relaxed previous assumptions about limits to both the pace and aggregate size of RD growth. In order to evaluate different approaches to volumetric limits on categories of feedstock (see Options to Restrict RD Growth to Stabilize the LCFS Credit Market, below), the previous constraint method - total lipid-based distillate fuel production - was changed to caps on the five primary classes of lipid feedstock consumed in California: used cooking oil, tallow, corn oil (meaning technical corn oil, an inedible byproduct of corn ethanol production), soybean oil, and canola oil. CARB reports an “other” category for biodiesel (BD) production, while canola oil is grouped into “other” for RD production at present. It is likely that the vast majority of the “other” category of RD is made from canola oil. Total volumes of “other” BD were very low, often negative (likely representing administrative adjustments to credit generation) and so we omit “other” BD from the model and assume that “other” RD is entirely canola oil.

Actual availability of UCO, tallow, and corn oil increases at a 3% annual rate from the most recent historical data. This approximately matched pre-2022 growth rates, UCO and tallow have grown more rapidly in recent years, but this is likely due to increased foreign imports with uncertain potential to continue this rate of growth. The 3% growth rate in this space is meant to approximate growing production of wastes and residues due to population and economic growth from current sources. Crop-based oils are assumed to be available up to the specified cap, due to the large international market for vegetable oils. Complete elimination of the all caps led to the model predicting an immediate and total conversion of the entire diesel pool to RD, which is unrealistic. A constraint to limit total growth of lipid based fuels to no more than 500 million GGE per year, aligning with the growth between 2022 and annualized 2023 data was added to prevent unrealistically rapid conversion rates. At present, no data are available with which to determine an long-term absolute physical limit on total lipid or crop-based lipid consumption. California already imports fuels made from several categories of feedstock, implying that the upper bound on aggregate consumption may be the global supply of lipids, which is more than sufficient to fully displace all diesel and jet fuel consumption within the near term. Given current market conditions and the rapid growth of RD in the last two years, it is difficult to find an empirical basis upon which to limit the rate of growth in these fuels. Without such a basis, the limits on wastes and residues retained their previous approach - 3% annual growth from the most recent historical data - and a limit of 2 billion gallons of crop-based fuels was assumed for the “uncapped” scenarios. This led to significant increases in RD consumption in all future years and petroleum diesel being displaced from the fuel pool by 2032 in uncapped scenarios, it is possible that even this rapid rate of growth is an underestimate.

Deficit Generation by Intrastate Aviation Fuel

Currently, the LCFS provides opt-in status to generate credits for sustainable aviation fuel (SAF). The proposed amendments call for intrastate aviation fossil jet fuel to generate deficits starting in 2028. Intrastate travel is defined as flights that start and end in California, though other definitions have been proposed.

Undated Approach. Previous versions of FPSM reflected SAF’s opt-in status. This update adds intrastate conventional jet fuel usage as a deficit-generating fuel from 2028. UC Berkeley modeling from a recent RIMI project estimated intrastate fuel consumption to be 403 million gallons in 2019, 475 million in 2030, and 488 million in 2035, we adopt these and interpolate for intermediate years.(*15*) In prior versions, FPSM modeling assumed that future ICAO, Federal, and State policy, combined with voluntary efforts, would result in SAF deployment sufficient to approximately match total intrastate aviation fuel consumption by 2030 and thereafter. We retain that assumption for the update. As in prior versions, FPSM assumes that all significant volumes of SAF deployed through 2035 will be lipid-based hydrotreated esters and fatty acids (HEFA). While other technologies have been proposed to produce SAF, including alcohol-to-jet synthesis, cellulosic biofuels, or e-fuel synthesis, none have deployed at commercial scale to date and insufficient data exist to model real-world performance with confidence. We therefore continue to omit projections of novel fuel technologies entering into this space; these can be added when data are available. Within the lipid-based fuel categories, feedstock is allocated among three categories of lipid-based fuel (BD, RDI, and SAF) in the following order: first BD at the blend rate (as a fraction of total liquid diesel and diesel substitutes), then SAF, then RD, with each feedstock using the lowest-CI feedstock first. This method is designed to yield aggregate feedstock portfolios across all lipid-based fuels that approximately align with historical feedstock utilization patterns, adjusting for likely growth.

Automatic Acceleration Mechanism (AAM)

CARB proposes adopting Automatic Acceleration Mechanism (AAM) which advances all annual CI benchmarks by one year when certain conditions are met. Starting 2027, if the credit bank to average quarterly deficit ratio exceeds three and credit generation exceeds deficit generation, the AAM is triggered unless it was triggered in the immediately prior calendar year. Because the trigger criteria for the AAM had not been proposed at the time of our previous publication, we were unable to model its effect for the 2023 publication.

Updated Approach. Due to the limitations of the original structure of the FPSM, we integrated the AAM into the FPSM for this update by manually advancing the compliance trajectory by one year, the year after banked credits exceeded ¾ of prior year deficits. This entailed, when conditions were triggered, an additional scenario run starting from the year after the triggering event through the end of the trajectory.

Other Updates from 2023 Report

We made additional updates to input assumptions based on more recently available LCFS data, as described below.

Electricity CI score. FPSM estimates grid average CI changes over time by interpolating between the most recent historical data and an assumed zero CI in 2045. We updated FPSM parameters to reflect a slightly higher average electricity CI score in 2023 than the interpolated trajectory based on the published 2022 value predicted, future interpolated values through 2045 were therefore also increased.

CaRFG, ULSD, and fossil jet fuel baseline CI. The base year (2010) CI values for CaRFG, ULSD, and fossil jet fuel have been updated (99.44 to 99.15, 100.45 to 105.76, 89.37 to 89.43, respectively), and the benchmarks for years 2024 through 2045 reflect these revisions. The reduction target trajectories used in the FPSM reflect these revisions as well.

Non-road electricity pathways. We updated non-road electricity pathways (eCHE, eTRU, fixed guideway, e-forklift, etc.) energy based on recent data showing higher recent growth than previously projected. We increased energy used for these in 2023, as well as in future years.

Petroleum fuel projects. Because petroleum fuel projects (refinery investments, renewable hydrogen refinery, innovative crude, etc.) earn credits based on carbon savings through investments vis-a-vis their own baselines, FPSM projects credits directly in this case (rather than projecting an amount of fuel and associated CI score). Recent data on credits continue to lag previous projections, so these have been reduced to reflect this underperformance and the impact of a planned phase-out of these pathway categories, as laid out in the proposed amendments.

Renewable natural gas (RNG). Average RNG CI has declined since the 2023 FPSM report, due to the increased penetration of livestock digester gas into this market. We adjusted FPSM assumptions to reflect more recent shares of RNG feedstocks (i.e., higher share of livestock digester gas, and lower share of landfill gas) to reflect these trends for 2023, resulting in a slightly greater credit generation trajectory. The previous assumption of 4% annual CI improvements for all RNG categories after 2030 was retained.

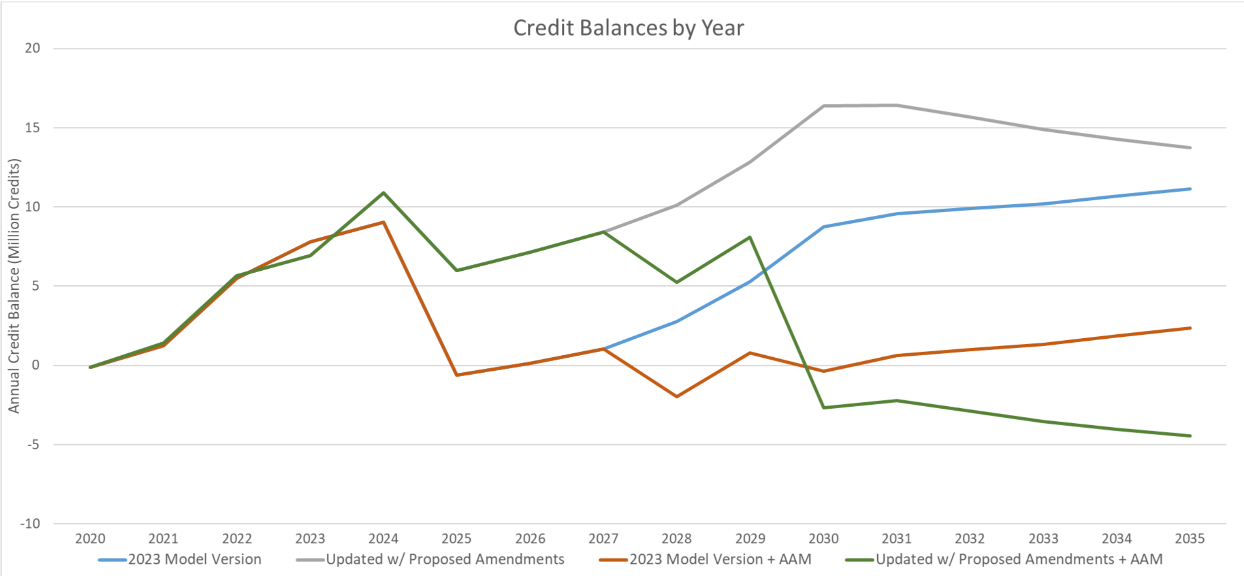
Results

The previously published FPSM report projected 22.4 million total deficits and 30.2 million credits in 2023. Annualized estimates based on the first three quarters of 2023 data project 22.5 million total deficits and 29.4 million credits. While the aggregate figures from the data do not deviate substantially from previous projections, the composition does. The significant increase in RD credits is counteracted by a downward adjustment of on-road EV credits due to the slightly higher CI score, and of project-based credits, as well as updating to the latest incremental crude oil deficit value, which has increased from prior levels. Changes to electricity CI, fossil fuel baseline CI, non-road EV pathways, RNG CI, and Refinery Project Credits yielded net credit impacts of less than a half-million each in 2030. Some of these categories increased credit generation (non-road EVs, RNG) and others a net decrease (on-road EVs, project-based credits). On net, apart from the impact of proposed amendments, and the data-driven changes in RD deployment assumptions, the 2023 report continues to represent the current and anticipated condition of the LCFS with good accuracy (*1*).

Most of the proposed amendments in the current LCFS rulemaking are unlikely to significantly change the credit balance in 2030 and 2035 compared to estimates in Ro, Murphy, and Wang (2023) (*1*). An exception is the Auto-Adjustment Mechanism (AAM), which was discussed but not explicitly modeled in the previous paper. Most of the proposed changes align well with concepts proposed by CARB staff during pre-rulemaking workshops, and so were included in the previous report with reasonable fidelity. The new MHD HRI and FCI credits were the notable exception, in that they were insufficiently described to allow us to model them. However, the reduction in LD HRI and FCI capacity to generate credits largely offsets the assumed credit streams from these pathways, yielding only a slight increase of credits overall, around a half million projected credits in 2030 (compared to almost 40 million deficits in 2030).

Updated data and revised projections on RD deployment, however, have significantly shifted credit dynamics in the LCFS market, and with it, FPSM projections of long-term LCFS credit balances. Ro, Murphy, and Wang (2023) concluded that the proposed 2030 amendments with a 30% reduction target by 2030, as we understood them then, were likely to yield an approximate balance between credit supply and demand, through the mid-2020's at least (Figure 2). Based on updated modeling, this conclusion is no longer the case. The model runs published in 2023 (performed before Q2 or Q3 2023 LCFS program data were released) anticipated total consumption of petroleum diesel in 2023 to be around 1.8 billion gallons, and RD consumption around 1.5 billion gallons. While full 2023 data are not yet available, annualizing the averages of the first three quarters of published data, we anticipate diesel consumption to be around 1.5 billion gallons, with 1.8 billion gallons of RD. Essentially, nearly 300 million gallons of RD above the anticipated amount (which itself reflected expectations of robust growth) materialized *the year after the projection was made*. If we assume a 43 gCO_2e/MJ carbon intensity for this new supply (roughly the average of all RD consumed in CA through the first 3 quarters of 2023), the additional 300 million gallons imply around 500,000 fewer deficits generated by petroleum diesel, and 1.9 million additional credits, adding around 2.4 million credits to the bank compared to projections from a year before.

The AAM makes a much more significant difference in net credit balance in 2030 and beyond, though it is only triggered under specified market conditions. The updated model projected two AAM-triggering events, in 2027 and 2029 under the currently proposed LCFS amendments, driven principally by the recent changes in RD availability. This compares to a single triggering event, in 2027, when using parameters from the 2023 report. The two AAM-triggering events yield a 39% LCFS target in 2030.



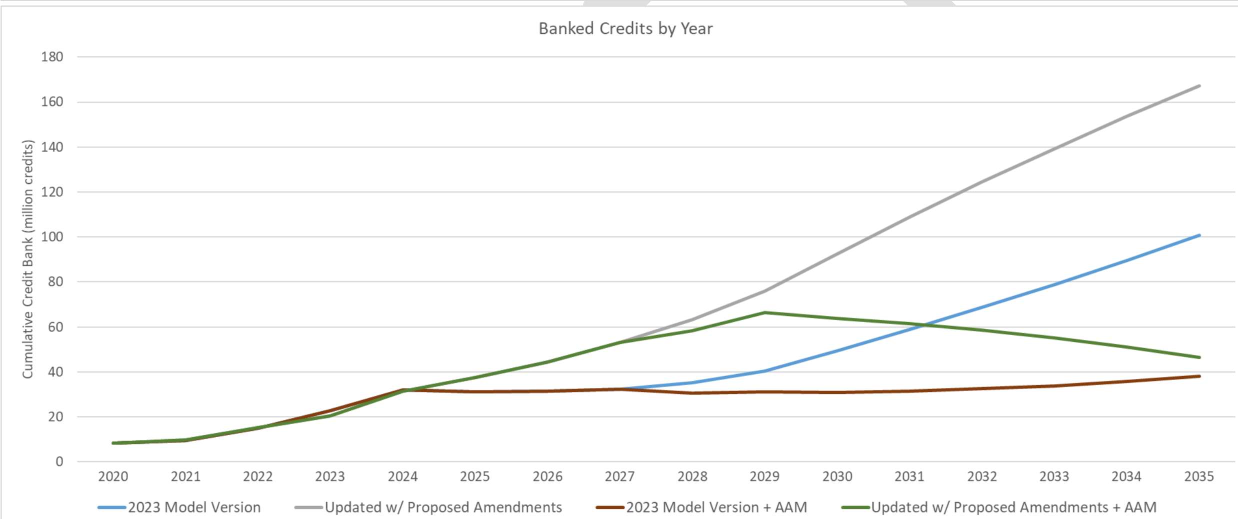


Figure 2: (a, above) Yearly net credit balances and (b, below) net banked credits from updated FPSM modeling of LCFS through 2035, results from previous publication (Ro, Murphy, Wang, 2023) are included for comparison. The scenarios modeled in our previous report would be expected to trigger the Auto Acceleration Mechanism (AAM) would be triggered once, in 2027. The updated scenarios with proposed amendments is projected to trigger the AAM twice, in 2027, and 2029.

Discussion and Policy Implications

Based on the updated modeling presented in this report, the primary finding of our 2023 report, regarding 2030 LCFS program targets, no longer holds. The proposed 30% 2030 CI reduction target, even with the deficit-increasing effects of the AAM, now appears unlikely to bring credit supply and demand into approximate balance before 2030. Instead, current trends indicate a LCFS market with a significant oversupply of credits persisting until the late 2020's and possibly into the 2030's. This oversupply will continue market conditions similar to those that have prevailed since 2022 and continue today. As a result, while some incremental increase in LCFS credit price might be expected as a result of the higher targets, significant price increases are unlikely until either a fundamental shift in the price and supply dynamics around RD (and to some extent SAF) or the market returns to an approximate balance between credits and deficits, neither of which appears likely until 2030 or later.

Continued deployment of hydrotreated fuel production capacity, and the relative ease with which drop-in fuels like RD and SAF can be transported mean that the potential supply to California is sufficient to satisfy most or all of California's liquid diesel demand, and likely a fraction of jet fuel demand as well, by the mid-2020's. Vegetable oil prices, while high, have not demonstrated themselves to be an impediment to continued growth, and absent a more severe collapse of biomass-based diesel (D4) RIN prices few other market-mediated brakes on growth seem likely.

Taken together, this implies that obligated parties in the LCFS will have a readily available source of inexpensive credits available from hydrotreated fuels, especially RD, through the mid-2020's at least. As long as this supply exists, we would expect little upward pressure on LCFS credit prices; obligated parties will have little incentive to invest in innovative, but riskier, approaches to reducing GHG emissions from transportation fuels until either the supply of inexpensive RD is exhausted or it has displaced all petroleum diesel, and all aviation fuel is subject to a deficit obligation.

Raising the LCFS target above the proposed 30% CI reduction in 2030 would increase demand for credits and could incrementally increase LCFS credit price, however higher targets will not break the fundamental market relationship that is being established. RD and hydrotreated SAF appear likely to enjoy a cost advantage over other sources of compliance credit, and until either the low-cost supply runs out or California's market cannot accept more, we would expect only modest increases in LCFS credit price absent major shifts in policy incentives, especially at the federal level. Unless the growth of RD is significantly restricted, it is unlikely that the current market conditions will shift in order for LCFS credit prices to increase appreciably this decade.

It may seem like fully displacing petroleum diesel with inexpensive hydrotreated RD, as well as a significant fraction of jet fuel with hydrotreated SAF, would align with California's climate and environmental goals, however the volumes of these fuels required for that outcome present significant near- and long-term problems. First, while hydrotreated vegetable oil fuels likely reduce emissions of GHGs when substituted for petroleum, these benefits are modest. Waste-based fuels can reduce life cycle emissions by over 70% compared to petroleum, and even crop-based fuels can deliver 40% GHG reductions according to LCFS assessments and other independent analyses. Some reduction in GHG emissions may be possible by switching to renewable energy or renewable hydrogen sources during the production process, however these fuels lack a pathway to reduce emissions enough to achieve, or even approach carbon neutrality. Given California's long-term goal is to achieve carbon neutrality by 2045, hydrotreated lipid fuels like these are best suited to be bridge fuels, to reduce emissions in the near term while zero- or near-zero carbon solutions are brought to market. A limited amount of waste-based biofuel may have a role in the long-term fuel portfolio, but excessive deployment of crop-based fuels risks creating stranded assets or crowding out more sustainable solutions.

Second, the volume of RD implied by current growth trends raises substantial concerns around sustainability and GHG impacts that are unaccounted for by current LCFS CI assessment methods. Indirect land use change (ILUC) is particularly worrisome. Current LCFS CI assessment methods apply ILUC impact adjustments that were adopted in 2015, based on modeling of international agricultural commodity markets and land use patterns of the time. Both agricultural commodity markets and land use behavior have changed significantly over the last 9 years, due to improvements in technology, geopolitical factors, climate change, and more. The model used for the current ILUC assessment, GTAP-AEZ, derived the estimated land use impacts from biofuels by simulating a supply shock sized to match anticipated U.S. RFS volumes at the time. These focused predominantly on grain crops for ethanol production, and soybean for biodiesel. The recent growth in vegetable oil based biofuels, however, has moved beyond the parameters of the model used at the time. A recent comparison of current ILUC models by the U.S. EPA found a wide range of uncertainty around ILUC impact of soybean oil biofuels, ranging from 11 g CO_2e/MJ to over 260 g CO_2e/MJ (*16*). The current soybean oil ILUC impact estimate used by the LCFS is 29.1 g CO_2e/MJ, near the bottom end of that range. Given the uncertainty involved in ILUC assessment, and the asymmetric risks of overestimation vs. underestimation of ILUC impacts, adopting a value based on an estimate from a single model, especially one at the lower end of the uncertainty range established by multiple models, creates substantial risk of unrecognized GHG emissions, environmental harm, and stranded assets (*17*).

As a result, it is unlikely that continued growth of RD along current trends will help California meet its environmental goals, and risks creating a market in which emissions from the transportation fuel sector continue to rise even while LCFS targets are nominally met. Significant volumes of RD, including some from crop-based feedstocks, can contribute to California's progress toward carbon neutrality, but the current rate of growth crowds out investments in other low-carbon fuels. The aggregate consumption of RD, combined with expected growth due to Federal policy, as well as that in other states and other jurisdictions including Canada, which does not account for ILUC, can lead to profoundly negative GHG and other environmental impacts. Significant restrictions on the growth of RD appear to be the most feasible and certain, and possibly the only, way to reestablish the LCFS capacity to support innovative low carbon fuel technologies and a strong credit price, especially in the short timeframe relevant for these investment decisions.

It should also be noted that the proposed amendments, combined with the rapid growth of RD create a LCFS credit market that is likely to trigger the auto-adjustment mechanism twice, at the earliest possible opportunities. The credit bank to deficit ratio remains at a high enough level to trigger a third AAM event, however FPSM projects a sufficient decline in credits to block this from occurring. If a year of net credit surplus were to occur in the 2031-2034 time period, a third AAM trigger event could occur. The two anticipated AAM triggering events result in a 39% LCFS target by 2030, increasing by 4.5% per year thereafter. Revenue in the LCFS credit market predominantly originates from charges applied to petroleum gasoline that are passed through to consumers. Gas price impacts are a function of the fuel's carbon intensity score, the LCFS target, and the LCFS credit price. Higher targets, therefore, yield higher per-gallon retail gas price impacts. A 39% LCFS target combined with a $50 credit price would be expected to yield just over 20 cents per gallon in increased gasoline cost; higher credit prices would yield proportionately higher price impacts.

If California achieves its ambitious deployment goals, around 23% of the total fleet will be made up of ZEVs in 2030, the rest will be predominantly fueled by gasoline. The transition from gasoline vehicles to ZEVs is anticipated to move faster for higher-income consumers than lower-income ones as well. The AAM triggering events that would likely follow adoption of the proposed amendments without any restriction on RD growth could yield regressive impacts on California gasoline consumers. This impact may accompany a situation where the emissions benefits supposedly gained from the program turn out to be overstated, due to underestimated ILUC impacts. A more measured approach, that delays some increased target ambition until the transition to ZEVs has progressed further could mitigate this risk.

Impacts of Expanded Deficit Obligation on Intrastate Jet Fuel

Prior versions of FPSM assumed that all SAF entered the market as an opt-in fuel, and its only impact on broader fuel markets was to consume some of the cap on total lipid-based fuel capacity. Given the new deficit obligation, and the switch in FPSM methodology to feedstock category based caps, the impact of SAF assumptions on broader markets is magnified. The revised hierarchy of fuel types with regard to access to preferred feedstocks (BD first following historical patterns, then SAF followed by RD, with both taking the lowest-CI feedstocks first) was picked in part because of its compatibility with the underlying structure of FPSM. It is unlikely, however, that this highly simplified heuristic will accurately predict the actual feedstock use patterns by each fuel type, and FPSM results should be interpreted with that caveat in mind.

As a result of this allocation hierarchy, the deficit obligation for aviation fuel is often minimal or zero, because SAF is assumed to have first priority on feedstock and production capacity, and all intrastate aviation demand is therefore satisfied by SAF. This means that few, if any, fossil jet fuel deficits emerge in most modeling runs and the petroleum jet fuel deficit obligation is reflected in FPSM via increased petroleum diesel deficits. It is possible, though not certain, that this assumption is an essentially accurate representation of how markets will respond to future conditions, however it is also possible that producer preference to produce RD will continue to hold and there will be more petroleum jet fuel deficits, but fewer petroleum diesel deficits than these FPSM results would indicate. Since the GHG impacts of RD and SAF are largely determined by the feedstock used, net LCFS credit impacts are similar in either scenario.

FPSM assumes five primary classes of lipid feedstock (used cooking oil, tallow, corn oil, soybean oil, canola oil); GHG impacts in the model are primarily determined by how much of the feedstock pool is consumed to displace petroleum, and to a smaller degree by which fuel category consumes a specified blend of feedstock. As such, FPSM assumes the same CI scores for RD and SAF supplied to California based on the feedstock-weighted average. The impact of the feedstock allocation method on LCFS credit balance, or net emissions from the transportation fuel supply in California is small, though almost certainly non-zero. Work is ongoing at UC Davis at present to develop a more robust and realistic model of competitive dynamics within the lipid-based fuel space, including the differences in processing emissions.

At this point, it is unclear whether hydrotreated fuels will predominantly enter the California market as SAF or RD over the long run, RD dominates these volumes today however the Federal 45Z tax credits for SAF production have yet to be finalized and could significantly shift the economics in this space to support a shift to more SAF production output. Other anticipated policy actions, including ongoing efforts within California to increase support for SAF, future work from ICAO, or stronger voluntary commitments within the aviation sector could also impact this balance. The FPSM modeling presented here provides a reasonable approximation of likely behavior at the scale of the total lipid based fuel market (including biodiesel, RD, and SAF). FPSM results should not be interpreted as making a credible quantitative prediction about the likely feedstock mix for any specific category of fuels, however.

Options for Restricting RD Growth to Stabilize the LCFS Credit Market

In theory, the approach used by the LCFS at present should be able to guide the market towards a reasonable volume of RD. The current approach, however, depends on accurate assessment of ILUC impacts from biofuels and the current assessment is out of date, and based on modeling assumptions that are no longer reflect current biofuel and agricultural markets.(*18*–*23*) Updating the ILUC impact factors in the LCFS would require an extensive and complex research and analysis project, followed by a public engagement process to disseminate the new model and seek feedback. All told, this process would likely require 2-3 years at a minimum before actionable policy guidance would be delivered. The current rate of RD growth does not allow this extensive a delay before arriving at a more protective policy. By the time updated ILUC factors were developed, large amounts of land may be converted to cultivation for oil crops, resulting in millions of tons of CO_2 emissions. If an updated set of ILUC impact factors, or the development of a new approach to ILUC risk mitigation is the preferred outcome, an interim policy to mitigate growth in this space is needed as well.

To date, the only options for ILUC risk mitigation discussed by CARB during the pre-rulemaking workshop process have been feedstock sustainability certification requirements and a cap on the issuance of LCFS credits for specified categories of biofuels. Feedstock sustainability certification provides useful assurance that the practices used in the production of a given lot of feedstock meet specified criteria, however they are incapable of mitigating indirect risks like ILUC, which are driven by aggregate demand within a given market, which in the case of vegetable oils, is effectively global. There is ample potential supply of crop-based vegetable oil that would meet proposed sustainability criteria, directing that feedstock to biofuel production means the consumers who would have otherwise used that oil (e.g. human food producers, animal feed producers, soap and cosmetic makers, etc.) must find alternative sources of vegetable oil; historically some of these sources include unsustainable alternatives, including those that require conversion of additional land into cultivated use. (*24*–*26*)

Stakeholders have suggested capping the consumption of all crop-based fuels, or all lipid-based fuels. Both options can achieve the ultimate goal of mitigating the risks associated with unrestricted RD growth. Because lipid feedstocks (e.g. used cooking oil, tallow, technical corn oil, soybean oil, etc.) are largely fungible with each other in many applications, a lipid-based cap would be expected to provide better protection against resource shuffling within vegetable oil markets. Both forms of a cap entail administrative complexities, however several plausible solutions exist (see below). If properly designed and implemented, a cap would provide very good certainty that critical limits on RD deployment would not be exceeded due to growing use in the California market. Critically, a cap was evaluated as part of the Standardized Regulatory Impact Assessment associated with the current rulemaking, as part of Alternative 1. This alternative was rejected because it provided fewer GHG reductions than the proposed amendments, however this is primarily due to a lower 2030 CI target. Our prior work demonstrated, and this report confirms, that targets of 30% or higher are feasible even with a cap on crop-based fuels.

To help illustrate the impacts of different cap designs and target levels, we created several scenarios in FPSM: crop-based fuel caps of 500 million and 1 billion gasoline gallon equivalents (GGE) per year and lipid-based fuel caps of 2 and 3 billion gallons per year. These values were chosen as instructive examples of plausible cap levels to illustrate the magnitude of anticipated market impacts and do not imply specific policy recommendations. For comparison, 2022 consumption of crop-based feedstocks was around 450 million GGE, and consumption of lipid-based fuels was around 1.95 billion GGE. The results, along with those for the current amendments are presented in Figure 3 (next page), with anticipated AAM triggering events included in the projections of credit balance and bank. The Proposed Amendment, 3 billion GGE lipid-based fuels cap, and 1 billion GGE crop-based fuels cap scenarios all trigger the AAM twice, in 2027 and 2029. The 2 billion GGE lipid-based fuel cap, and the 500 million crop-based fuel cap avoid triggering the AAM altogether, in our scenarios. They would, however, require a reduction in total use from 2023 or 2024 levels of consumption of the capped fuel categories, which could have significant market impacts and lead to market uncertainty regarding the reliability of policy signals; phasing in these caps over several years could help mitigate this risk.

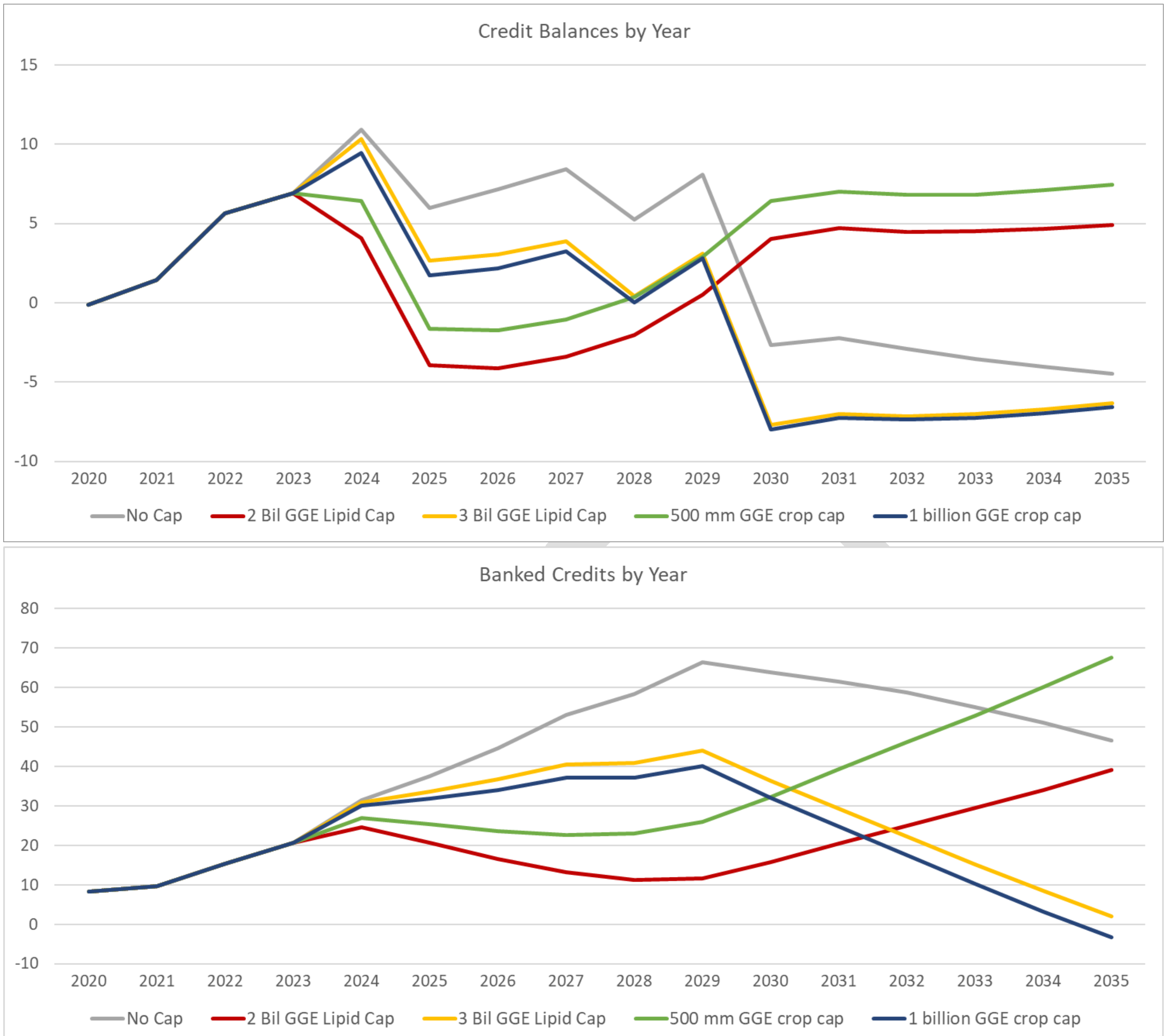


Figure 3: (a, above) Yearly net credit balances and (b, below) net banked credits from FPSM modeling of several lipid fuel scenarios. AAM-triggering events manually added when prior year banked credits exceed ¾ of prior year deficits and yearly deficits>credits. The gray “No Cap” line reflects modeled results for the LCFS amendments at the time of writing (February, 2024).

Previous FPSM modeling anticipated the proposed LCFS target trajectory, including the significant 5% “step-down” in 2025, would bring credit and deficit generation back into approximate balance for most of the mid-2020’s before the bank began growing again. The projected magnitude of this expansion was comparatively small, of a size that could be addressed by a single AAM-triggering event in the late 2020’s. The faster-than-expected deployment of RD implies not only the need for multiple AAM-triggering events before the balance between credits and deficits is restored, but that it is likely that a bank of 40 million credits or more will accumulate and persist for several years before being drawn down. A bank of that size could exert considerable downward pressure on credit prices.

This modeling implies that establishing a cap on crop- or lipid-based fuels at roughly 2022 consumption levels would be expected to restore an approximate balance between credit supply and demand, and help create conditions that support a strong LCFS credit price. Higher caps, including those set at levels California could easily reach in 2024 at present growth rates, are unlikely to stabilize the market without an extended period of credit oversupply and multiple AAM-triggering events. Since these caps entail a decline in consumption from current (post-2022) levels, a phase-in may be needed to prevent a shock to the market.

Conclusion

This report presents results from updates to the Fuel Portfolio Scenario Model to reflect proposed amendments to the LCFS from the current rulemaking, as well as a significant shift in projections of hydrotreated lipid-based fuel availability, predominantly renewable diesel. The proposed amendments, with the exception of the deficit obligation for intrastate jet fuel and the AAM, are expected to yield comparatively minor changes in credit balance through 2035. Updated projections of RD deployment, as well as new data about RD consumption in California, however, prompt a critical reconsideration of conclusions from previous modeling. RD capacity is growing much faster than anticipated at the national level, with growth anticipated to continue for the next 2-3 years at a minimum. This creates a vast pool of low-cost renewable diesel that can supply large amounts of LCFS credit. Until this pool is exhausted, or California markets for it are saturated, it is unlikely that the proposed amendments will achieve their primary goal of strengthening the LCFS credit price. The amount of growth projected presents significant sustainability concerns, especially related to ILUC, and neither existing LCFS provisions nor any in the proposed amendments provide adequate protection. Moreover, if the projected growth trends continue, it is likely that the AAM will be triggered more than once before balance is restored in the credit market.

Adopting a new approach to ILUC risk mitigation, or updating the modeling required by the previous approach entails a multi-year research and policy development process; by which point significant environmental harm and damage to California's progress toward climate goals will have been irrevocably done. A cap on fuels from crop or lipid feedstocks has already passed through some of the administrative steps required for adoption, and offers the best option for quickly arresting the growth in RD markets. A cap could either be used as a stopgap until a more nuanced solution is developed, or it could be retained indefinitely. A 500 million GGE cap on crop-based fuels, or a 2 billion GGE cap on lipid-based fuels appear likely to restore balance between credit supply and demand, strengthen the LCFS credit price, and are fully compatible with California achieving its medium- and long-term climate goals. Several options for the design of such a cap are briefly described.

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Authors
Ro, Jin Wook, PhD
Murphy, Colin W., PhD
Wang, Qian, PhD

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Fuel Portfolio Scenario Modeling (FPSM) of 2030 and 2035 Low Carbon Fuel Standard Targets in California

Jin Wook Ro, Ph.D., Postdoctor Researcher, Policy Institute for Energy, Environment, and the Economy, University of California, Davis
Colin W. Murphy, Ph.D., Deputy Director, Policy Institute for Energy, Environment, and the Economy, University of California, Davis
Qian Wang, Ph.D., Energy Futures Program, University of California Davis Institute of Transportation Studies

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16. Abstract

The Low Carbon Fuel Standard (LCFS) plays a critical role in California's efforts to reduce greenhouse gas (GHG) and air pollutant emissions from transportation. The LCFS incentivizes the use of fuels with lower life cycle GHG emissions by using a credit market mechanism to provide incentives for low-carbon fuels, using revenue generated by charges applied to high-carbon ones. Maintaining an approximate balance between LCFS credit and deficit supplies helps support a stable LCFS credit price and the broader transition to low-carbon transportation. The Fuel Portfolio Scenario Model, presented here, evaluates bottom-up fuel supply and LCFS compliance to inform LCFS policy decisions. We considered two key fuel demand scenarios: (1) the Low Carbon Transportation scenario, reflecting the expected transition to low-carbon transportation in California over the next 15 years, and (2) the Driving to Zero scenario, featuring a significantly higher consumption of petroleum gasoline. In both scenarios, 2030 LCFS targets around 30% resulted in a near-balance between credits and deficits, with some banked credits remaining. Several additional scenarios were modeled to explore the impact of target trajectory timing, alternate post-2030 targets, greater biofuel use, and other parameters. This fuel portfolio scenario modeling work can meaningfully inform policy development.

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The California Resilient and Innovative Mobility Initiative (RIMI) serves as a living laboratory – bringing together university experts from across the four UC ITS campuses, policymakers, public agencies, industry stakeholders, and community leaders – to inform the state transportation system's immediate COVID-19 response and recovery needs, while establishing a long-term vision and pathway for directing innovative mobility to develop sustainable and resilient transportation in California. RIMI is organized around three core research pillars: Carbon Neutral Transportation, Emerging Transportation Technology, and Public Transit and Shared Mobility. Equity and high-road jobs serve as cross-cutting themes that are integrated across the three pillars.

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Disclaimer

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Jin Wook Ro, Ph.D., Postdoctor Researcher, Policy Institute for Energy, Environment, and the Economy, University of California, Davis
Colin W. Murphy, Ph.D., Deputy Director, Policy Institute for Energy, Environment, and the Economy, University of California, Davis
Qian Wang, Ph.D., Energy Futures Program, University of California Davis Institute of Transportation Studies

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California has been a leader in reducing greenhouse gas (GHG) emissions, and the Low Carbon Fuel Standard (LCFS) is a critical element of California's policy portfolio to reduce GHG emissions from transportation sector. The LCFS sets a declining target for the life-cycle carbon intensity (CI) of transportation fuels. Fuels with lower CIs than the target generate credits while fuels with higher CIs generate deficits. Entities that distribute fuels are obligated to either reduce the CI of their fuel to meet the target or acquire enough credits to offset their deficits each year. The sale of credits creates a market with an LCFS credit price that varies over time. In recent years, the credit price has dropped due to rapid growth in alternative fuel deployment, the effects of the COVID-19 pandemic, and other factors. The California Air Resources Board (CARB) administers the program and has announced its intent to conduct a rulemaking to strengthen the 2030 program target. Their goal will be to increase demand for credits and support continued investment in low-carbon fuel technologies. Maintaining a balance between credit supply and demand helps keep a stable LCFS credit price, so that the LCFS can incentivize low-carbon fuels as intended and reduce GHG emissions.

In this study, the Fuel Portfolio Scenario Model (FPSM) was developed to assess the feasibility of different reduction targets and program designs for 2030 under various scenarios. The FPSM develops fuel portfolio scenarios based on the historical LCFS data, projections of future fuel availability, and forecasted demand for various types of transportation fuel generated by the Transportation Transitions Model (TTM). Fuel demand forecasts include the impact of recent Zero-Emission Vehicle (ZEV) rules, including Advanced Clean Cars II, Advanced Clean Trucks, and Advanced Clean Fleets. FPSM assembles these forecasts into scenarios using transparent, user-provided assumptions and assesses LCFS credit and deficit generation. Using the FPSM, this study presents the results from several scenarios related to topics relevant to the 2023 rulemaking for the LCFS.

This study mainly focuses on two fuel demand scenarios that differ, primarily, in the amount of gasoline demanded. A range of proposed reduction targets are considered. They center around options discussed by CARB during pre-rulemaking workshops, and also include targets proposed by stakeholders during the public comment process prior to the rulemaking. These include 2030 reduction targets of 25%, 27.5%, 30%, 32.5%, 35%, 37% and 40%, as well as several schedules for achieving these targets.

FPSM results indicate that a 30% LCFS target in 2030 is likely to be feasible under both higher and lower gasoline demand scenarios. Targets 25% or below are highly unlikely to bring the credit market into balance. Targets above 35% may be achievable, however, they would require ethanol to reduce CI significantly faster than historical rates, in addition to growth of bio-based diesel substitutes to total volumes that may cause significant negative sustainability or land use change impacts. In addition, targets around 30% are typically projected to have a bank of credits remaining in 2030, that can protect against market fluctuations or credit shortfall; higher 2030 targets typically imply smaller reserves and higher post-2030 deficit generation.

By 2030, electric vehicles (EVs) will generate more than half of total credits in the LCFS system, over 75% of which will come from light-duty EVs. By 2035, all new vehicles sold in California will be ZEVs. As ZEV sales fractions approach 100% leading up to this date, the LCFS reduction target must rise rapidly to keep pace with the increasing supply of EV credits.

The LCFS sets year-by-year targets used for compliance, which means that different trajectories are available for the same reduction target in future years. The impacts of different target reduction schedules were analyzed using the FPSM. For identical 30% targets for 2030, a more rapid increase of the reduction target in the early-2020s leads to fewer surplus credits through the mid-2020s and a faster depletion of the credit bank. The suggested trajectory proposed by CARB prior to the initiation of the formal rulemaking calls for a 5% target increase in 2025. This so-called “step down” is feasible but may significantly reduce the size of the accumulated credit bank. While this can help support a stronger LCFS credit price, it can also reduce the flexibility of regulators to adopt more ambitious targets post-2030.

This work demonstrates the capacity of FPSM to provide rapid, flexible scenario analysis to support LCFS policy design. Such analysis helps inform policy makers by testing a variety of target trajectories and/or policy provisions. While CARB’s 2023 rulemaking is expected to address and resolve critical issues related to long-term credit balance, the treatment of renewable natural gas under the LCFS, provision of capacity credits for medium and heavy-duty ZEVs, and the adoption of a target auto-acceleration mechanism, many other issues raised by recent research remain to be addressed. FPSM can be part of the toolkit that helps sustain the LCFS track record of successful policy.

Contents

Introduction

California has been a global leader in climate policy, having adopted a broad portfolio of programs to reduce emissions from many economic sectors. Transportation is a particularly challenging sector to address. The production and consumption of transportation fuels accounts for over half of California's total greenhouse gas (GHG) footprint, and transportation affects almost every facet of the economy and people's lives. Successfully reducing GHG emissions from transportation will be critical to California meeting its statutory GHG reduction targets, including a 40% decline in GHGs compared to a 1990 base year by 2030, and an 85% reduction of emissions as part of achieving overall carbon neutrality by 2045 (1,2). To meet this challenge, California has adopted many policies for decarbonizing the transportation sector by shifting from fossil fuels to low-carbon or carbon-neutral fuels and vehicle technologies.

The Low Carbon Fuel Standard (LCFS) is a critical element of California's policy portfolio, and it has been a model for similar fuel programs in other jurisdictions. To date, British Columbia, Oregon, Washington, Brazil, and the Canadian federal government have adopted similar clean fuel programs. The goal of the LCFS is to reduce carbon emissions from the transportation sector by regulating full life-cycle carbon intensity (CI) of transportation fuels, regardless of their form. To create certainty in the market and move toward decarbonization over many years, the target for the average CI of all transportation fuels declines over time. Transportation fuels which have lower CIs than the target generate credits fuels while higher-CI fuels than the CI standards generate deficits. Credits and deficits are measured in metric tons (tonnes) of carbon dioxide equivalent (CO_2e) using 100-year Global Warming Potential (GWP) equivalencies. They essentially reflect GHG reductions (for credits) or emissions (for deficits) that occur above or below that year's targets.

At the end of every compliance year, any fuel distributor holding deficits must obtain an equivalent number of credits to show that they have ultimately complied with the target. The targets require greater reductions in CI each year, which applies continually increasing pressure to reduce GHG emissions within the transportation system. High-carbon fuel producers therefore are incentivized to either reduce the CIs of their fuels. They can accomplish this by improving production efficiency, blending high CI fuels with low-carbon components, or buying credits from low-carbon fuel producers. This purchase of credits provides revenue for low-carbon fuel producers and creates an incentive for high-carbon fuel producers to ensure that low-carbon fuels enter the market. Fuel policies must balance support for fuels, such as crop-based biofuels, that have entered the market at scale but yield only modest GHG benefits against fuels that yield deeper GHG benefits but are further from commercial adoption, such as cellulosic fuels or renewable electricity. The LCFS accomplishes this by incentivizing the actual amount of emission reductions, ensuring that the lowest-carbon fuels receive the highest level of support.

The California Air Resources Board (CARB) is the regulator in charge of the LCFS. CARB regularly reviews and updates the LCFS reduction targets and issues detailed regulations to reflect up-to-date circumstances and the state-of-the-science. CARB has announced its intent to conduct a rulemaking in late 2023, with the purpose of increasing the 2030 program target. Intended changes include adding an automatic adjustment mechanism, additional infrastructure capacity credits, and adjusting some provisions on the production of renewable natural gas (RNG). This rulemaking will help align the LCFS with the strategic vision for long-run climate policy articulated in the 2022 CARB scoping plan. This plan lays out a high-level overview of how California intends to meet its 2030 and 2045 GHG reduction targets (3).

The purpose of this study is to provide an analysis of impacts which may be caused by anticipated updates and changes in the LCFS, particularly the selection of a 2030 CARB program target level. It builds on work and modeling tools described in the *Driving California's Transportation Emissions to Zero by 2045* (*Driving to Zero*) report (4). *Driving to Zero* was issued by authors from across the four University of California Institutes of Transportation Studies. It describes how California's transportation system could achieve the state's carbon neutrality goal with in-depth examinations of changes needed in the vehicles, fuels, transportation behavior, and policy. The work presented in this report is a continuation of the research and modeling presented in Chapter 9 of *Driving to Zero*. It focuses on estimating transportation fuel portfolios through 2035, corresponding credits and deficits, and it allows the development and analysis of various scenarios depending on potential changes.

To provide the necessary quantitative analysis, this report presents the Fuel Portfolio Scenario Model (FPSM), a scenario analysis tool based on the models used in the *Driving to Zero*. The FPSM organizes and curates the creation of fuel supply scenarios, based on the historical LCFS data and projections of future availability of specific classes of fuel. The FPSM allows for LCFS credit and deficit generation to be quickly estimated for any portfolio of fuels, which facilitates rapid analysis of LCFS policy scenarios, such as the impacts of different targets on credit balance. We show results from several modeling scenarios related to topics likely to be addressed in the 2023 rulemaking for the LCFS, including the selection of a program target for 2030, and the impacts of different target auto-adjustment mechanisms.

Methodology

The FPSM builds on similar tools developed over the last decade. The first publicly available scenario model of its type was the *Illustrative Compliance Scenario Calculator* published by CARB in advance of the 2018 LCFS rulemaking (5). This was published as a tool to facilitate scenario analysis regarding 2030 LCFS targets, as well as to organize engagement with LCFS stakeholders. The basic structure of the model was adapted for use in work that was eventually published in the report *California's Clean Fuel Future*, with significant enhancements to its capacity for evaluating multiple fuel demand scenarios and a broader portfolio of credit-generating fuels (6). That core model structure was adapted for the work presented in *Driving to Zero*, with numerous improvements and a shift from VISION to the UC Davis Transportation Transitions Model (TTM) for underlying vehicle fleet and activity projections. The FPSM reflects the continued evolution of functionality from the *Driving to Zero* model with better capacity for rapid scenario analysis, an improved user interface, and numerous improvements to fuel supply projections.

The FPSM is built in Microsoft Excel spreadsheets. It incorporates results from the TTM and historical quarterly summary fuel data reported by CARB as inputs for transportation fuel consumption and demand as well as manual inputs from the users of the FPSM. Historical data from CARB are combined with TTM projections to create a trajectory of demand across seven categories of fuel including gasoline, liquid gasoline substitutes, diesel, liquid diesel substitutes, natural gas, electricity, and hydrogen through 2050. These fuel demand trajectories are assumed to be inelastic, except for limited substitution across certain categories. A notable case of substitution is that the model allows relatively easy switching between gasoline and liquid gasoline substitutes or diesel and liquid diesel substitutes.

The FPSM builds portfolios of fuels from type-specific projections of fuel availability to satisfy the fuel category projections. For each portfolio of fuels, this model calculates expected fuel consumptions, credit and deficit generation, and life-cycle emissions for different scenarios with relevant variables including technological improvements and potential policy updates.

The FPSM does not perform optimization or statistical simulation on its own, nor does it estimate fuel costs or LCFS credit prices or simulate market response to credit balance. It is designed to allow rapid scenario analysis with as much flexibility as possible by describing expected results when the variables change. The current version of the model includes historical LCFS data from 2017 to 2022.

Scenario Selection and Variables

The purpose of the FPSM is to allow users to easily develop and test scenarios under consistent user-defined sets of modeling assumptions. Producing an FPSM scenario requires user input of fuel demand, reduction target, and control parameters. Fuel demand parameters are yearly projections for the seven top-level fuel categories listed above, divided into light-duty vehicle (LDV) and medium- and heavy-duty vehicle (MHDV) segments. Reduction targets are presented as yearly LCFS average CI reduction targets, expressed as percentage reductions from the baseline year (2010 in the case of California's LCFS). Control parameters reflect a wide range of assumptions and model parameters, including average annual production growth, CI improvement, or market transition points.

Based on these selections, graphical figures of outcomes through either 2030 or 2050 are auto-generated for gasoline pool consumption, diesel pool consumption, CI reduction target, net credit balance and bank, and total credit. This enables the rapid analysis of compliance.[1] The FPSM also allows multiple fuel demand scenarios, reduction target trajectories, and control parameter schemes to be created and saved, supporting further analysis.

Fuel Demand Scenarios and the Transportation Transitions Model

If California is to meet its climate goals, including carbon neutrality by 2045, it will have to undergo a profound change in the vehicles and technologies its drivers use. The most impactful will be the transition from petroleum-fueled internal combustion engine (ICE) vehicles to zero-emission vehicles (ZEVs), particularly battery electric vehicles (BEVs, often abbreviated "EVs"). The vast majority of both LDV and MHDV fleets are anticipated to switch from ICE to ZEV in coming decades, driven by several key policies. These include:

- The Advanced Clean Cars II rule (ACC2) sets increasing targets for light-duty ZEV sales until 2035. After this, all new vehicles sold or registered in California must be ZEVs such as electric vehicles, hydrogen fuel cell vehicles (HFCVs), and plug-in hybrid electric vehicles (PHEVs), meeting specified targets for all-electric range to qualify.
- The Advanced Clean Trucks rule (ACT), sets increasing targets for ZEV sales in the medium- and heavy-duty sector and requires that, by 2035, 55% of class 2b, 75% of class 4-8 straight trucks, and 40% of class 7-8 tractor sales are ZEVs.
- The Advanced Clean Fleets rule (ACF) requires that certain fleets, especially larger ones, have an increasing fraction of their vehicles be ZEVs. Large fleets, drayage trucks, and specified other fleets are required to be 100% ZEV by the early 2040s at the latest.

The TTM models the transition to ZEVs by assuming that California attains, but does not significantly exceed, regulatory targets set by these policies. It estimates the effect of other policies like the cap-and-trade system, as well as incentives for ZEV purchase, mobility equity initiatives, tailpipe emissions standards, and the expected fuel price impacts of the LCFS on vehicle sales in order to project annual vehicle fleet composition.[2]

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[1] While FPSM generates projections out to 2050, uncertainty about critical technological and economic parameters increases significantly after around 2035. Results should be interpreted accordingly. For this report, which is intended to focus on FPSM's use as a tool for policy development, we primarily focus on results through 2035.

[2] Estimation of fuel price impacts by the LCFS is done exogenously via approximate estimation of LCFS credit prices and representative target trajectories. Ideally, the impacts of LCFS credit price would be endogenously considered in an integrated assessment of fuel and vehicle impacts, however this approach is outside the scope of this work.

Results of the TTM model outline a trajectory towards carbon-neutral transportation that complies with California's environmental, transportation, and climate policies.

The TTM simulates vehicle sales, retirement, and use based on economic and technical parameters. It is based on the Argonne National Laboratory's VISION model. In the TTM, vehicles are classified based on their weight classes. For each class, the TTM generates results for fuel demand projections until 2050 broken into several fuel categories: petroleum gasoline; liquid gasoline substitutes including ethanol and drop-in renewable gasoline; petroleum diesel; liquid diesel substitutes including biodiesel (BD) and renewable diesel (RD); compressed natural gas (CNG); liquefied natural gas (LNG); electricity; and hydrogen. LNG was, at one point, thought to be a promising transportation fuel but has largely been abandoned in favor of CNG. Thus, for the purpose of FPSM modeling, LNG is integrated into CNG category.

In this study, several scenarios for the California vehicle fleet and driving activity are generated with the TTM and used to set the fuel demand for the FPSM. This report focuses on three scenarios:

- The business-as-usual (BAU) scenario represents outcomes in which the policy portfolio prior to the adoption of ACC2, ACT, and ACF is fully implemented, but no additional policies are adopted. The BAU scenario cannot meet any of California's climate targets.
- The low carbon transition (LCT) scenario includes the adoption of ACC2, ACT, and ACF and assumes additional policies are adopted in the future to ensure that California's transportation system achieves carbon neutrality by 2045, which is defined as $<$ 5 million tonnes of CO_2e.
- The driving to zero (DtZ) scenario reflects projections used for modeling in the *Driving to Zero* report, specifically the ZEV scenario for LDVs and the LC1 scenario for MHDVs. This scenario assumes full rebound of driving to pre-COVID-19 levels and slightly lower deployment rate for ZEV, particularly for heavy-duty HFCVs. The DtZ scenario was included as a scenario of interest because it projects significantly higher gasoline demand. This offers a useful comparison to assess the sensitivity of the FPSM and the LCFS system to changes in gasoline demand.

The DtZ scenario reflects the TTM outputs used for modeling in the *Driving to Zero* scenario, which has a similar combination of policies as the LCT scenario. However, the DtZ scenario was developed before ACC2 and ACF had been fully described, and before the impacts of the COVID-19 were reflected in state fuel consumption data. Therefore, the differences between LCT and DtZ are: (1) updated modeling of some policies, and (2) improved representation of historical fuel consumption, notably integrating the effects of the COVID-19 pandemic.

Modeled updates to policies resulted in a modest increase in the number of EVs on the road compared to the scenarios used in the DtZ scenario, yet these changes resulted in small shifts in net fuel consumption. A much larger change was seen after updating fuel consumption to reflect the impact of COVID-19, which caused a massive reduction in driving demand and gasoline consumption in 2020 and 2021. There was a significant rebound of gasoline demand in 2022, as lockdowns and emergency public health provisions were discontinued, however current consumption has not returned to historical levels prior to COVID-19. Based on TTM modeling and extrapolation from historical trends, post-pandemic driving behavior appears to have reduced gasoline consumption by about 750 million gallons per year. It is unknown at this point whether this reduction is permanent due to persistent changes in driving habits, notably an increase in telework, or if gasoline consumption will continue rebounding toward the historical consumption trajectory. The LCT scenario implicitly assumes permanence by integrating this decline in demand into the new long-run fuel demand trajectory, while the DtZ scenario does not. This means that LCT and DtZ are essentially a low and high gasoline demand scenario, with comparatively minor differences otherwise.

The vehicle fleet and driving activity scenarios described in this report are based on updates made to the TTM after the publication of *Driving to Zero*. We updated fuel economy assumptions for several vehicle categories in the TTM for California (CA TTM) according to published sources. For LDVs, we refer to *Table 4.12* (Production and Production-Weighted Fuel Economies of New Domestic and Import Cars, Light Trucks and Light Vehicles, Model Years 1975-2021a) in *The 2021 EPA Automotive Trends Report* (7). We directly use United States (US) Environmental Protection Agency (EPA) estimates of fuel economy of gasoline vehicles from 2010 to 2020. For LDV fuel economy assumptions beyond 2020, we extrapolate recent trends assuming a 2.5 miles per gasoline gallon equivalent and a 1.25 miles per gasoline gallon equivalent increase every five years for cars and light trucks, respectively (Table 1). We then calculate fuel economy from 2020 to 2050 accordingly.

Table 1. Fuel economy assumptions (miles per gasoline gallon equivalent) for gasoline cars and light trucks from 2010 to 2050 for new vehicles.

Vehicle Type	2010	2015	2020	2025	2030	2035	2040	2045	2050
Car	25.7	28.2	30.7	33.2	35.7	38.2	40.7	43.2	45.7
Light Truck	18.8	21.1	22.4	23.6	24.9	26.1	27.4	28.6	29.9

For CNG medium-duty delivery trucks, we base assumptions on fuel economy data from the *Alternative Fuel Case Study: UPS Delivers with Alternative Fuels* from the Office of Energy Efficiency and Renewable Energy of the US Department of Energy (8). This study estimates the fuel economy of UPS delivery trucks to be 8.2 miles per gasoline gallon equivalent in 1999. This number is used directly in our new fuel economy assumption for CNG medium-duty delivery trucks. We still assume a 0.25 miles per gasoline gallon equivalent increase every five years, as in the previous version of the CA TTM. We then calculate the corresponding fuel economy from 2010 to 2050 (Table 2).

Table 2. Fuel economy assumptions (miles per gasoline gallon equivalent) for CNG medium-duty delivery trucks from 2010 to 2050.

Vehicle Type	2010	2015	2020	2025	2030	2035	2040	2045	2050
Medium-duty delivery truck	8.7	9.0	9.2	9.5	9.7	10.0	10.2	10.5	10.7

A final post-processing step was necessary to align the vehicle sub-categories in the TTM with conventions established in the LCFS. Vehicle classifications (e.g., LDV or MHDV) normally overlap with fuel categories because most MHDVs are currently fueled by diesel and LDVs are fueled by gasoline. This allows for the assumption that diesel pools are for MHDVs, and gasoline pools are for LDVs. However, there are some mismatches between the systems. For example, heavy-duty (HD) pickup trucks are classified as HDVs under the TTM, but they are classified as LDVs under the LCFS for the purpose of assigning energy economy ratios. Thus, to adjust the mismatches, the TTM results were post-processed to shift fuel demand of HD pickup trucks from the MHDV category to LDV.

The FPSM assembles portfolios of conventional and alternative fuels and then tests them for compliance with the LCFS under a variety of targets. Several reduction targets are of particular interest to the LCFS at present (Table 3). Under the current LCFS regulation, credits and deficits are calculated based on CI benchmarks for transportation fuels such as gasoline, diesel, and jet fuel and these benchmarks are required to be reduced either by 20% by 2030 (for gasoline and diesel) or as described in the rule (for jet fuel). The CI benchmarks for jet fuel were designed to be equal to the CI benchmarks for diesel after 2022 in the current rule, and thus the same approach was taken in this study. In addition, the current rule does not specify the targets after 2030, and thus the benchmarks will remain the same for all years after 2030 (represented as "20% C" in Table 3).

In pre-rulemaking workshops, CARB indicated particular interest in 25%, 30% and 35% reduction targets for 2030 to address the significant oversupply of credits in the market at-present. We also included 27.5% and 32.5% to evaluate the impact of intermediate steps between these points. Targets of 37% and 40% were evaluated to better understand system behavior and modeling assumptions required to support higher targets, as well as for comparison against other models in this space. For all target trajectories, year-by-year targets were chosen to align with an approximately linear increase in stringency through the mid-2020s, with slight increases in year-on-year target acceleration in later years. Following CARB's typical practice, we sought to have target increases in round increments no smaller than a quarter percentage point where possible. Finally, we tested an additional 30% target in which there is a greater increase in target stringency in early years (2025-2026) to examine the impact of target timing, which is presented as "*30% F*" in Table 3. All scenarios assume a 6% per year target increase after 2030, for consistency, post-2030 target dynamics are briefly discussed below but largely outside the scope of this study.

Table 3. Carbon intensity reduction target trajectories from 2023 to 2035. Each trajectory requires a certain reduction target by 2030 (20% C: Current target with 20% by 2030, 30% F: 30% by 2030 with front-loading in early years).

By 2030	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
20% C	11.25	12.50	13.75	15.00	16.25	17.50	18.75	20.00	20.00	20.00	20.00	20.00	20.00
25%	11.25	12.50	14.50	16.50	18.50	20.50	23.00	25.00	31.00	37.00	43.00	49.00	55.00
27.5%	11.25	12.50	15.00	17.50	20.00	22.50	25.00	27.50	33.50	39.50	45.50	51.50	57.50
30%	11.25	12.50	15.50	18.50	21.00	24.00	27.00	30.00	36.00	42.00	48.00	54.00	60.00
30% F	11.25	12.50	16.50	20.00	22.50	25.00	27.50	30.00	36.00	42.00	48.00	54.00	60.00
32.5%	11.25	12.50	16.00	19.00	23.00	26.00	29.00	32.50	38.50	44.50	50.50	56.50	62.50
35%	11.25	12.50	16.00	19.50	23.50	27.50	31.00	35.00	41.00	47.00	53.00	59.00	65.00
37%	11.25	12.50	16.50	20.50	24.50	28.50	32.50	37.00	43.00	49.00	55.00	61.00	67.00
40%	11.25	12.50	17.00	21.50	26.00	30.50	35.00	40.00	46.00	52.00	58.00	64.00	70.00

Control Parameters

As mentioned above, the FPSM is intended to allow users to create various control parameter schemes to reflect policy or technology scenarios of interest, save these, and easily return to them without requiring significant manual modification of model parameters. For this purpose, the control parameters can be adjusted and updated easily in the model. The variables for performing scenario analysis under the control parameters are classified into five categories: CI improvement rates, goals and growth rates, project and infrastructure credits, blend rates and fractions, and distillates capacity. Most of the relevant variables, except for the reduction target trajectories and the TTM results selection, can be modified under the control parameter scheme, and the users are allowed to select one of the default schemes or add their own variables for the analysis. For example, the CI improvement rate for fuel takes two parameters: year and rate. The model assumes that a CI of fuel remains the same until the specified year, and then declines by a fixed rate each year afterwards. If there is no value for the year, the CI value declines by the rate continually. This allows for CI projections from external sources to be used as the basis for CI estimates as far into the future as they are available, and simple annual decreases at a user-specified rate take over thereafter.

The variables for goals and growth rates by fuel type deal with specific consumption goals, required plans, and growth rates for each fuel category. The fuels under control are electricity, liquid gasoline substitutes, sustainable aviation fuel (SAF), and natural gas (NG). This allows users to create scenarios in which the state meets specified milestones for the introduction of specified amounts of fuels or grid decarbonization targets.

- Electricity: Light-duty electric vehicle, heavy-duty electric vehicle, and electric forklift (e-forklift) credits can be phased out linearly over the duration year starting from the adjustment plan start year. This was added to reflect the potential distortionary effect that these vehicle classes can have on the LCFS market by receiving policy incentives after they have reached technological and market maturity. For the scenarios described in this report, neither category was phased out. Decarbonization of the electricity grid in California can also be modeled here. It is important to decrease the CI of electricity, because electrification of LDVs and MHDVs is one of the major plans for California to decarbonize the transportation sector. Currently, it is required to achieve 100% of retail electricity to be supplied with renewable and zero-carbon sources by 2045 under SB100 (9). This goal can be modified by changing the target year. In addition, the years when the renewable energy fraction of residential and non-residential charging reaches to 99% can also be adjusted here. The growth rates of offroad vehicles such as e-forklift, fixed guideway, electric power for ocean-going vessels (eOGV), electric cargo handling equipment (eCHE), and electric transport refrigeration units (eTRU) can be modified as well.
- Liquid gasoline substitutes: Specific consumption goals and growth rates for drop-in renewable gasoline and cellulosic ethanol can be modeled in this section. Drop-in renewable gasoline is not in the market yet and in the early stage of development, so the model is designed to take two goals as inputs so that it allows to express two different growth rates for the earlier and later stages. This is not intended to indicate a projection that such fuels will enter the market. Rather, it recognizes that without the provision of a low-carbon liquid gasoline substitute at significant volume by 2040, it will be extremely difficult for California's transportation system to achieve carbon neutrality. The model takes

year values and consumptions as inputs for the goals, and the growth rate for drop-in renewable gasoline is allowed to change after the second goal year. For cellulosic ethanol, a goal can be set by changing the year and target consumption, and the growth rate after the target year can be varied depending on scenarios.

- Distillates: In the FPSM, the CIs of RD, BD and SAF were estimated by feedstock availability. To estimate potential feedstock availability in the future, a certain growth rate for each feedstock was assumed with allowing adjustments. Detailed calculation methodology is described in the "FPSM Calculations" section, below. In addition, the goal for SAF by 2030 and growth rates of aviation demand before and after 2035 can be modeled here.
- NG: Fossil natural gas has rapidly been displaced from the CA LCFS by lower-carbon RNG, accounting for around 3% of total NG in 2022; this displacement is assumed to be complete in future years. Potential RNG supply in this model is based on a national RNG supply assessment (10). This source presents the potentials of RNG in two cases, low resource case and high resource case, and this model allows users to select a low, high, or average case (average case is derived from the low and high cases). The projected RNG resources are presented at the US national level, and California's share is assumed to be limited to a GDP-weighted share of that production. In general, the low availability case is used for the FPSM projections because it better aligns with historical RNG consumption in the LCFS. This section also allows users to model the schedule of phasing out the negative CI, or avoided methane credit, of livestock digester RNG. The model assumes that RNG demand will be satisfied in ascending merit order based on CIs. This approximately aligns with historical RNG consumption trends, in which livestock digester RNG, the lowest-CI available, entered the market after landfill RNG, municipal solid waste (MSW) digester RNG, and wastewater treatment RNG but rapidly grew to a dominant share of the market.

The variables in the project and infrastructure credits section include a refinery investment credit cap, a renewable hydrogen refinery credit cap and goal, an innovative crude credit goal, and infrastructure caps and goals for hydrogen refueling infrastructure (HRI) and direct current (DC) fast charging infrastructure (FCI). Although caps and years are specified in the regulation, these variables can be changed to test different regulatory schemes. In general, credits from these pathways are treated exogenously, by assuming linear growth to a user-specified target level and year.

Fuel blend rates and fractions can also be adjusted here. Blend rates of BD to total diesel and substitutes, 6% initially, and ethanol to total gasoline, 11% initially, were modeled in the same way. They take year values as when the initial rates will be used by, and new blend rates after the year are also modeled. The default blend rate for ethanol to gasoline was set as 11% through 2030 and 16% thereafter. This represents the 10% or 15% "blend wall" put in place by regulatory restrictions preventing higher blends, plus an additional one percentage point to reflect the use of E85 (85% ethanol blend) or higher blends. This assumption is based on historic LCFS data. The default ratio of sugar ethanol to total ethanol was set as 8% based on historical data from 2017 to 2021. However, depending on the feedstock availability and market conditions, the ratio can fluctuate. Thus, the ratio can be adjusted for different scenarios. Naphtha and renewable propane are generated as co-products of hydrotreated RD and SAF production and can themselves generate credits under the LCFS. FPSM assumes that the amount of these coproducts generated by production of fuels that are ultimately used in California will also be used in California and credited under the LCFS. We assume the coproduct production rate for naphtha and renewable propane relative to RD and SAF production are set as 5% and 4% by volume, respectively. The generation, use, and credit generation of process coproducts like these are subject to significant uncertainty. Future work is recommended to improve projections in this area.

The likely growth of lipid-based fuel production capacity in North America is sufficient to displace virtually all of California's petroleum diesel consumption by 2030, however sustainability constraints and inter-state competition for that supply mean that not all capacity is likely to be directed to California. Modeling these constraints and competitive dynamics is outside the scope of this work. To approximate these effects, the distillates cap was set at a default level of 1,750 million diesel gallon equivalents, consistent with previous CARB modeling. The maximum annual distillates capacity and growth rate can be adjusted here, and detailed calculation methodology will be described in the "FPSM Calculations" section, below.

Table 4 shows the parameters used in this study. While users can modify and adjust for their own alternative scenarios, the default values for this study were mainly adopted from the previous studies or other literature. The NA values mean that the parameters were not reflected in the scenarios as a default.

Table 4. Parameters used in the modeling and the default values. (LD EV: Light-duty electric vehicle, HD EV: Heavy-duty electric vehicle, eOGV: Electric ocean-going vessel, eCHE: Electric cargo handling equipment, eTRU: electric transport refrigeration unit, HRI: Hydrogen refueling infrastructure, FCI: Fast charging infrastructure).

Parameters	Unit	Value
Carbon intensity (CI) improvement rate		
Starch ethanol	%	2.0%
Sugar ethanol	%	4.0%
Cellulosic ethanol (post-2030)	%	4.0%
Biodiesel (BD) (post-2030)	%	0.0%
Renewable diesel (RD) (post-2030)	%	0.0%
Sustainable aviation fuel (SAF) (post-2030)	%	0.0%
Initial carbon intensity of renewable gasoline	g CO2e/MJ	35.0
Renewable gasoline (post-2025)	%	3.0%
Renewable naphtha (post-2025)	%	3.0%
Hydrogen (post-2030)	%	6.0%
Renewable natural gas (RNG) (post-2030)	%	4.0%

Parameters	Unit	Value
Goals and growth rates by fuel type		
Electricity		
LD EV credit adjustment plan - start	year	NA
LD EV credit adjustment plan - duration	years	NA
HD EV credit adjustment plan - start	year	NA
HD EV credit adjustment plan - duration	years	NA
Achieving zero-carbon electricity grid by	year	2045
Low-CI or smart charging of residential reaches 99% by	year	2040
Low-CI of non-residential reaches 99% by	year	2035
e-Forklift credits phase out - starting year	year	NA
e-Forklift credits phase out - duration	years	0
e-Forklifts growth rate	%	3.0%
Fixed guideway (before 2030)	%	1.0%
Fixed guideway (after 2030)	%	3.0%
eOGV / eCHE / eTRU	%	3.0%
Liquid Gasoline Substitutes		
Renewable gasoline cap goal 1 - year	year	2030
Renewable gasoline cap goal 1 - volume	mm GGE	200
Renewable gasoline cap goal 2 - year	year	2040
Renewable gasoline cap goal 2 - volume	mm GGE	1,000
Renewable gasoline growth rate after 2nd goal year	%	0.0%
Cellulosic Ethanol goal by 2030	mm gal	300
Cellulosic Ethanol volume growth rate (post-2030)	%	5.0%
Distillates		
Growth rate of each feedstock availability	%	1%
Off-road adjustment for diesel pool consumption		5%
Off-road adjustment phasing out start year		2035
SAF goal in California by 2030	mm GGE	540
Aviation demand growth rate (before 2035)	%	2.5%
Aviation demand growth rate (after 2035)	%	0.9%
Average fleet-wide fuel economy increase rate for aviation	%	1.4%

Parameters	Unit	Value
Natural gas		
RNG potential selection		Low
Livestock digester credit phase out - start		2035
Livestock digester credit phase out - end		2040
Project and Infrastructure Credits		
Refinery investment credit cap (% of prior year deficits)	%	2.5%
Renewable hydrogen refinery credit goal by 2030	MMT	NA
Renewable hydrogen refinery credit cap (% of prior year deficits)	%	2.5%
Infrastructure cap for FCI and HRI (% of prior year deficits)	%	2.5%
Last year for FCI and HRI	year	2025
FCI crediting years	years	5
HRI crediting years	years	15
Innovative crude credit goal by 2030	MMT	NA
Blend rate and fraction		
Keep current biodiesel blend rate (6 vol%) by	year	2050
Biodiesel blend rate after 2050	%	6.0%
Keep current Ethanol blend rate (11 vol%) by	year	2030
Ethanol blend rate after 2030	%	16.0%
Ratio of sugar ethanol and sugar ethanol plus starch ethanol	Vol %	8.0%
Naphtha fraction of RD	Vol %	5.0%
Renewable propane fraction of RD	Vol %	4.0%
Distillates capacity		
Annual maximum distillates capacity for lipid-based fuel	mm DGE	1,750

FPSM Calculations

The purpose of the primary inputs - demand scenarios, reduction target trajectories, and control parameter schemes - are to establish a set of assumptions and constraints to guide the primary calculations in the FPSM. Based on the inputs and fuel supply data taken from literature, the FPSM assembles a portfolio of fuels to meet the aggregate fuel demand under conditions defined by the control scheme. The life cycle emissions impacts are then subjected to credit and deficit assessment, as they would be under the LCFS, to determine the number of credits and deficits generated by each pathway in each year. If a year ends with a net excess of credits, they are banked for future years. If the year ends with a deficit, the bank is drawn on to cover the deficit. The FPSM does not attempt to simulate market response (e.g., investment or fuel production decisions), in response to market conditions, nor does it simulate existing cost-containment mechanisms in the event of persistent credit deficits. Its focus is to highlight anticipated credit market balance under a variety of scenarios.

CARB Summary Preprocessing

Historical (years through 2022) LCFS data for credits, deficits, and fuel volume are directly obtained from the quarterly summary report published by CARB (11). Where data were available on a quarterly basis, they were aggregated to annual values and combined with annual data from CARB to populate historical portions of the model. the cumulative bank, and cumulative buffer account are values from the fourth quarter of each year, and the volume-weighted averages of the quarterly reported CIs were used as the average CIs of each year. If new quarterly summary data are added, FPSM will automatically update the historical data used as a reference point for the following calculations for each fuel. These historical LCFS data were used to establish a historical baseline and validate internal calculations of credit and deficit balances. For years after historical data, the results from TTM projections were used as a baseline for further calculations. In addition, TTM results were also used to estimate values for each vehicle category in detail, such as a separation between LDVs and HDVs, which was not available under the historical LCFS data.

Some fuel categories projected in the FPSM did not have corresponding entries in the historical LCFS data, thus some historical baselines had to be calculated or inferred. For example, incremental electricity consumption—electricity that generates additional “incremental” credits using the LCFS Low-Carbon or Smart Charging pathways—was calculated in the FPSM using electricity consumption from historical LCFS data. In addition, some feedstock categories in the historical data were merged into one category in the FPSM, as a conservative estimate of CI impacts and growth potential. Sources of RNG were consolidated into three CI bins: livestock digesters (lowest, often negative CI), landfill gas (highest CI), and all other categories. These included wastewater sludge digesters, anaerobic municipal solid waste (MSW) digesters, and wastewater treatment plants according to the similar CI scores for fuels in these pathways. Each fuel type in the FPSM aggregates all fuel production from pathways in that category, so the FPSM projects a single trajectory for volume and CI growth for all corn ethanol, or all soybean-based RD and does not attempt to simulate varying CI scores from specific producers.

Gasoline and Liquid Gasoline Substitutes

In the TTM results, all liquid gasoline substitutes are aggregated into a single category following the label from early versions of the VISION model. In practice, the FPSM considered two liquid gasoline substitutes: ethanol and drop-in renewable gasoline. Thus, instead of having four categories as shown in the TTM results (LDV gasoline, LDV ethanol, HDV gasoline, and HDV ethanol), the FPSM primarily focused on three categories (gasoline, ethanol, and drop-in renewable gasoline substitutes). These were further subdivided into three sub-categories for ethanol depending on the feedstocks (cellulosic biomass, starch, and sugar), and two for drop-in liquid gasoline substitutes (naphtha and all other liquid drop-in renewable gasoline substitutes).

Naphtha is a low-value coproduct of hydrotreating lipids for producing SAF and RD. It has been approved by CARB with several pathways. However, comparatively few credits have been issued for these pathways given the volumes of RD and SAF—and therefore the potential volumes of coproduct naphtha—that have been credited under the LCFS. Thus, when merging historical LCFS data with TTM results, renewable naphtha in the historical data was considered as the only naphtha for historical years, and coproduct naphtha which was calculated from RD and SAF production was considered only thereafter.

At the time of writing, there is no current drop-in renewable gasoline pathway approved under the LCFS, though several candidates are at pre-commercial stages of development. Predicting which technology or production process may be approved as an eligible fuel pathway and how much will be produced are outside the scope of this study. Thus, this study calculates available potential of drop-in renewable gasoline based on the goal and growth rate from the control scheme and assumes that the difference between required drop-in renewable gasoline and available renewable gasoline must be met by an additional amount of petroleum gasoline. Several technologies, including cellulosic biofuels, synthetic fuels produced using renewable electricity (e-fuels), or algal fuels may be able to satisfy this demand. To some extent, the projected amount of drop-in renewable gasoline serves as an indicator of need and a target for future policy. The CI of renewable naphtha was estimated from the historical data and was assumed to decrease as described in the control scheme. In addition, as there is no current drop-in renewable gasoline, the CI of renewable gasoline was assumed to be the same as CI for renewable naphtha.

The calculation gasoline and gasoline substitute volumes begins with the gasoline consumption either from the historical LCFS data or the TTM results. The FPSM assumes that the amount of ethanol makes up a fixed fraction of total liquid gasoline and gasoline substitutes consumption, which is at 11% by volume in the near term, reflecting ubiquitous E10 (10% ethanol blend) plus other higher ethanol blends like E85 to account for one extra percentage point. Ethanol use optionally increases in future years in scenarios that assume a relaxation of the blend wall or growth in consumption of high-alcohol blends (e.g., E85). Drop-in renewable gasoline is assumed to be blended with ethanol at the same ratio as conventional petroleum gasoline. Higher ethanol blend rates or a greater diversity of ethanol blends can be simulated by adjusting the average blend rate to reflect desired levels. Past consumption of renewable naphtha is taken from historical data and projected as a modeled fraction of SAF and RD production. The TTM projections of gasoline substitutes were satisfied in four steps: (1) by ethanol blended into total liquids at the volumetric rate, (2) by the amount of renewable naphtha coproduct available, (3) by drop-in gasoline substitute up to the user-specified limit of such fuels, and (4) any remaining residual was assumed to be met by additional petroleum gasoline. This means, under some circumstances, the consumption of petroleum gasoline in the FPSM may be higher than the TTM results. This is because the VISION-based structure of TTM did not consider cost, regulatory, or sustainability constraints when projecting alternative fuel consumption. The FPSM therefore adjusted these projections downward by the method described above when necessary.

Once the total volume of each fuel was determined, the ethanol was categorized based on the feedstocks available in California: starch, sugar, and cellulosic biomass. Corn ethanol, sorghum ethanol, and wheat ethanol shown in the historical LCFS data were classified as starch ethanol. These sources have supplied most of the ethanol consumed in California. Sugarcane and molasses ethanol were classified as sugar ethanol, and fiber ethanol was classified as cellulosic ethanol. When assigning total ethanol to these categories, the model first assigned cellulosic ethanol and then separated remaining groups into starch and sugar ethanol. Compared to starch and sugar ethanol, which have been in the market for a longer time, cellulosic ethanol has recently emerged and contains higher uncertainty in its CI value and available technologies. Thus, the model estimated the cellulosic ethanol volume based on the goal and growth rate from the control schemes, and the remaining volume was separated into starch and sugar ethanol based on the historical fraction or as shown in the control scheme. It is important to track ethanol by different feedstocks because they have different CIs. The CI may vary depending on the processing technology even with the same feedstock, but the FPSM only considers an average CI for each feedstock category. There are four ethanol CI values calculated in this study: starch, sugar, cellulosic, and volume-weighted average-of-all. Historical ethanol CIs for total ethanol were directly obtained from historical LCFS data, and the historical CI of each type of ethanol was calculated from the reported volume and credits. For years subsequent to historical data, CI trajectories for all three categories of ethanol were projected using the user-specified rate of CI improvement. Although there may be a distortion due to differences in individual fuel pathways, it was confirmed that the historical CI and the calculated CI from the three categories of ethanol are not significantly different from each other, varying less than 0.5%. Emissions and LCFS credits were calculated based on these assigned volumes and CIs of three categories of ethanol.

Diesel, Liquid Diesel Substitutes, and Aviation Fuel with Distillate Constraint

Non-fossil lipid-based fuels, such as BD and RD, have emerged as scalable and commercially viable alternatives for petroleum diesel. They have already contributed significantly to reduce GHG emissions and other air pollutants from diesel vehicles. In addition to BD and RD, demand for SAF from hydrotreated lipids has also been increasing. This is helping to decarbonize the aviation sector. These fuels are eligible for LCFS credit generation as opt-in fuels. Although current BD, RD, and SAF production pathways are not carbon-neutral over their full life cycle, they can still reduce overall GHG emissions compared to petroleum diesel or jet fuel.

Lipid-based fuels present significant concerns, most importantly indirect land use change (ILUC) impacts. ILUC impacts can be caused by increased demand for an agricultural commodity, such as the feedstocks for biofuels. Impacts stem from the conversion of natural land to cultivated land, which releases carbon due to the loss of biomass and solid organic carbon in the soil. ILUC risk is strongly associated with crop-based feedstocks, though cross-oil substitution by many industrial consumers of vegetable oil means that ILUC impacts caused by waste feedstocks, such as used cooking oil, are not completely zero. To address these ILUC impacts under the LCFS, a predetermined ILUC factor is assigned to a fuel which is derived from a feedstock associated with the ILUC. Quantifying ILUC impacts involves the consideration of a variety of economic, agronomic, social, and ecological factors. The science on this topic is not yet settled due to major uncertainties. A recent article evaluating ILUC impacts of corn ethanol production supported by the US Renewable Fuel Standard was met with multiple critical response letters from academic researchers, and a recent National Academies expert workgroup that was convened to review life cycle assessment (LCA) methods relating to biofuels could not produce a definitive recommendation on modeling methodology. Instead, they highlighted the complexities of the field and need for future research (12–19). Existing ILUC models often lack reliable and sufficient calibration data about international commodity markets as well as grower preferences and, even if such data were available, they would have been collected prior to the rapid expansion of lipid-based renewable fuel production or the anticipated impacts of climate change on grower decision-making. Taken together, these factors explain the very high uncertainty in ILUC modeling. Resolving this uncertainty and fully modeling ILUC impacts are beyond the scope of this study. Instead, this study followed the approach used in previous studies (5,6).

In this study, the maximum capacity of lipid-based fuel production was limited to a level unlikely to cause any serious ILUC impacts (20,21). The baseline for this value was set at 1,750 million diesel gallons equivalents per year for all lipid-based fuels (BD, RD and SAF). This can be adjusted in the control scheme if needed. This approach generally aligns with concepts for a cap on crop-based feedstocks currently under consideration by CARB for adoption into the LCFS. This maximum capacity was determined based on results from other studies and was not calculated from a solid market or resource availability, so this value can be adjusted and updated along with the future research. The FPSM allows users to adjust the maximum capacity and its growth rate easily. This calculation only applies to future years when the historical data are not available. In the FPSM, similar to gasoline and liquid substitutes, diesel and liquid substitutes for LDVs and HDVs are not distinguished as in the TTM results. Thus, the FPSM contains four categories shown in the historical data including conventional diesel, BD, RD and SAF.

With the maximum capacity set for BD, RD and SAF as the upper limit, the model allocates the available supply of lipid feedstock to the fuels, in the order of SAF, BD, and RD. While the actual supply capacity or demand of each fuel may be interactive with each other, the FPSM assumes that the demands are met in this order. Their interactions in terms of resource availability, markets, or environmental benefits may be discussed in future research. Compared to the ground transportation sector, the aviation sector has less feasible alternatives to liquid jet fuel, so the demand for SAF was assumed to be satisfied first. Estimated demand for SAF by 2030 can be specified by the user and, for the scenarios described in this study, it was estimated based on forthcoming modeling work done by UC Berkeley and UC Davis researchers (including the authors of this report) under the Resilient and Innovative Mobility Initiative (RIMI) (22,23). At present, California has no explicit requirements for specific volumes of SAF to be consumed. However, with the presence of the LCFS opt-in, an informal target of 20% SAF consumption by 2030, and a recently-authorized Federal SAF tax credit, this was judged to be a reasonable target for 2030 consumption. The overall cap on total lipid-based fuels means that setting a higher or lower assumption for 2030 SAF consumption would yield a commensurate decrease or increase in BD and RD consumption. This would impact credit and deficit balances under the LCFS because SAF is an opt-in fuel while BD and RD are not. Aggregate carbon intensity of lipid-based fuels would also reflect the slightly higher hydrogen consumption for hydrotreated SAF production compared to RD. However, aggregate life cycle emissions across California's fuel pool are not strongly sensitive to SAF volume assumptions. Post-2030 demand or consumption of SAF was projected using user-specified travel demand growth assumptions and aircraft fuel economy improvement rates, carried over from the *Driving to Zero* study (4). Future work by this research team will more deeply evaluate impacts of SAF consumption levels and different policy designs.

Once the SAF demand was satisfied, BD and RD volumes were projected using a similar approach as for the gasoline and liquid substitutes. This parallels TTM results, wherein all diesel liquid substitutes are aggregated. The amount of BD was calculated first from the total diesel pool, and any remaining capacity for lipid-based fuels enters the market as RD. Any remaining diesel demand is then met with petroleum diesel. Similar to the case of gasoline and liquid substitutes, the calculation starts from the total diesel pool consumption for HDVs and LDVs from the TTM results. The FPSM first estimates BD volumes as a fraction of total liquid diesel demand, using the user-specified blend rate. Because BD is normally blended with conventional diesel while RD completely replaces conventional diesel, it was assumed that BD is blended with conventional diesel or RD at the specified blend rate. The BD blend rate and its projection can be modified as desired, and the default blend rate was set as 6% considering the typical blend rate at 5% and the additional 1% enters the market from the higher blends like B20 (20% BD blend).

After calculating total consumption, BD and RD were adjusted to account for the gap between the TTM results and historical data. TTM only accounts for on-road uses of fuel, while the LCFS also covers non-road uses. To adjust the difference, the total values of diesel, BD and RD, which were based on TTM results, were increased by 5% until 2035. After this time, the additional fuel consumption for off-road uses was decreased by 1% annually to 0%. The 5% rate was determined based on the average off-road portion of the diesel pool consumption, and it was phased out to 0% considering the transition of off-road equipment fuels from fossil fuel to electricity or hydrogen. This schedule can be modified by users within the control parameter schemes.

Similar to the ethanol from different feedstocks, BD, RD and SAF from different feedstocks have different CIs. Under the LCFS, BD includes canola, corn oil, soy oil, tallow, used cooking oil (UCO) and others as feedstocks, and RD includes corn oil, UCO, tallow, soy oil and other sources as feedstocks. The FPSM used these historical data to estimate the potential availability and CI of each type of fuel, and it was assumed that feedstocks were consumed in order ascending CI values. Future potential availability was calculated based on the growth rate modeled in the control scheme except for soy oil, which has the highest CI values for both BD and RD. The potential availability of soy oil was set without any limitation, so that soy oil could be used to make up for any shortage from other feedstocks, up to the total limit on lipid-based fuels. The CI values were calculated based on historical data. Improvement rates are described in the control scheme.

Using the break-down results and estimated CIs, the weighted average CIs of RD, BD, and SAF were calculated. While the average CI of BD was directly used to calculate the credits generated from BD, an additional step was added to calculate the CI value for RD and SAF. In contrast to BD, there is no clear benefit for a feedstock to be used for RD rather than SAF. Thus, instead of using each CI of RD or SAF, the FPSM used a weighted average CI of RD and SAF for credit calculation from RD and SAF. (Figure 1) It is important to note that actual CI of any given fuel will depend largely on the feedstock used to make the fuel. The FPSM essentially treats all lipid-based fuels as part of a single pool and does not attempt to project which feedstocks will go to SAF, RD, or BD. CI projections for any single lipid-based fuel category are, therefore, highly dependent on the order of operations used by the FPSM. The aggregate CI of all lipid-based fuels ultimately is a better indicator of real-world CI performance in this space than the CI of any single lipid-based fuel category. The amount of waste and residue oils grows more slowly than diesel demand so, in most scenarios, the CI of lipid-based fuels increases over time as higher-CI soy oil makes up an increasing fraction of total volumes. When diesel demand declines to the point where the total amount of lipid-based fuels is less than the cap, the FPSM assumes that fuels from soy oil are the first to exit the market, leading to a decline in CI in later years. Because of this trend, the carbon intensities of renewable diesel and biodiesel show increase-then-decrease behavior, which is more noticeable for renewable diesel due to larger volumes.

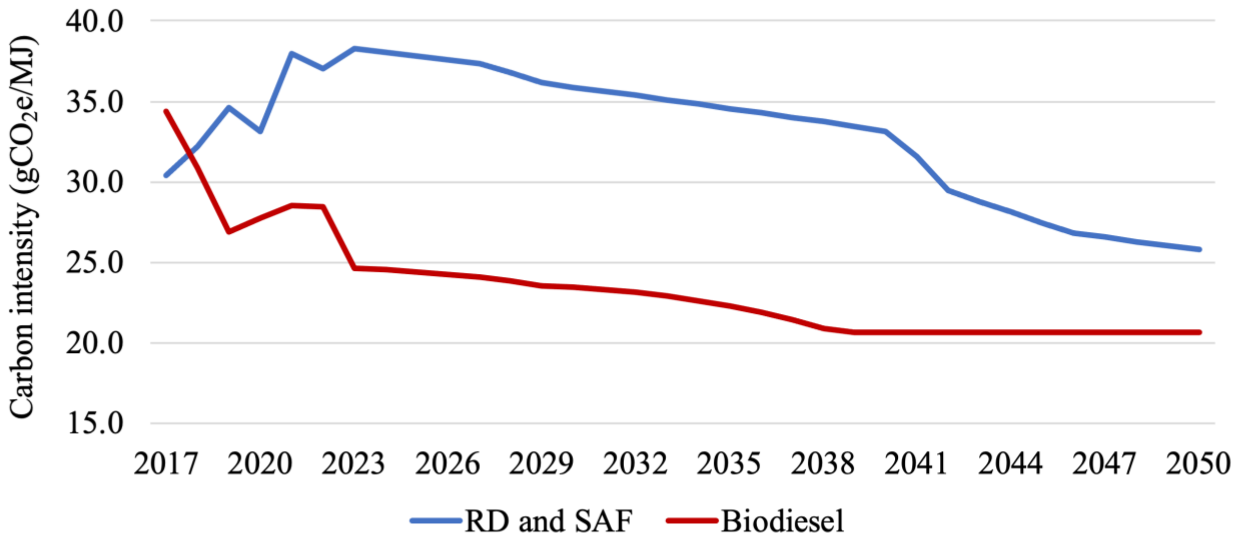


Figure 1. Carbon intensities of renewable diesel (RD), sustainable aviation fuel (SAF) and biodiesel over time (2017-2050). The rapid reduction in RD CI after 2041 is because that is the year in which all fossil diesel is displaced from California's fuel pool. Thus, reductions in liquid fuel demand after that point occur in the highest-CI feedstocks like soybean oil first, until crop-based oils are driven out of the system by the mid-2040s.

Natural Gas

Natural gas, including RNG, plays a small but important role in California's fuel portfolio. The TTM differentiates between compressed natural gas (CNG) and liquefied natural gas (LNG) for LDVs and HDVs, while the historical LCFS data subdivide natural gas fuels into bio-CNG, bio-LNG, fossil-CNG and fossil-LNG as the amount by source. Over the past five years, 90% of natural gas used as a transportation fuel in California has been in CNG vehicles, and this fraction continues to increase. Thus, the FPSM aggregated all NG use into a single CNG category. (11)

RNG dominates the total natural gas supply used under the LCFS due to the incentive offered for its lower CI compared to fossil natural gas (NG). The average CI of the natural gas pool is a function of the relative fraction of different feedstocks in the final mix.

To accurately estimate GHG emissions from natural gas, it is necessary to clarify the source or feedstock used in its production. Estimating this CI value starts from the estimates of potential RNG production by source, which is obtained from an ICF report which estimates the potential RNG in 2040 by source in the United States across high, medium, and low potential resource scenarios (10). California's potential supply of any category of resource was assumed to be limited to a population-weighted share of the national supply. The "Low" resource estimate from the ICF report best matches historical RNG consumption trends and is thus used as the default assumption on RNG resource availability. This may be underestimated potential supply to California because the state's LCFS typically offers the largest incentive for RNG, in both per-unit terms and when aggregated across the total market. Thus, the results for RNG in the FPSM may be viewed as a conservative (high) estimate of its CI. The FPSM allows users to select alternative supply scenarios from the ICF report, if desired. The four anaerobic digestion based RNG source categories in the ICF report were merged into three categories to match historical LCFS data (the gasification and power-to-gas pathways were judged to be too speculative to project significant volumes in the LCFS by 2030 and so excluded). Our model incorporates RNG source categories including dairy manure, municipal solid waste (MSW) and wastewater treatment plant (WWTP), and landfill.

Based on these estimated potential availabilities for 2040, the FPSM assumed a linear increase of supply until 2040 and then remains at those levels until 2050. Yearly volumes of natural gas consumption from the TTM projections were then satisfied in ascending order of CI, first livestock digester gas was used, then WWTP and MSW digester gas, and finally any remaining demand was met with landfill gas. A small and declining amount of fossil natural gas is still used in the LCFS, likely due to the presence of long-duration legacy contracts for some fleets, or similar business arrangements. The FPSM assumes the amount of fossil NG continues to decline over time. The ratio between RNG and fossil NG from this step was then used to separate RNG and fossil NG for LDVs and HDVs in the TTM results.

The ratio among RNG from different sources and fossil NG was also used to calculate average CI values for RNG and total NG, and the CI values were then used to calculate the credits generated from NG. While the CI values for landfill RNG and MSW/WWTP RNG were assumed to be improved by the rate designed in the control scheme, a different calculation was performed for dairy RNG due to the assumed expiration of avoided methane credits currently available to these pathways, due to anticipated future regulation (24). The CI value of dairy RNG was assumed to increase linearly according to the schedule set by the user. After the expiration eligibility for avoided methane credits – phased in between 2035 and 2040 - it was assumed to be the same as the CI of MSW/WWTP RNG.

Electricity

The TTM results contain two values for electricity: LDV and HDV. However, under the LCFS, there are several more types of credits generated from electricity as transportation fuel. The CARB differentiates between LDVs and MHDVs, as well as on-road and off-road uses, as each may have a different Energy Economy Ratio - EER - used for credit quantification. On-road types are further differentiated by charging location (residential or non-residential) and by grid electricity or low-CI electricity. Currently, EV charging credit generators either use the grid CI electricity or opt into "incremental crediting" programs using low-CI electricity procured from wind and solar generation or a smart charging program. To date, over 30% of total charging and 90% of non-residential charging take advantage of low-carbon incremental crediting provisions.[3]

Several assumptions were made for the FPSM to simplify the calculation. First, although there is electricity which has a lower CI value than the grid electricity but not necessarily zero, the FPSM assumed that all low-CI electricity is zero-CI electricity to simplify the model. Second, as assessed by CARB, the FPSM assumed that the CI of grid electricity will be zero in 2045 with a linear decrease from the current CI. Third, all residential EV charging was assumed to be for LDVs with categories for on-road electricity in the FPSM including residential grid electricity charging for LDVs, incremental credits from residential charging, non-residential grid and low-CI electricity charging for LDVs, and non-residential grid and low-CI charging for HDVs.

The calculation for electricity consumption is based on historical fractions and TTM results. As the consumption of electricity which generates incremental credits was not directly available from historical data, it was estimated based on other available data. In the historical data, it contains total electricity consumption as well as category-specific consumptions like grid-average CI, zero-CI, and other low-CI electricity. However, category-specific consumptions do not sum up to total electricity consumption, due to LCFS accounting and reporting methodology.

Use of incremental crediting, particularly for low-carbon electricity, has been growing since it was added to the program in 2018. The FPSM assumes this growth continues until almost all charging occurs using low-carbon electricity. Alternative assumptions about the relative prevalence of different charging categories can be modified by the user in the control scheme. The electricity consumption and relevant credits were then calculated based on the fractions and TTM results.

While the TTM only projects fuel consumption of on-road vehicles, the LCFS allows off-road vehicles or equipment, such as fixed guideways, electric ocean-going vessels (eOGV), electric transportation refrigeration unit (eTRU), electric forklift (e-Forklift) and electric cargo handling equipment (eCHE), to generate credits. Thus, the credits generated by electricity consumed in these types of vehicles or equipment were calculated based on historical data and user-specified assumptions. The FPSM assumes a linear increase of each category based on the assumed growth rates. Phasing out of credit generation can also be modeled as desired. The ratio of low CI or zero-CI electricity was assumed to increase linearly with a growth rate set by the user. E-forklifts are unusual compared to the other non-road EV pathways, due to the relatively high penetration of e-forklifts in the state fleet – thought to be over 50% at present though significant uncertainties remain in the fleet data. As a result, e-forklifts generate a large amount of LCFS credits despite their relatively small total fuel consumption.

[3] A third option, so-called "smart charging," varies electricity CI to reflect seasonal resource mixes across a 24-hour cycle. It seeks to incentivize charging at non-peak grid demand times. Given that the CIs for all times under these plans are greater than zero, and the relatively inexpensive options to procure renewable electricity that provides a zero CI, the smart charging options have gone comparatively unused. The FPSM scenarios presented here assume that this practice continues, and so the smart charging option is omitted from this report.

Others (Hydrogen and Projects)

Hydrogen currently plays a limited role in the transportation fuel pool. The TTM estimated that hydrogen will grow significantly in the future, particularly with an increasing demand for long-haul HDVs. In the FPSM, the projection from TTM results was used for hydrogen, and the CI values for hydrogen were modeled based on control parameters designed by the user.

In addition to credits from low-carbon transportation fuels, there is an opportunity for projects to generate credits under the LCFS. Capacity-based crediting projects include innovative crude oil, refinery investment credit, low complexity/low energy use refinery and renewable hydrogen refinery as well as hydrogen refueling infrastructure (HRI) and DC fast charging infrastructure (FCI).

Total credit generated from this sector is relatively lower than the credits from other transportation fuel pathways, so they were modeled based on linear growth from historical baselines to user-specified end targets. For example, the innovative crude credit and the renewable hydrogen refinery credit were designed to achieve goals by target years, and the refinery investment credit, HRI credit, and FCI credit were designed to be generated up to the maximum (determined by the percentage of prior year deficits) and then linearly decrease throughout the crediting years. The low complexity/low energy use refinery credit was assumed to be zero following the most recent historical data because there is no credit from this type of project after 2021. Default values for the scenarios presented in this report were carried over from *Driving to Zero* (4).

Results and Discussion

Compliance with LCFS was estimated by the FPSM based on the multiple fuel scenarios, model assumptions, and reduction targets. The temporal range FPSM nominally extends through 2050 but, due to the high sensitivity of model outputs to assumptions regarding ZEV deployment rate and the commercialization of novel technologies, uncertainty increases greatly over time, especially post-2035. As described in the methodology section, BAU, LCT and DtZ scenarios, were analyzed in the FPSM. However, BAU scenario results are not presented in this report because their relevance to near-term policy discussions is limited; they represent a world in which critical climate policies recently adopted by California—namely ACC2, ACT, and ACF—were not in effect.

Current Status in California and Demand Projections

Transportation in California still depends heavily on petroleum gasoline and diesel. Although the fraction of petroleum fuels has decreased over time, it is still above 80% of the total energy supply for transportation in California and is higher for the gasoline pool (Figure 2). Compared to the US renewable and low-carbon diesel pool consumption average of 6%, the 2022 ratio of renewable and low-carbon diesel fuel is about 42% of total in California.

Data from the first and second quarters of 2023 show the fraction of BD and RD in the diesel pool continuing to increase. Over 40% of the total LCFS credits were generated from RD and BD historically (Figure 3). The major challenge for continued growth of RD and BD will be the availability of feedstocks. Used cooking oil and other residues provided the majority of BD and RD through 2020. However, most available sources of these have been fully exploited for biofuel production. Soybean oil's share of BD and RD feedstocks began rapidly growing in 2021, and most future growth in North American lipid-based fuels—BD, RD and hydrotreated SAF—is anticipated to use soy or other crop oils as feedstock.

Ethanol has maintained a consistent presence in the LCFS market due to ubiquitous 10% ethanol blends (E10) in the retail gasoline market. The potential for growth in ethanol's credit generation is likely to be limited by the blend wall. FPSM assumes the blend wall will lift to 15% in 2031 but, even with this, declining total volumes of gasoline consumption likely limit credit generation potential. The CI of ethanol may decrease with the emergence of cellulosic ethanol and an increasing deployment of CCS on ethanol production facilities. Even so, ethanol's potential credit generation may be limited unless there is a significant increase in the use of flex-fuel vehicles which can be operated with an E85 blend or a broad adoption of mid-ethanol blends (e.g., E30). In addition, the impact of ethanol on credit generation may be further limited by the anticipated decline in liquid fuel consumption by LDVs, due to the increasing number of EVs and improved fuel economy in ICEVs.

Credits generated by RNG have increased recently. This is largely supported by anaerobic digestion of dairy manure feedstock. With the credits from avoided methane emissions, RNG from dairies is often assessed as having a negative CI value. The RNG from dairy manure has contributed about 16% of total credits in 2022, which is relatively high considering that it is 5% of total diesel pool energy consumption. However, the projection for RNG seems to be limited by limited sources of readily available wastes and residues that are not amenable to use in higher-value production systems than RNG; further research is needed to improve projections in this space. There are on-going debates regarding environmental justice issues associated with large-scale confined animal facilities, which should be taken into consideration (25,26).

CARB has indicated that it is considering the adoption of measures that would modestly reduce the potential supply of very low-CI livestock-derived RNG and phase out methane credits for avoided emissions by 2040. Possible effects these provisions modeled here, and the majority of these would not occur until after 2035, which is outside our range of analysis. The long-run growth potential of RNG appears limited. Multiple state policy actions, including ACT, ACF, and new incentives for purchasing ZEVs, have indicated that California's long-term vision for low-carbon transportation is centered on ZEVs rather than low-carbon combustion. This has led most fleets, OEMs, and related stakeholders to adopt a similar focus. Combined with the superior cost profile of EVs in most MHD applications, this implies limited growth potential for natural gas vehicles that could offer RNG entry into the transportation market, and thereby access to LCFS credits (27).

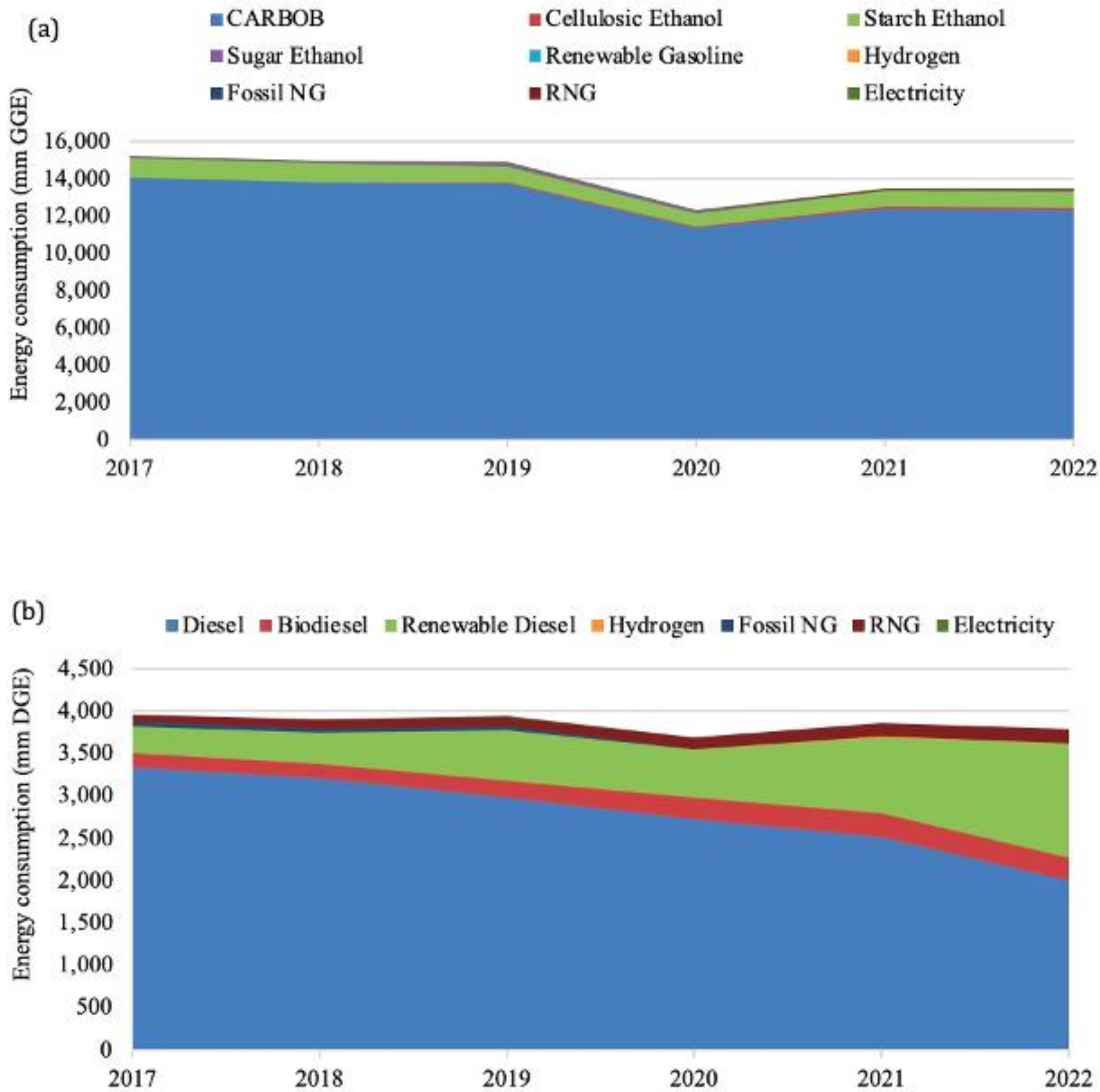


Figure 2. Historical transportation fuel consumption in California for (a) gasoline and (b) diesel pools (CARBOB: California Reformulated gasoline Blendstock for Oxygenate Blending, NG: Natural Gas, RNG: Renewable Natural Gas, mm GGE: million gasoline gallon equivalent, mm DGE: million diesel gallon equivalent).

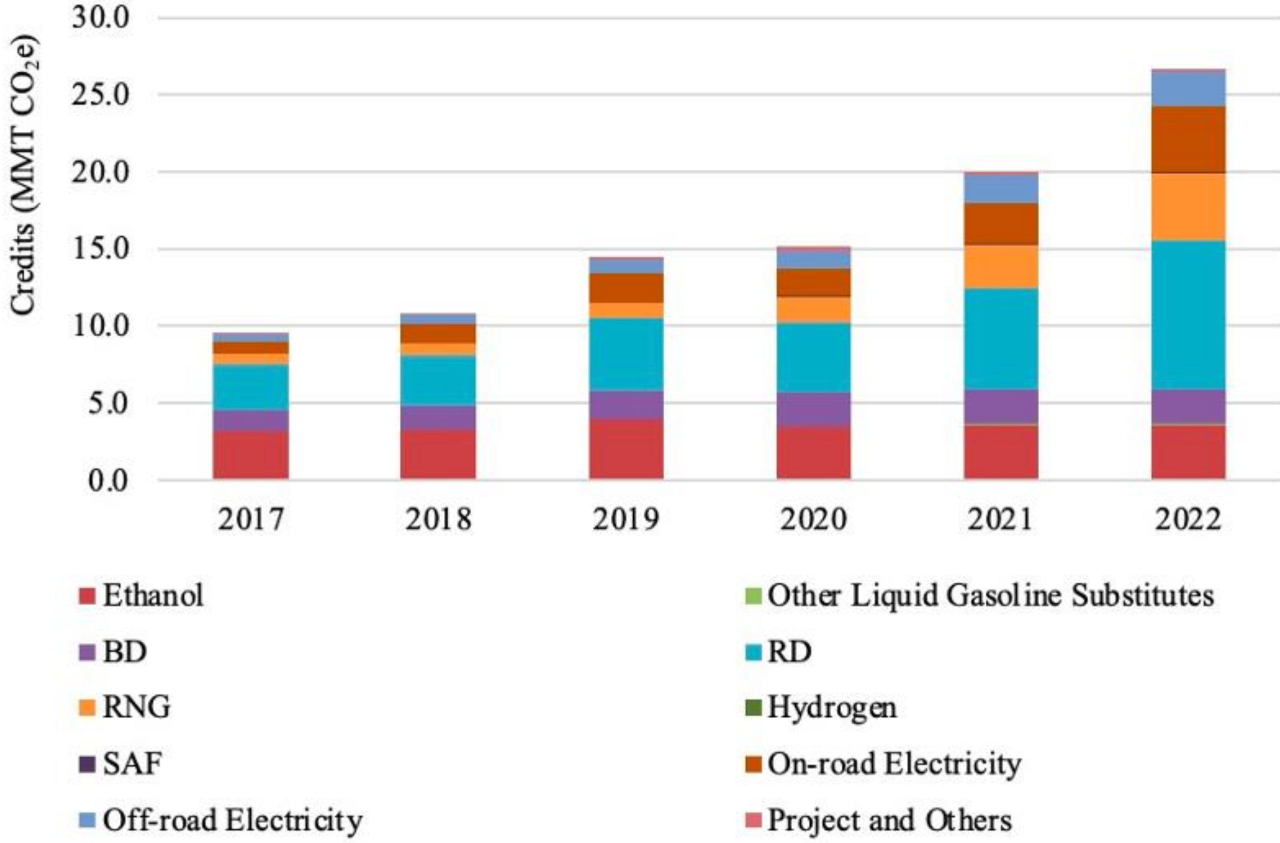


Figure 3. Historical credit generation under the LCFS in California (MMT CO_2e: million metric ton carbon dioxide equivalent, BD: biodiesel, RD: renewable diesel, RNG: renewable natural gas, SAF: sustainable aviation fuel).

The rate of fleet conversion to ZEVs and VMT trends are areas of particularly high uncertainty in this analysis. The TTM projections used to establish fuel consumption assume that California achieves, but does not greatly exceed, sales targets set out in ACC2 and ACT. They also assume that existing models of vehicle aging and retirement adequately predict the behavior of ZEVs over the coming decade.

There are several plausible ways in which real-world behavior could diverge from TTM projections, however. The EV sales fractions required for ACC2 compliance require a rapid build-out of EV supply chains, from acquisition and processing of critical minerals, through battery fabrication, to assembly of finished EVs. Major auto and truck OEMs have announced significant expansion of capacity in these areas. However, if capacity expansions are delayed, then the supply of EVs may be inadequate to meet ACC2, ACT, or ACF targets. Even if EVs are readily available, some vehicle owners may choose to retain ICEVs longer than current models predict, delaying the displacement of petroleum by electricity or low-carbon hydrogen. Fuels such as RD, RNG, or hydrogen could enter the market in higher-than-projected volumes to compensate, however, cost, infrastructure, or feedstock supply challenges may prevent them from delivering LCFS credit generation equivalent to EVs. Disruptions to the projected—and quite rapid—growth in EV supply would therefore reduce the potential LCFS credit supply and lower feasible LCFS targets.

Projecting VMT is similarly critical and challenging. Despite having adopted a state-wide policy requiring reductions in per-capita VMT in almost every major metropolitan area, California has been unable to arrest the long-term trend of VMT growth (28). TTM modeling projects a very gradual decline in per-vehicle VMT for ICE LDVs, though this is in part because the model projects high-mileage drivers to preferentially select EVs due to the operational cost advantages. If, however, per-vehicle ICE VMT continues to increase over the coming decade, gasoline consumption would increase, as would the generation of LCFS deficits, which complicates compliance with LCFS program targets.

The total gasoline pool consumption for each scenario (Figure 4), and the differences by fuel types, including gasoline, ethanol, and electricity for LDVs (Figure 5) are shown below. The primary difference between the old DtZ scenario and new LCT scenario is an assumption for the gasoline market trajectory after the COVID-19 pandemic. The DtZ scenario assumed a full recovery of driving to pre-COVID-19 pandemic level as shown in Figure 4 and Figure 5. Thus, throughout the analysis, the DtZ scenario was used as a high-gasoline-demand sensitivity scenario relative to the LCT scenario. The difference in petroleum gasoline consumption between LCT and DtZ is around 800 million gallons per year for most of the 2020s. For the most part, DtZ scenarios show similar credit bank levels in 2030 as LCT scenarios with 2030 LCFS targets two to three percentage points higher (see Section 3.2). This highlights the importance of accurately projecting VMT trends and understanding the long-term impacts of COVID on driving behavior.

The total GHG emissions for each scenario are shown in Figure 6. While reductions in line with California's GHG reduction targets, including both economy-wide and LCFS program targets, were achieved under both LCT and DtZ scenarios, they were not achieved under the BAU scenario due to emissions from fossil gasoline. Thus, the BAU scenario was excluded from the following analysis and figures as it lacks policy relevance and failed to achieve LCFS compliance under any of the assumptions and conditions tested.

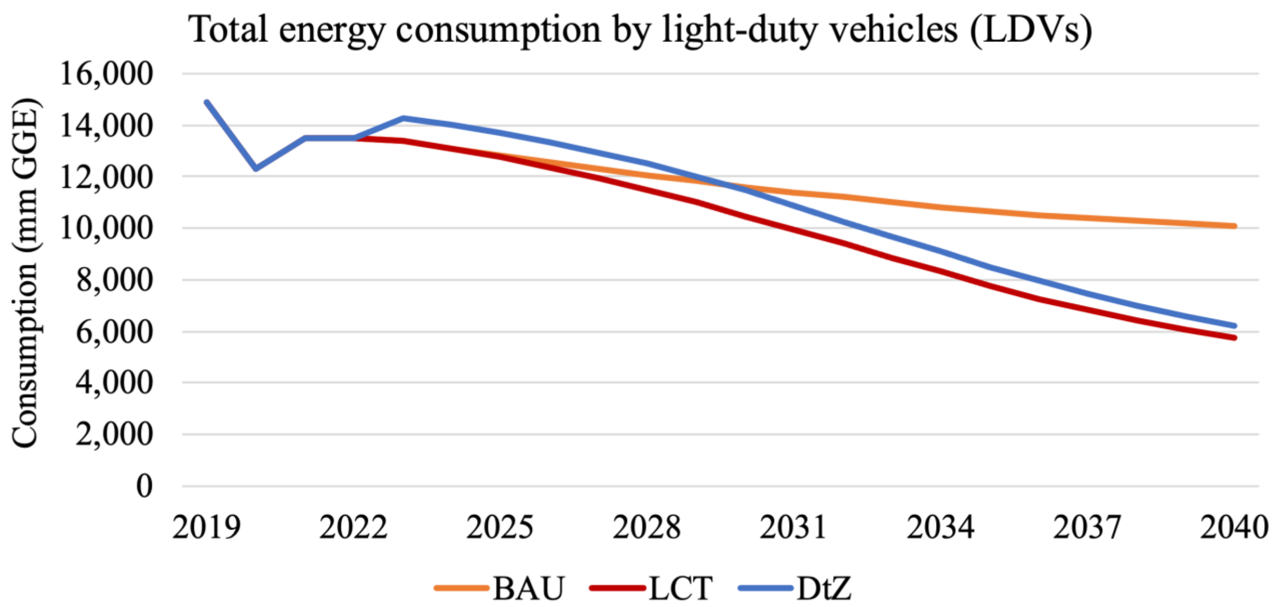


Figure 4. Total energy consumption by light-duty vehicles for each scenario.

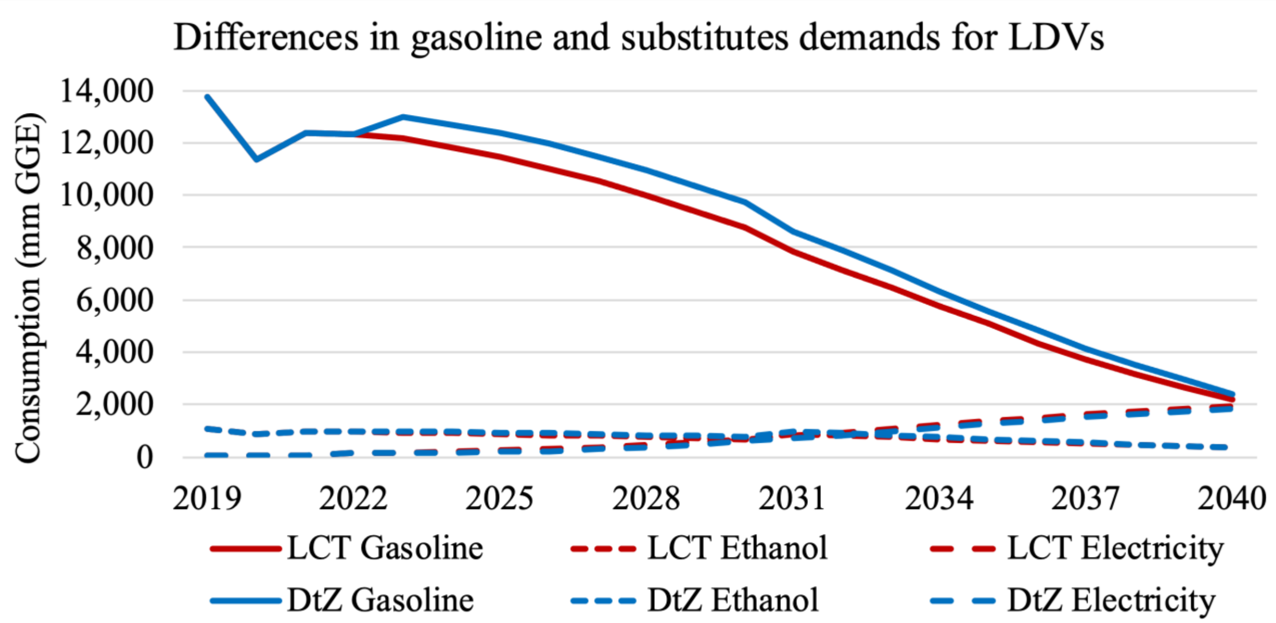


Figure 5. Differences in gasoline and gasoline substitutes demands for LDVs in LCT and DtZ scenarios.

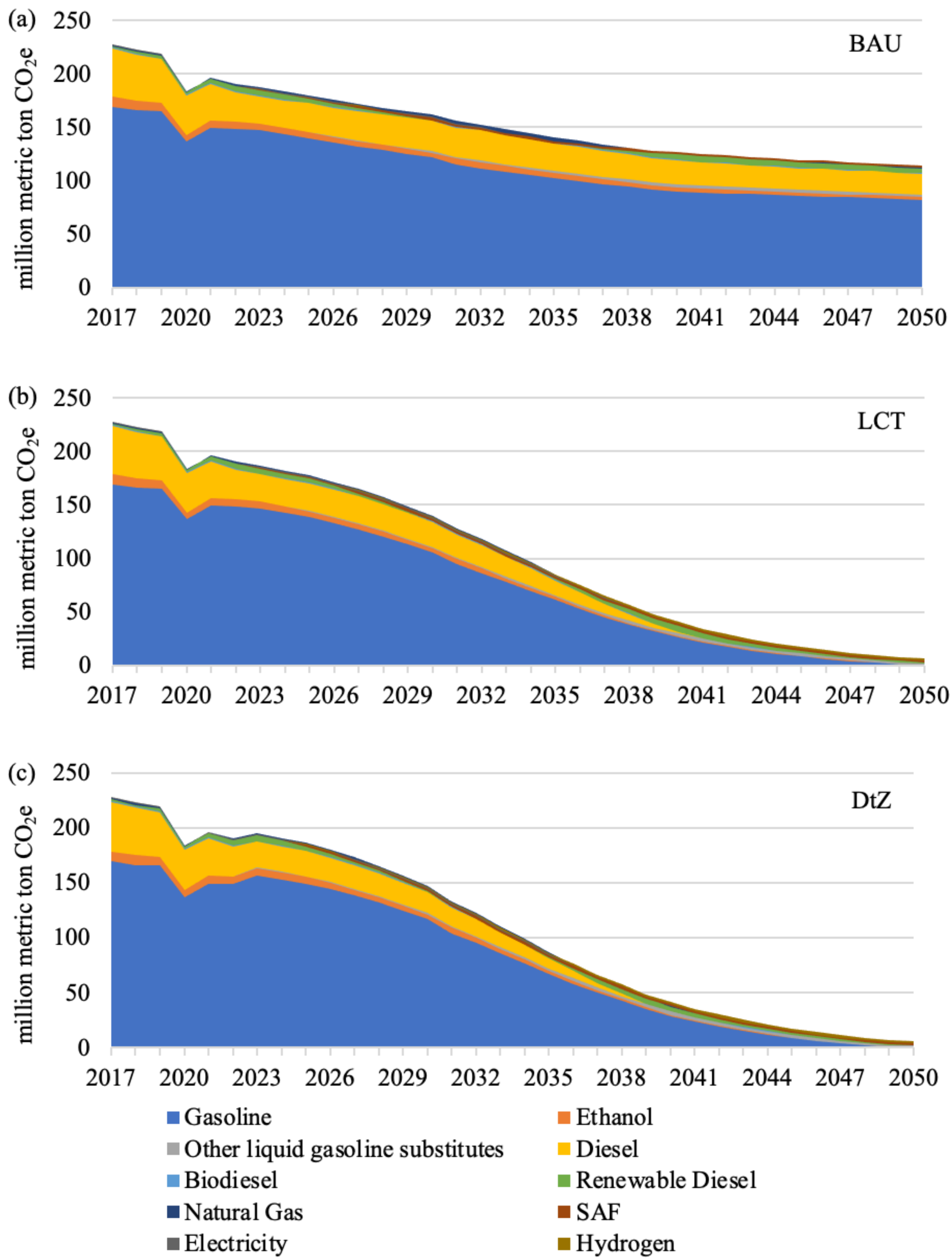
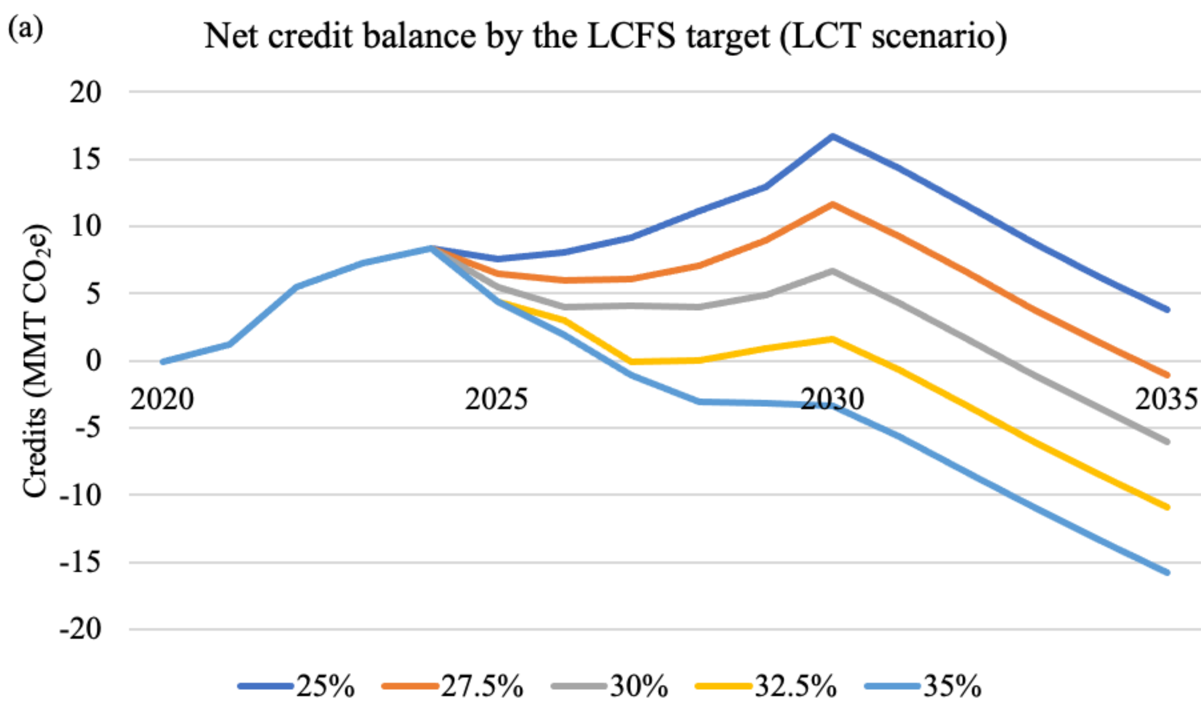


Figure 6. Total greenhouse gas (GHG) emissions from 2017 to 2050 for (a) BAU, (b) LCT, and (c) DtZ scenarios.

2030 LCFS Targets

Since 2020, the LCFS credit price has experienced a significant decline due to impacts from COVID-19 pandemic, faster-than-anticipated growth in RD production, and long-term structural trends. Raising the reduction target is a primary method for increasing the credit price to a level that sufficiently incentivizes investment in low-carbon fuel technologies. This can increase future deficit generation and reduce future credit generation.

CARB has announced that it will begin a rulemaking to update the LCFS, particularly focusing on the 2030 CI reduction target. Accordingly, this target was the primary focus of this analysis. As described above, the reduction targets of 25%, 27.5%, 30%, 32.5%, 35%, 37% and 40% by 2030 were tested with the FPSM. The results for credit balances and credit banks of the LCT scenario (Figure 7) and the DtZ scenario (Figure 8) are shown. The 37% and 40% target scenarios required significant changes to the underlying fuel pool and CI assumptions and are presented separately.



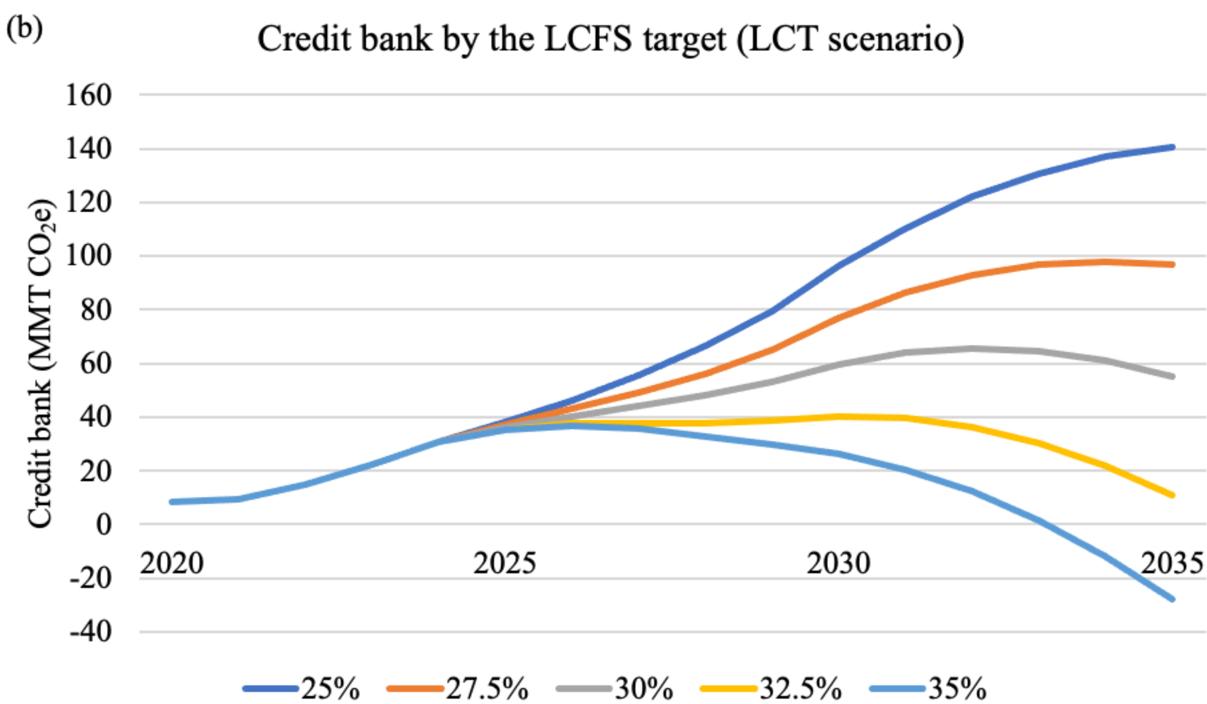


Figure 7. Net credit balances (a) and cumulative credit bank (b) by the tested LCFS targets for the LCT scenario.

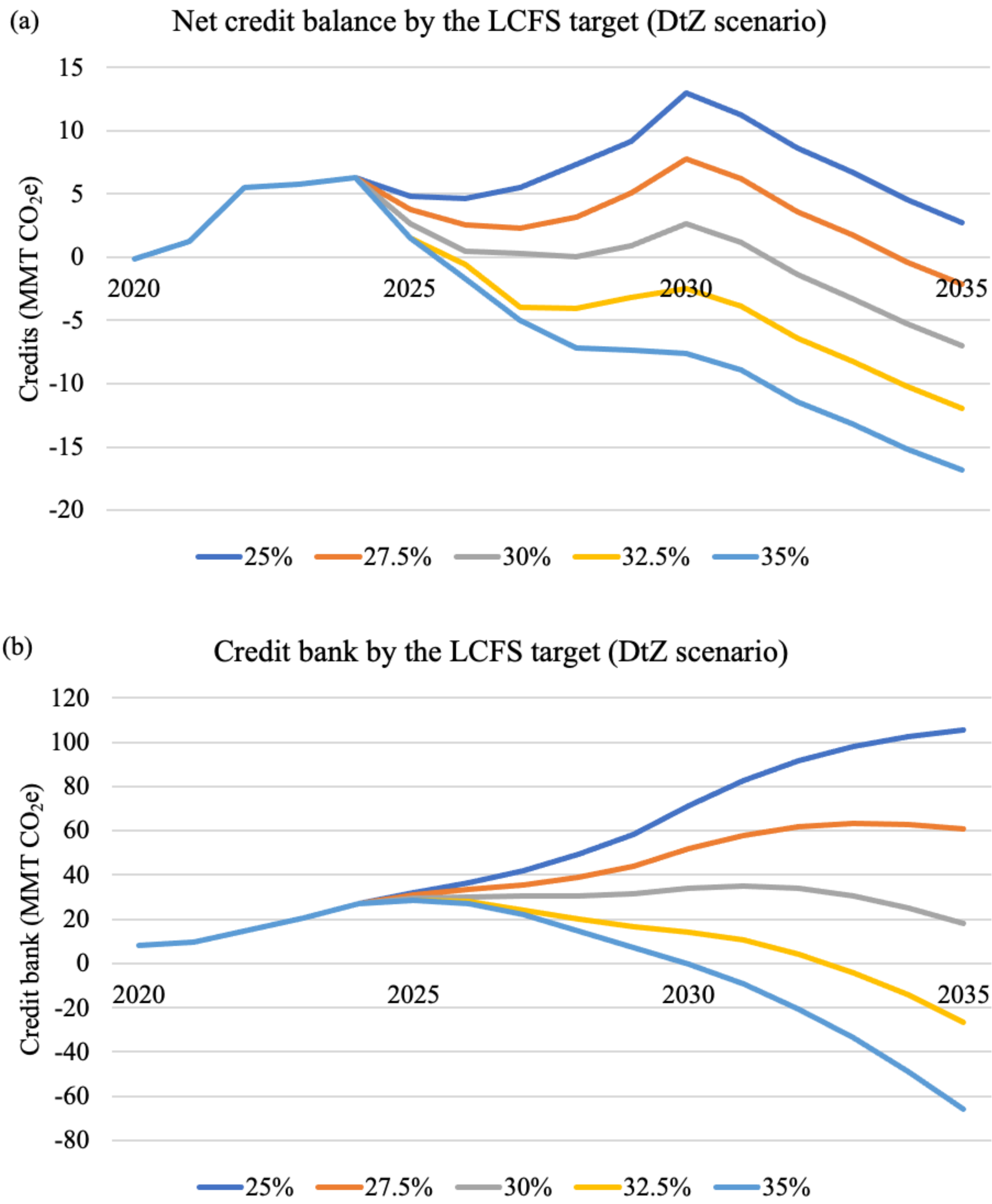


Figure 8. Net credit balances (a) and cumulative credit bank (b) by the tested LCFS targets for the DtZ scenario.

Comparing 2030 Target Scenarios:

All target scenarios indicated full compliance with LCFS targets through 2030, however annual credit generation and the number of banked credits in 2030 varied significantly across the range of considered targets. This is to be expected since FPSM does not simulate market reaction to target levels, in reality lower levels would likely lead to reductions in credit generation due to lower credit prices, and vice versa; as a result, the magnitude of the gap between different target levels may be somewhat overstated by FPSM's approach. This effect may be limited, however, by the relatively limited sensitivity of many critical credit generation pathways to LCFS credit prices or market conditions, e.g. as with EVs.

- The 30% target under the LCT scenario results in a net gain of around 7 million banked credits. The credit bank more than doubles by 2035 under the 25% and 27.5% reduction targets, grows gradually with the 30% reduction target, declines slightly with the 32.5% target, and shrinks significantly under the 35% target.
- Under the DtZ scenario, net credit surpluses were consistently lower. The 30% target results in a net gain of around 2.7 million banked credits in 2030.
- Under both the LCT and DtZ scenarios, the 35% reduction target ultimately depletes the credit bank. This happens by 2030 for DtZ and 2033 for LCT. With the DtZ scenario, the trend is similar to the LCT scenario, however it reflects a higher level of deficit generation due to greater gasoline demand.

In both scenarios, the rate of net credit growth increases in 2029 and 2030 due largely to the increase in EVs. This is despite a gradual non-linearity in target trajectories that result in slightly higher year-on-year target increases in these years (this nonlinearity is absent in current draft target proposals from CARB). The increasing rate of EV sales through the 2020s creates a nonlinearity in the transportation fleet's capacity to decarbonize. There are more low-cost credit generation opportunities in a fleet that is adding 500,000 EVs annually than there are in a fleet adding only 50,000.

While it is not essential to match the trajectory of target increases with the fleet's credit generation capacity, doing so creates a relatively stable amount of policy-induced pressure to deploy lower-carbon alternatives. This is conducive to a more stable LCFS credit market than one in which a linear target acceleration trajectory may, by design, result in some years of significant accumulation of excess credits and other years of significant drawdown of those stored credits.

Estimated sources of credits and deficits under the 30% target, along with anticipated volumes of fuel are presented below (

Table 5). Light-duty EVs are the largest source of credits in 2030, driven by the ACC2 rule. EVs, including LD, MHD, and non-road provide over 50% of total credits, with around 15% each coming from liquid diesel substitutes, BD, and RD, as well as RNG. By 2030, around 20% of the LDV fleet is projected to have switched to ZEVs, predominantly EVs. Combined with improved fuel economy, this may reduce petroleum gasoline consumption from over 13 billion gallons per year today to less than 9 billion. As California approaches 2035, after which no new ICE vehicles will be registered, sales fractions of EVs may approach 100%. The TTM results project that the LDV fleet will be approximately 50% EV by 2035.

Table 5. Credits and deficits generation by fuel type in 2030 with the 30% reduction target and the LCT scenario. The positive values are for credits, and the negative values are for deficits. Unit for fuel consumption is million gasoline gallons equivalent (mm GGE) unless noted as million diesel gallons equivalent (mm DGE).

Fuel	Credit (or Deficit)	Fuel Consumption
Gasoline	-32.66	8,754.7
Total ethanol	1.98	677.9
Cellulosic ethanol	1.04	204.6
Starch ethanol	0.79	435.4
Sugar ethanol	0.15	37.9
Drop-in liquid gasoline substitute	1.29	281.7
Diesel	-7.11	1,755.4
Biodiesel	1.09	172.9
Renewable diesel	5.08	1,097.1
Renewable natural gas (mm DGE)	6.45	169.1
Hydrogen – light-duty	0.95	51.4
Hydrogen – heavy-duty (mm DGE)	1.73	111.7
Sustainable aviation fuel	2.22	540.0
Electricity – light-duty	18.34	685.3
Electricity – heavy-duty (mm DGE)	4.46	95.2
Off-road electricity	1.81	97.7
Incremental crude deficits	-0.97	
Projects, infrastructure, and others	2.00	

Results from these scenarios are highly sensitive to assumptions about the long-term gasoline consumption trend, as well as the rate of EV deployment. The comparison between the LCT and DtZ scenarios serve to illustrate this sensitivity to gasoline consumption. The credit balance in 2030 and beyond is also quite sensitive to the availability of projected volumes of very low-CI RNG, the CI of liquid diesel substitutes, and project-based credit generation; future research is recommended to more comprehensively explore sensitivity to these, and other parameters.

GHG Emissions from Selected Scenarios

Under all scenarios evaluated, the displacement of petroleum fuels by lower-carbon non-petroleum alternatives lead to a reduction in life cycle GHG emissions over the modeled timeframe. LCT-based scenarios showed slightly lower life cycle GHGs than DtZ, owing to the lower demand for petroleum gasoline and a more rapid fleet transition to ZEVs. The LCT scenario achieves a nearly 25% reduction in 2030 life cycle GHGs compared to a 2020 baseline, whereas DtZ reduces emissions by slightly over 20% over the same time period. Both scenarios reduce 2035 GHG emissions by over 50% compared to the 2020 baseline. While analysis past 2035 is outside the scope of this study, both LCT and DtZ are on trajectories capable of meeting a carbon neutrality target within the transportation sector by 2045[4].

Total GHG emissions for LCT, DtZ, and BAU scenarios differ with different control parameter schemes and assumptions (Figure 9). For both LCT and DtZ scenarios, GHG emissions were slightly lower in the high-biofuel case than the default case, and they became more similar over time with a decrease of liquid fuel portion in the total fuel portfolio. Thus, increase of biofuel production may affect a short-term GHG reduction goal, but its impacts may diminish for a long-term GHG reduction goal.

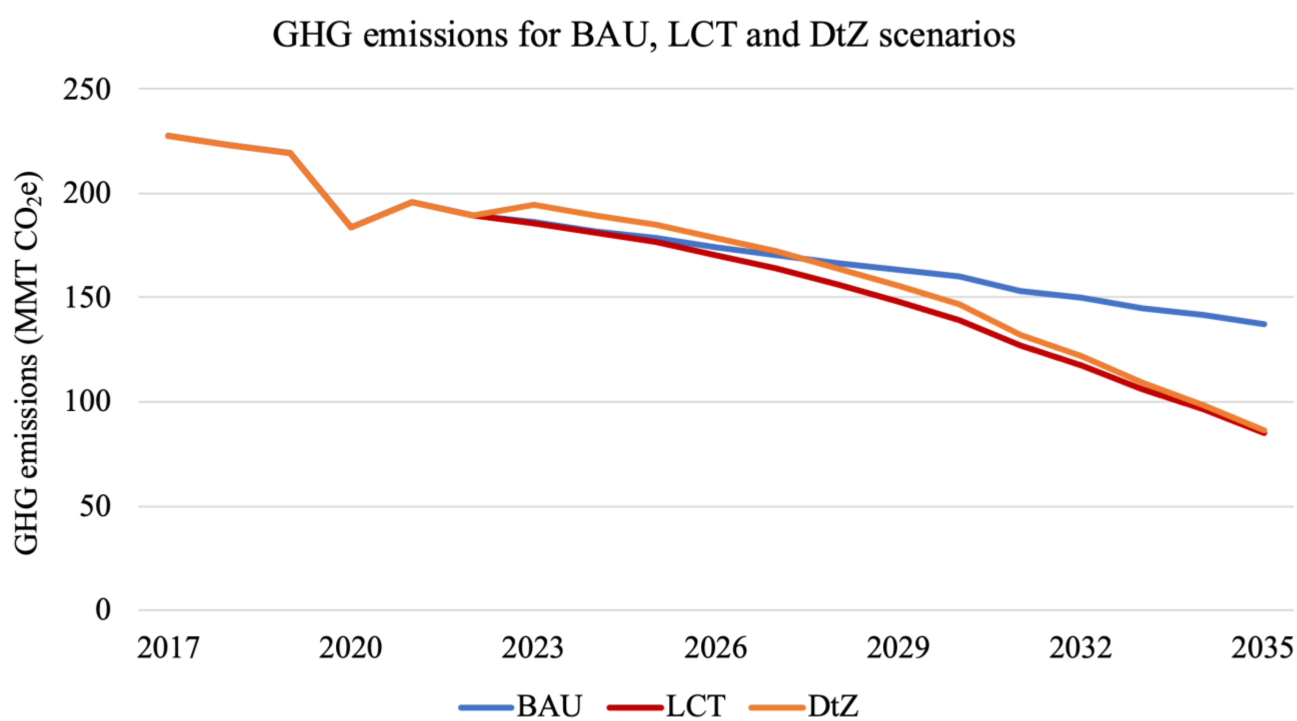


Figure 9. GHG emissions for BAU, LCT and DtZ scenarios. Note: the BAU scenario starts from the same baseline as the LCT scenario, and so adopts the assumption that 2022 data fully reflect the post-covid gasoline consumption trend. This leads to several years where BAU emissions are nominally below the DtZ case.

[4] Carbon neutrality, in this case, assumes the presence of ~5 million tonnes/year of net-negative carbon dioxide removal (CDR), such as CCS, beyond any CDR already credited in fuel pathways, as well as the emergence of ~1 billion gallons/year of low-carbon liquid gasoline substitute production capacity by 2040. See the *Driving California's Transportation Emissions to Zero by 2045* report for fore detail on carbon neutrality scenarios.

High Biofuel Scenarios

Under the default assumptions for control parameters (Table 4), the 37% and 40% reduction targets were not able to be met by either LCT or DtZ scenario. As mentioned above, FPSM allows an easy and rapid analysis of an alternative scenarios. This allowed us to test additional scenarios with modified control parameters to investigate the feasibility of 37% and 40% reduction targets. For this analysis, three additional control parameter schemes were tested. These adjustments focus on lipid-based fuel, ethanol, or both at the same time (

Table 6).

The first adjustment, called “ICF-Lipid,” was applied to the lipid-based fuels. In this scheme, the distillates capacity was increased from 1.75 billion gallons of total lipid-based fuel (BD + RD + SAF) to 2.75 billion gallons. The biodiesel blend rate was modified from the default 6% (on an energy basis), to a growing trajectory that reaches 16 % by 2030.

The second adjustment, called “ICF-Ethanol,” was applied to the ethanol fuels. It increases the improvement rates of ethanol CI based largely on assumed deployment of carbon-capture-and-storage (CCS) technology at ethanol production facilities in the mid-late 2020s. The adjustment also increases the ethanol blend wall sooner than the default scheme.

The third adjustment is a combination of the first and second adjustments, and it is called “ICF-Combined.”

These parameters were chosen to align with modeling results submitted by ICF to CARB comment docket following a pre-rulemaking workshop (29). The ICF modeling extends only through 2030, so we omit post-2030 impacts in this section.

With these adjusted control parameters, 37% and 40% reduction targets were tested for both LCT and DtZ scenarios. The results for net credit balance and credit bank vary widely (Figure 10 and Figure 11). The ICF-Lipid adjustment provided a significantly larger impact on credit balance through 2030. The ICF-Ethanol scenario yielded net deficits under both the 37% and 40% target scenarios for both LCT and DtZ demand scenarios, resulting in a rapidly depleted credit bank.

Table 6. Adjustments for control parameters to test 37% and 40% reduction targets.

Parameters	Unit	Default	Adjusted
“ICF-Lipid” case adjustment			
Biodiesel blend rate update year (from 6%)	year	NA	2030
Updated biodiesel blend rate	%	6%	16%
Annual maximum distillates capacity for lipid-based fuel	mm DGE	1,750	2,750
“ICF-Ethanol” case adjustments			
Carbon intensity improvement rate			
Starch ethanol (before 2030)	%	2%	10%
Starch ethanol (after 2030)	%	2%	3%
Sugar ethanol (before 2030)	%	4%	10%
Sugar ethanol (after 2030)	%	4%	3%
Cellulosic ethanol (before 2030)	%	0%	6%
Cellulosic ethanol (after 2030)	%	4%	4%
Blend rate			
Increasing ethanol blend rate from 11 vol% to 16 vol%	year	2030	2024

Under the LCT scenario, the ICF-Lipid adjustments maintained an approximate balance between credits and deficits for the 37% target but saw significant net deficits emerge in 2029 and 2030 under the 40% target trajectory. Under the DtZ demand scenario, the 37% target resulted in a declining but still robust credit bank, but a nearly depleted one at 40%. The combination of both ethanol and lipid fuel credit generation enhancements in the ICF-Combined adjustment led to projected compliance with a 40% target under both LCT and DtZ scenarios.

The key differences between the LCT and DtZ scenarios, and the scenarios presented in the ICF modeling, center on the amount and CI of biofuels entering California’s market in the coming decade. Given the uncertainties around EV production and the fleet turnover rate, there are few other options capable of generating sufficient credits to support targets significantly above 30%. This suggests that a likely effect of higher targets would be to significantly increase the amount of biofuel consumed by California for LCFS compliance. The increased ethanol consumption reflects (1) an extremely rapid adoption of E15 as a ubiquitous retail gasoline blend or (2) rapidly expanding consumption of mid- to high-ethanol blends by flex-fuel vehicles, coupled with declines in ethanol CI that are significantly more rapid than historical trends.

Taken as a whole, these results support the idea that targets higher than 30% or even 35% may be feasibly achieved. However, pursuing these options could require both significantly above-trend improvement in ethanol CI as well as continued rapid growth in consumption of lipid-based fuels[5]. Current and announced capacity for lipid-based fuel production in North America is approximately 5-7 billion gallons per year. Some of this would presumably be consumed in Canada to satisfy new federal regulatory requirements there. Meeting the approximately 2.75 billion gallons consumption of such fuels would, therefore, either imply that California consumes significantly more than a population- or GDP-weighted share of North American lipid-based fuels, or a massive expansion of North American supply.

Questions have emerged among stakeholders regarding the amount of lipid feedstock that could be sustainably produced to support expanded biofuel production. Most growth in this space is likely to come from crop-based vegetable oils such as soybean oil, which have uncertain—but potentially quite large—emissions associated with indirect land use change. CARB has invited feedback on the topic of a cap on crop-based biofuels, largely to address concerns that the LCFS is leading to undesirable impacts from land conversion. While they have offered no indication regarding the level at which such a cap would be set, or even that a cap would be included in any proposed rulemaking, it is likely that the ICF-Lipid adjustments reflect a level that would significantly exceed such a cap. GHG emissions from this scenario may be lower than those under the DtZ or LCT scenarios, however, the significant expansion of lipid-based fuel production capacity creates the possibility of large GHG impacts from land use change, including ILUC. Resolving this uncertainty is outside the scope of this report.

[5] This is not an exhaustive list of the conditions which would allow higher targets, but rather is based on the conditions of interest identified in the ICF modeling and regulatory comment.

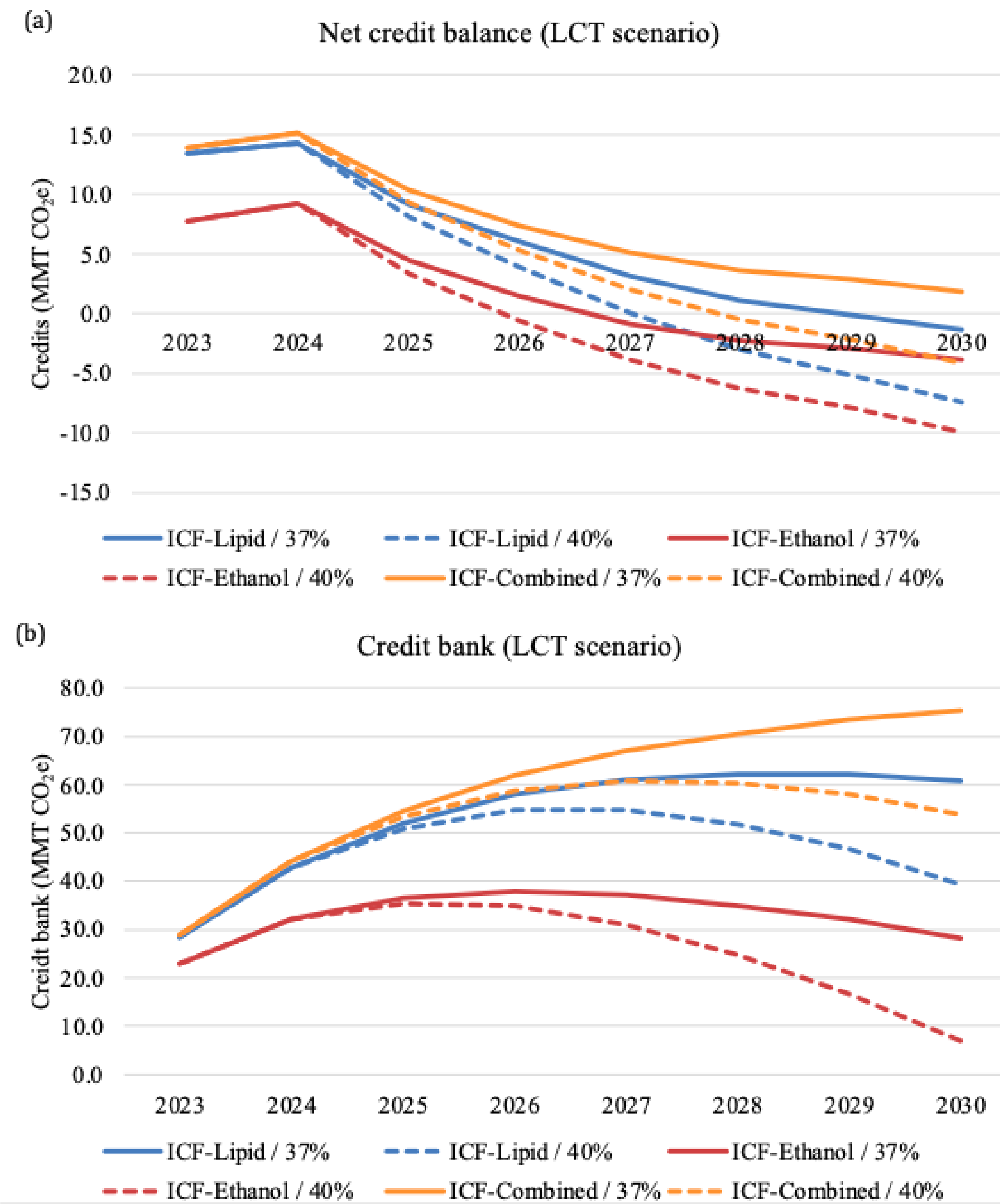


Figure 10. Net credit balance (a) and cumulative credit bank (b) with the adjusted parameters for LCT scenario.

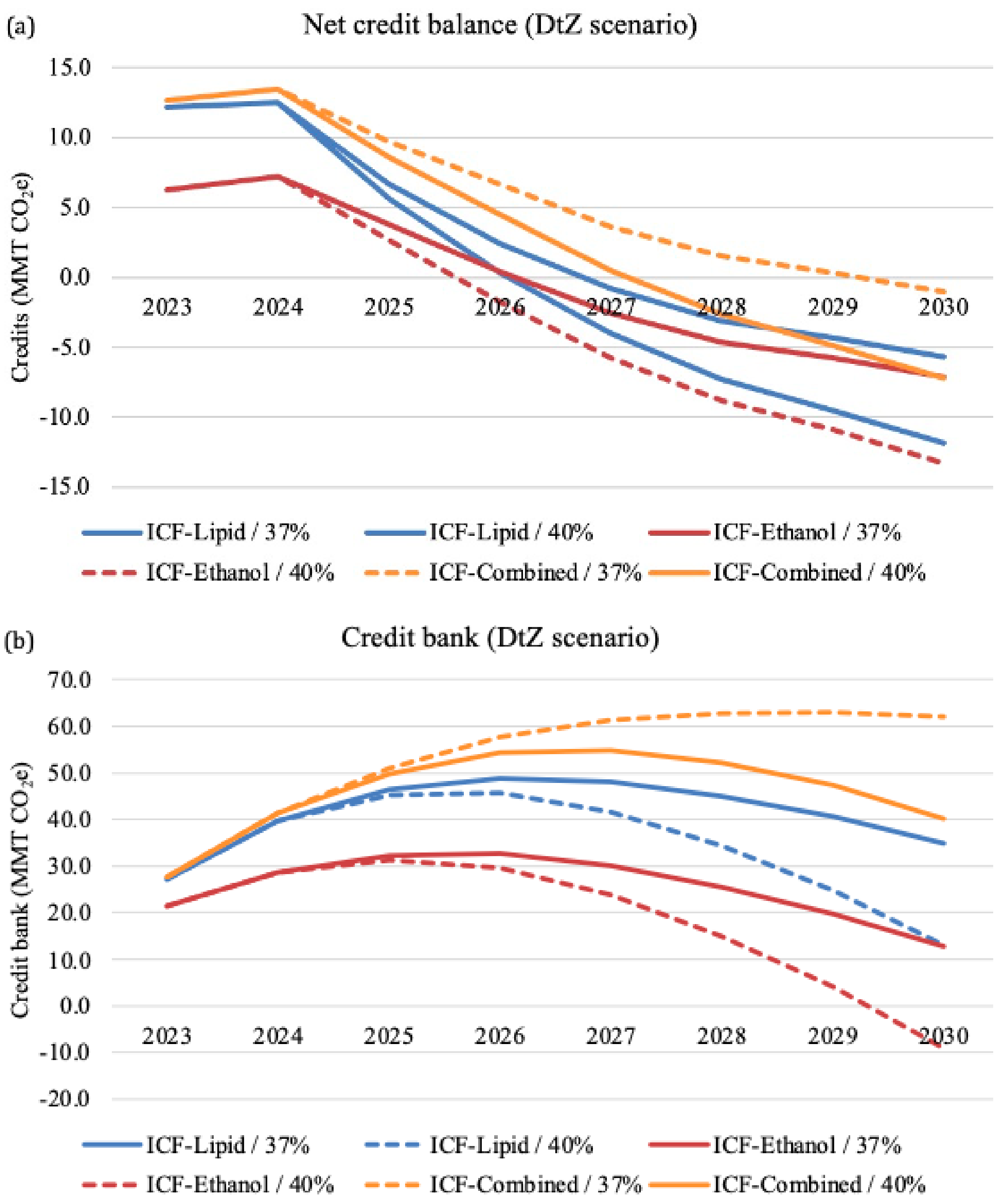


Figure 11. Net credit balance (a) and cumulative credit bank (b) with the adjusted parameters for DtZ scenario.

Impacts of Target Reduction Schedule

The LCFS sets year-by-year targets used for compliance. This allows a significant degree of flexibility for determining the compliance schedule under any given future long-term target. To explore these relationships, we evaluated three target trajectories for reaching a 30% target by 2030 using the FPSM. These include two 30% target trajectories described above (Table 3) and one trajectory from the California Transportation Supply (CATS) model developed by CARB, which will be discussed in Section 3.6 (Table 7).

The post-2030 trajectory from the CATS model was slightly modified to align with the other trajectories, which is an annual increase of the target by 6%, instead of its original value of 4.5%, after 2030. The front-loaded version more rapidly increases ambition in the mid-2020s but has more gentle increases in the latter part of the decade than the regular 30% target. The CATS model trajectory increases ambition in the early years even more than the front-loaded version. The results of this comparison for the LCT and DtZ scenarios are shown (Figure 12).

Despite the identical 2030 target of 30%, the CATS trajectory significantly reduces the surplus of credits through the mid-2020s, resulting in approximately 21 million and 10 million fewer banked credits than the 30% and front-loaded 30% trajectories by 2030 respectively. This is despite the fact that the maximum difference between the CATS and 30% targets is 3.25 percentage points, 18.75% versus 15.5% in 2025. Under the DtZ scenario, the 30%F and CATS trajectories drop the LCFS market into net deficit generation for four and five years, respectively.

Table 7. Target trajectories for testing the impacts of target reduction schedule.

By 2030	2023	2024	2025	2026	2027	2028	2029	2030
30%	11.25%	12.50%	15.50%	18.50%	21.00%	24.00%	27.00%	30.00%
30% F	11.25%	12.50%	16.50%	20.00%	22.50%	25.00%	27.50%	30.00%
CATS	11.25%	12.50%	18.75%	21.00%	23.25%	25.50%	27.75%	30.00%

Under both LCT and DtZ fuel demand scenarios, the CATS target trajectory results in net deficit generation for a period, as does the frontloaded 30% target scenario. Under all combinations of fuel demand scenarios and target trajectories, the credit bank remains net positive through 2030, though the CATS target trajectory under the DtZ scenario draws it down to around 13 million credits in 2030, as compared to approximately 41 million projected annual deficits.

Taken together, these results indicate that a rapid near-term increase in LCFS target, such as the 16.5% 2025 target from the frontloaded 30% target trajectory or the 18.75% target from the CATS target trajectory, are unlikely to result in the depletion of the credit bank by 2030. Under the LCT demand scenario, all target trajectories resulted in a gradually increasing credit bank. Under the DtZ demand scenario, the credit bank remained stable or declined.

Banked LCFS credits serve a variety of useful roles, including hedging against unfavorable or volatile future market conditions and creating liquidity for credit trades. Drawing the bank down to zero (or nearly so) is therefore inadvisable. The significant decline in LCFS credit prices in 2021 and 2022 suggest that the current bank—approximately 15 million credits in 2022 as compared to approximately 20 million deficits—may be above the optimal size for a stable LCFS credit market capable of supporting the necessary transition to very low carbon transportation.

Given the relative novelty of carbon instrument markets, there is no clearly established standard for the size of an adequate aggregate level of banked credits, and suggesting one is outside the scope of this report. Additional research is required to better understand the impact of aggregate banked credit volumes on LCFS market dynamics. It is also important to note that changes to LCFS program parameters not discussed in this report would also impact net credit balances. Additional scenario analysis of any proposed target trajectories or program changes is recommended.

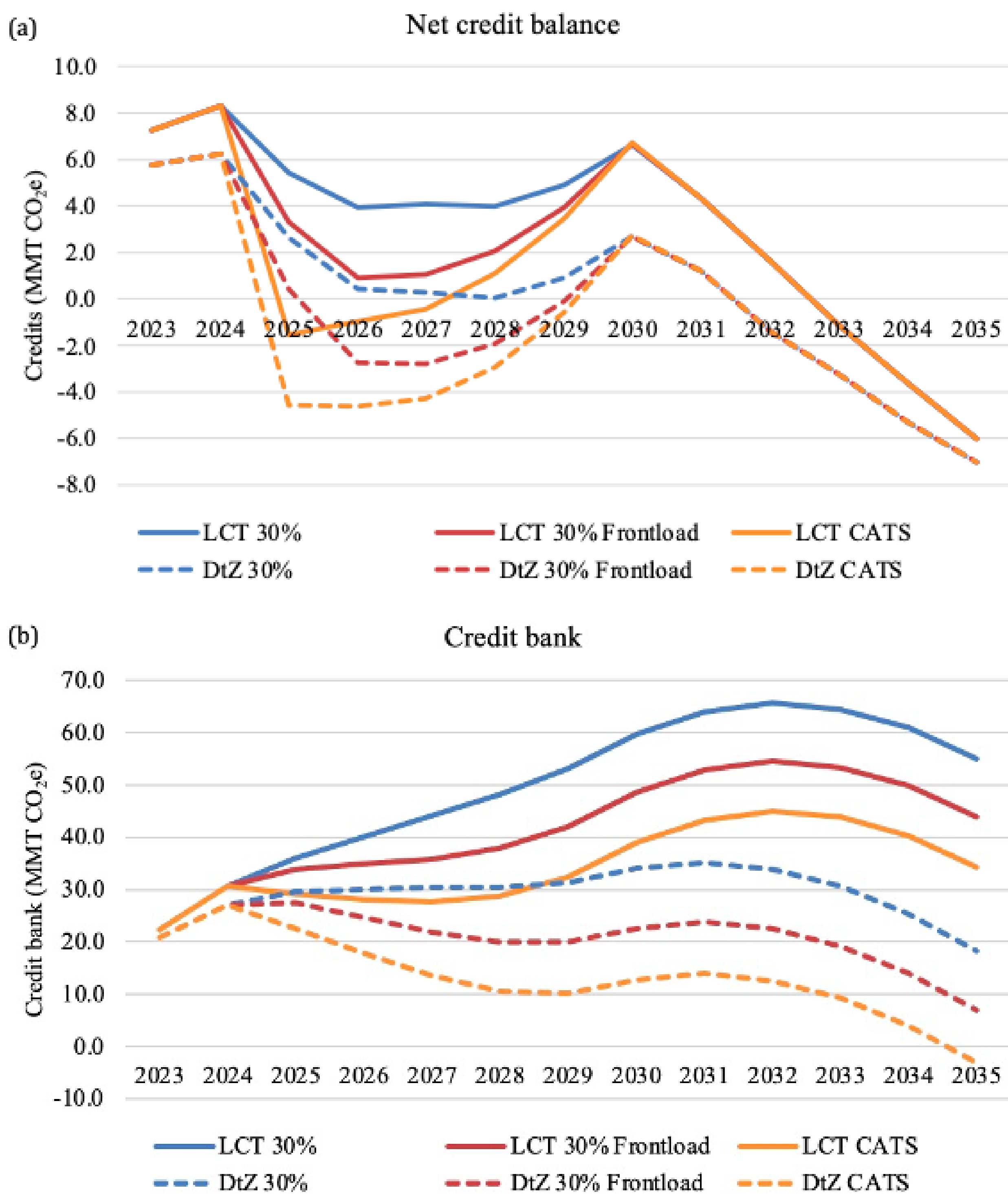


Figure 12. Net credit balance (a) and Cumulative credit bank (b) with the 30% and the front-load version of 30% targets for the LCT and DtZ scenarios.

Post-2030 Targets

While the current rule-making process focuses largely on the 2030 reduction target, California's climate goals function over a longer timeframe. The 2030 target must establish a trajectory that can achieve carbon neutrality by 2045. It is therefore important to consider how 2030 targets affect post-2030 GHG emissions and future policy.

Selecting post-2030 targets is complicated by expected changes in California's vehicle fleet due to policies like ACC2, ACT, and ACF. As California approaches the 2035 ACC2 deadline—after which, no new ICE vehicles will be registered—EV sales shares are expected to rise rapidly and approach 100%. This means that, as older ICE vehicles retire, they will be replaced by ZEVs, leading to a period of rapid change in the composition of the LDV fleet. California's annual new car sales are typically in the 1.5-to-2-million-unit range, which sets a *de facto* maximum rate at which new EVs can enter the fleet. With around 29 million LDVs total, this implies fleet turnover rates that could get as high as 5-7% per year. Replacing an ICE LDV with an EV reduces the number of deficits generated from the consumption of gasoline and increases credit generation from the additional charging by the new vehicle. The combination of these effects results in rapid changes in the net balance of LCFS credits and deficits. The program's target must increase more rapidly than it did in the in the early- to mid-2020s (or before) in order to keep deficit generation approximately in balance with credit generation.

To analyze the impacts of different incremental targets after 2030, different sets of target trajectories were tested for the LCT and DtZ scenarios. Differences in LCFS target acceleration schedule post-2030 arise when comparing target increases of five and six percentage points per year from 2031-2035 (Figure 13 and Figure 14). Both the LCT and DtZ scenarios show net positive credit balances in 2030 at a 30% target. Different rates of target acceleration in the 2020s mean that the bank of credits in 2030 can range from 12 to 60 million credits, depending on how quickly targets accelerated in the 2020s (See Figure 12), A larger bank in 2030 means that more ambitious post-2030 targets can be achieved without risk of bank depletion and excessively high credit prices. A smaller bank implies less flexibility to accommodate higher targets.

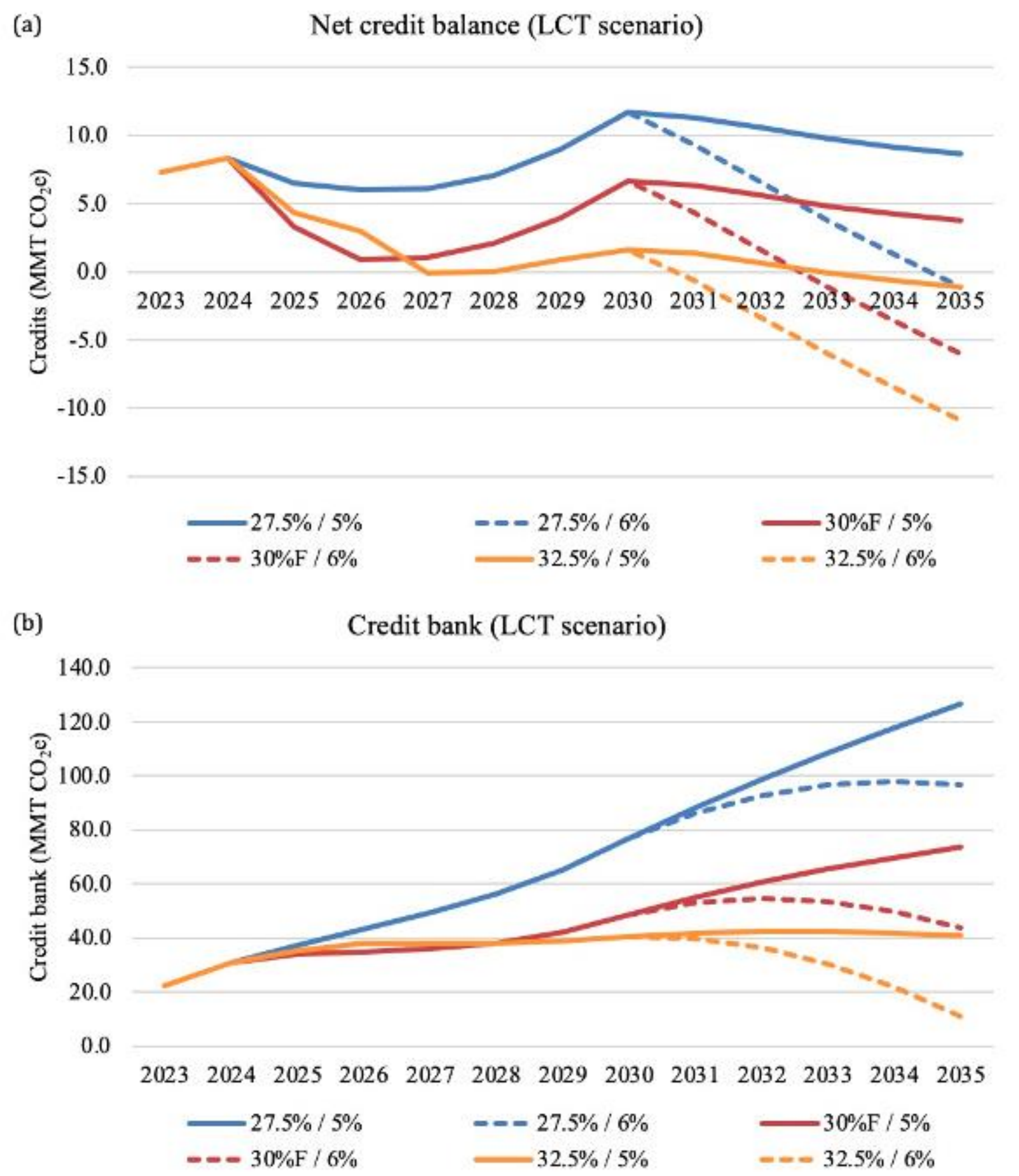


Figure 13. Net credit balance (a) and Cumulative credit bank (b) with different post-2030 incremental percentage points of the reduction target for the LCT scenario.

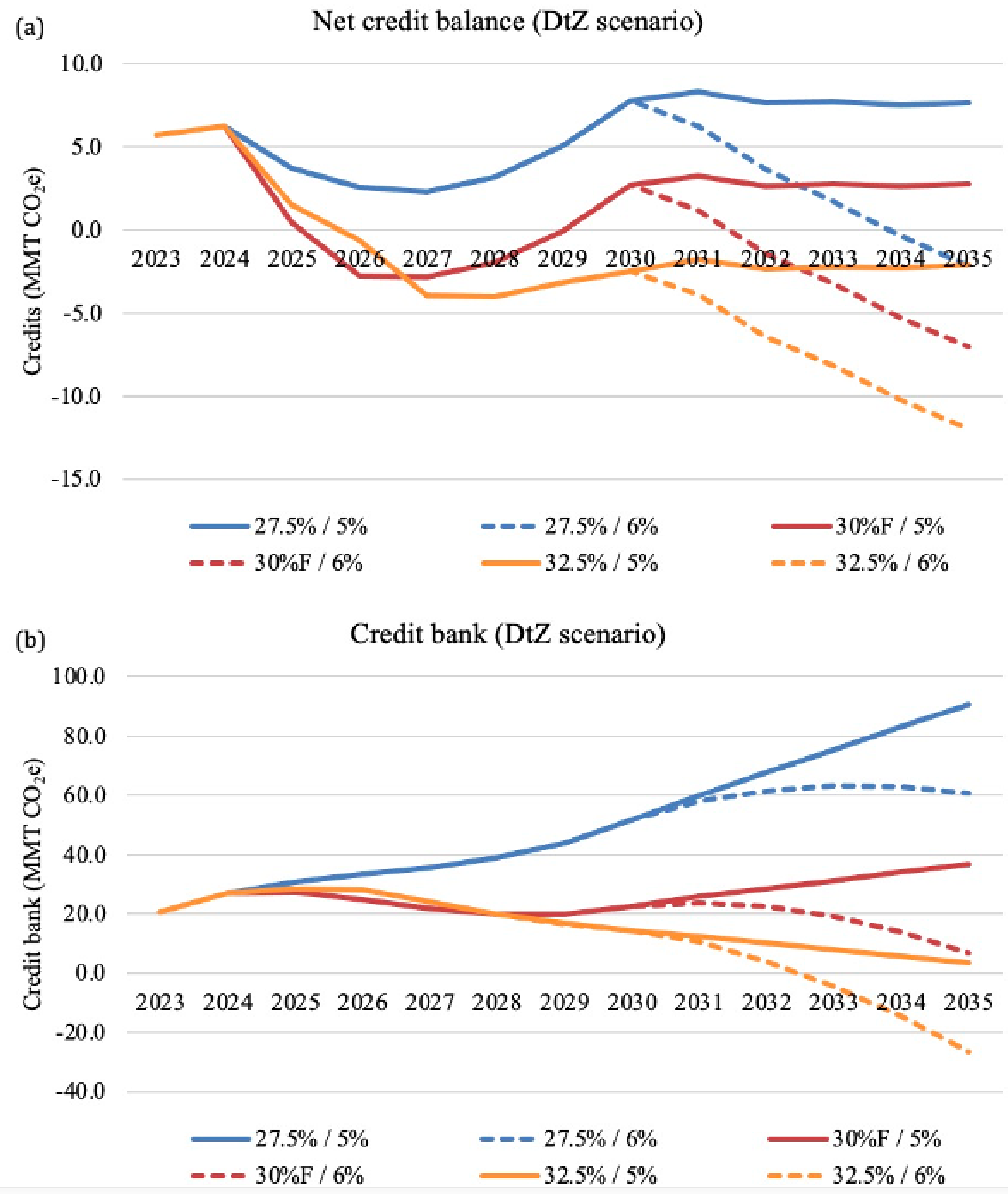


Figure 14. Net credit balance (a) and Cumulative credit bank (b) with different post-2030 incremental percentage points of the reduction target for the DtZ scenario.

Under both DtZ and LCT demand scenarios, six percentage point annual target increases resulted in decreasing annual credit balances, sometimes to the point of net deficits. Five percentage point annual target increases resulted in constant or very gradually declining annual credit balances (Figure 13 and Figure 14). Notably, under a more ambitious 32.5% 2030 target scenario the declining credit balance caused by 6% annual target increases led to credit bank depletion by 2033 in the DtZ scenario, and near-depletion in the LCT scenario with about 11 million credits remaining, against 41 million annual deficits. Lower 2030 targets did not come so close to depleting the credit bank.

These figures demonstrate the critical relationship between pre-2030 and post-2030 target ambition. Higher levels of pre-2030 target ambition make it harder to support higher levels of post-2030 target ambition and vice versa[6]. Policy makers will need to decide how best to schedule LCFS target acceleration. Early ambition typically has better climate impacts than later due to the temporal dependence of GHG emissions (30).

Delaying target increases would be expected to reduce cost impacts on consumers. This is especially relevant given the expected vehicle fleet in the early 2030s. TTM modeling projects the California vehicle fleet composition reaching 50% ZEV around 2035. Prior to that point, most drivers in California will still be driving an ICE vehicle, typically fueled by petroleum. As targets exceed 30% and continue to climb, the per-gallon price impacts on retail gasoline would be expected to rise as well. Given the expectation that the transition to EVs will generally occur most rapidly among higher-income drivers, this implies that lower-income drivers may be disproportionately exposed to the retail fuel price increases caused by the LCFS. Delaying the onset of higher targets provides more time for lower-income drivers to transition into EVs; policies focused on equity and improving access to electrified transportation can assist in this effort. Even where significant retail gasoline price impacts occur, they are likely to be less than the social cost of carbon applied to the CO_2 emitted from combustion of gasoline, and the value of air quality benefits from of reducing vehicle combustion. Lower-income and disadvantaged communities are typically at greater risk from both climate and air quality related pollution impacts, so even with anticipated fuel price impacts, the net effect of the LCFS is likely to be positive for most parties. The distributional parameters of these impacts should not be overlooked, however, and further study of this topic is recommended (31,32).

Delaying the maximum ambition of LCFS targets to a level sufficient for the state to meet long-term climate goals but not higher could help achieve a balance between the aggregate benefit of reduced emissions, as well as the net positive impact on disadvantaged communities.

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[6] This conclusion is, in part, a result of the static nature of the FPSM model. Higher early targets would be expected to bring additional supplies of low-carbon fuel into the market, allowing higher post-2030 ambition. This impact is likely to be muted, however, because the primary driver of LCFS credit generation in the early 2030s is the transition to ZEVs, especially EVs. That transition is driven primarily by policies like the ACC2 rule. The amount of credit generated per LDV is generally seen as too small to significantly affect vehicle purchase decisions for most LDV purchasers, and revenue from LDV charging credits typically goes to utilities or vehicle charging service providers who have little impact on LDV purchase decisions. As such, higher LCFS targets or credit prices are unlikely to affect the rate of LD EV deployment, and the treatment of LD EV deployment as exogenous to credit market parameters is a reasonable reflection of expected behavior.

Comparison with the CATS Model

The CATS optimization model has been developed by CARB to determine fuel portfolios likely to be available for California. It addresses the problem of minimizing the cost of fuel supply while meeting the fuel demand. The August 2023 workshop by CARB provided an updated version of the CATS model with a new scenario. To simulate a similar scenario to the CATS model in the FPSM, a scenario called "CATS" was developed by adjusting fuel demand, control parameter scheme, and reduction target trajectory to match those presented in the CATS Example Input file presented at that workshop, to the greatest degree possible.

The CATS fuel demand output is used in a similar way to the TTM results. The output provides an estimate of total fuel demand within aggregated categories. While the total gasoline pool demand projections are close to each other, the CATS scenario presented by CARB projects significantly greater diesel demand than TTM. In the LCT scenario, the demand for petroleum diesel and liquid diesel substitutes diminished more rapidly than in the CATS scenario. The LCT scenario also assumed more transitions to hydrogen fuel cell technology than the CATS scenario.

The CATS control parameter scheme was developed in the FPSM to implement assumptions from the CATS model. For example, instead of using FPSM default CI improvement rates, CI values of fuel each year were imported from the CATS model assumptions and credits from off-road and projects were estimated based on the values from the CATS model. The CI values for ethanol, BD, and RD and SAF over time are shown in Figure 15. The CATS model assumes relatively higher CI values for lipid-based fuels such as BD and RD and SAF, and relatively steady CI values for ethanol. The FPSM by default, assumed a decreasing trend for CI of ethanol. In addition, renewable gasoline was assumed to be less than 20 million gasoline gallon equivalent (mm GGE), and SAF was assumed to be 266 million diesel gallon equivalent (mm DGE) by 2030 with a maximum distillate capacity of 2,060 mm DGE. Blend rates of biodiesel and ethanol into respective counterparts were also adjusted to 17% and 12% respectively. Because of these different assumptions on the blend rates, application of the CATS control parameter scheme to the CATS fuel demand changes the composition of fuel portfolio while keeping the total fuel pool at the same level. Gasoline and diesel pool demand projections with the CATS fuel demand and the CATS control parameter scheme (Figure 16 and Figure 17) are compared with the LCT scenario with the default control parameter scheme.

The most notable difference between CATS and FPSM is in the trajectory of diesel demand. FPSM projects a significant decline in diesel demand due to a broad transition towards ZEVs in most segments of the MD and HD fleets. CATS projects a more modest transition to ZEVs in this space. The differences through 2030, however, are relatively modest and have a limited impact on the capacity of California's fuel system to meet the LCFS targets by 2030. Further research and modeling is warranted to better understand long-run transition dynamics in the MD and HD vehicle space, as well as their impacts on fuel policy.

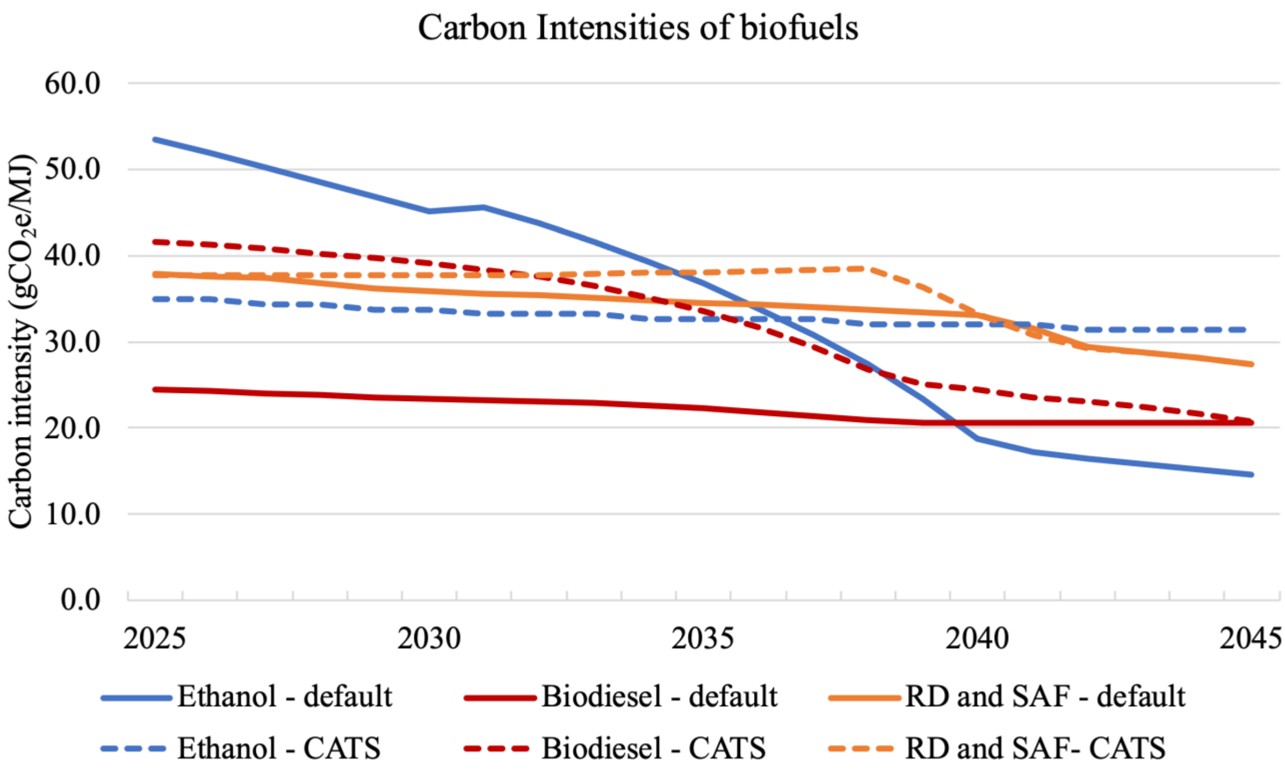


Figure 15. Carbon intensities of biofuels including ethanol, biodiesel, and weight-averaged renewable diesel and sustainable aviation fuel.

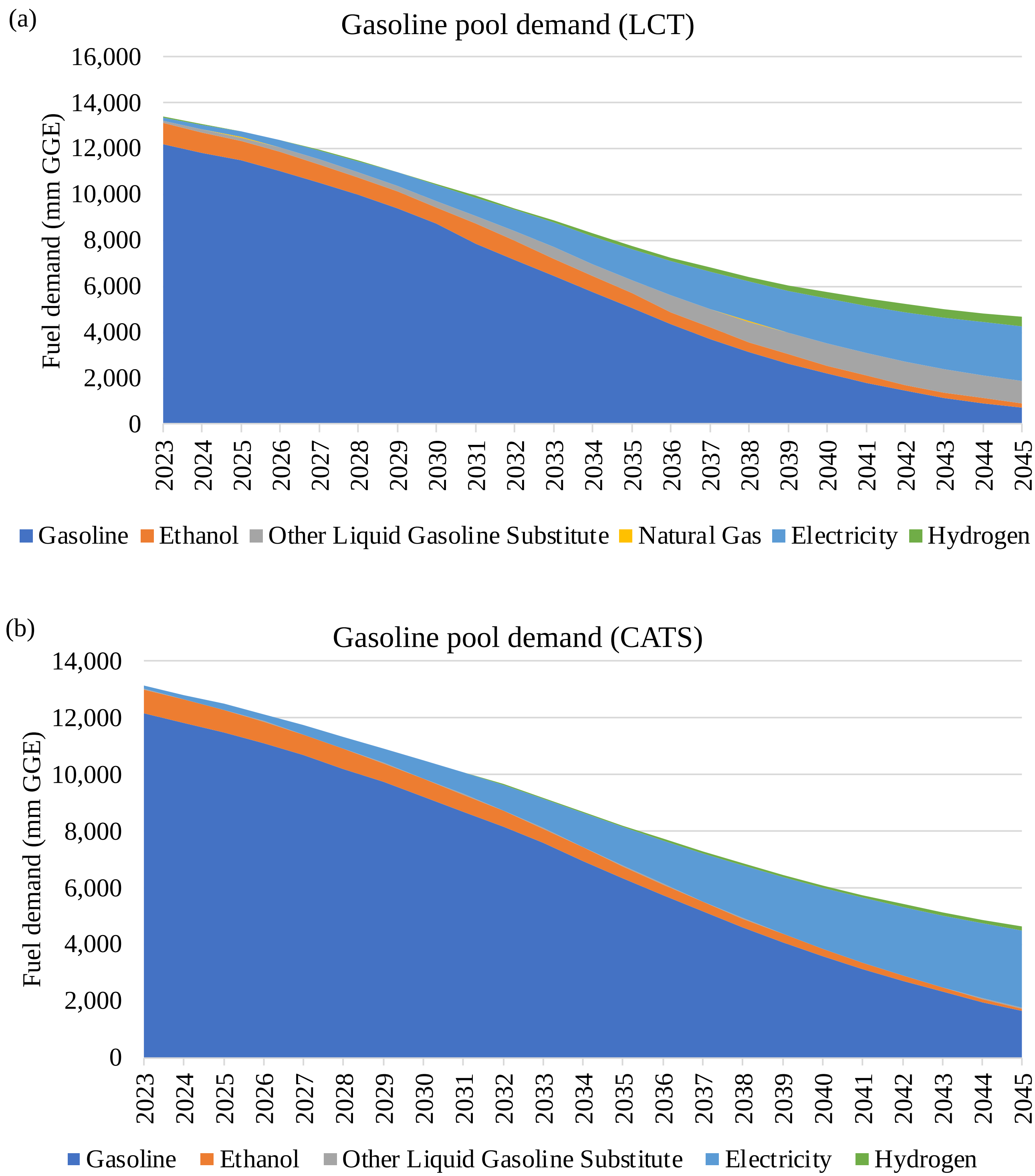
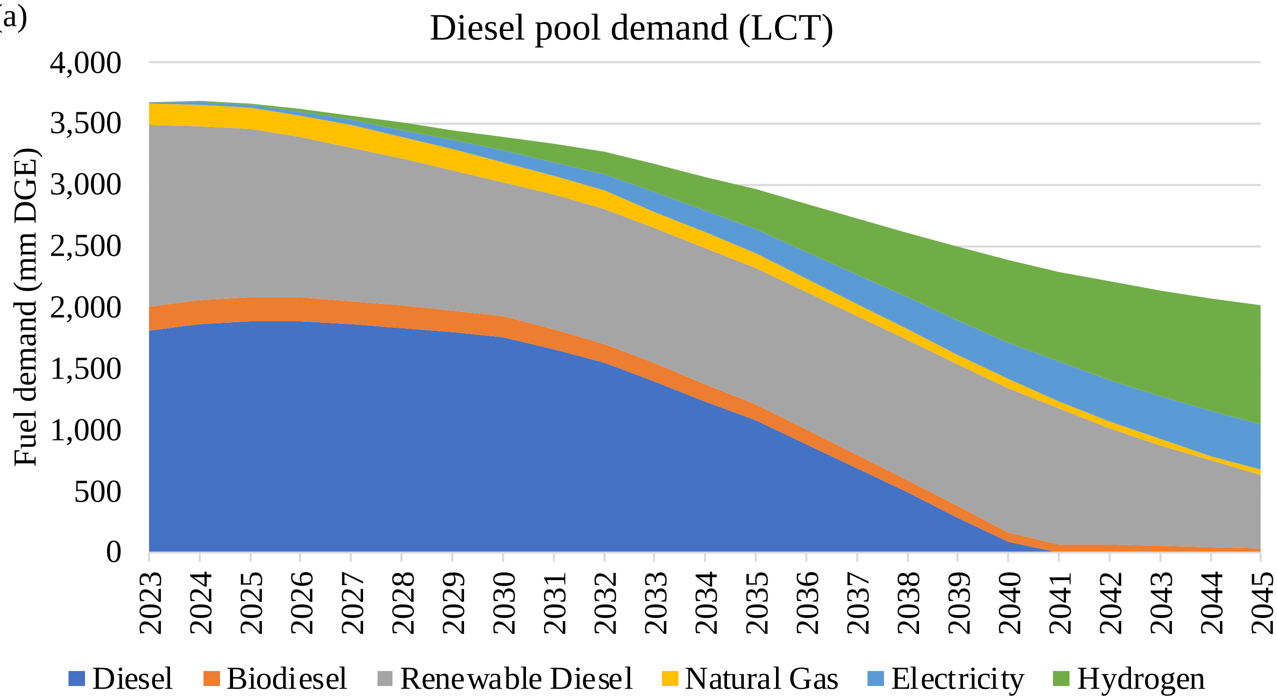


Figure 16. Gasoline pool demand projections for (a) LCT scenario with the default control parameters in the FPSM and (b) CATS scenario with the CATS control parameters.

(a)



(b)

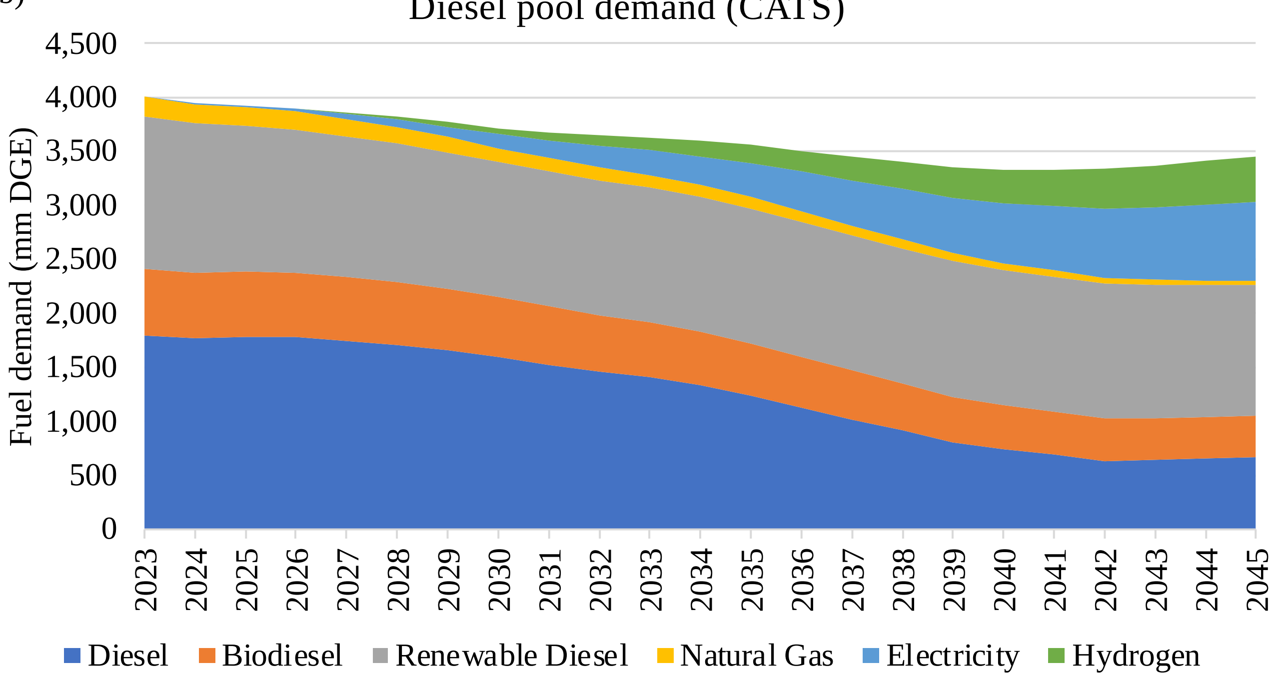


Figure 17. Diesel pool demand projections for (a) LCT scenario with the default control parameters in the FPSM and (b) CATS scenario with the CATS control parameters.

The CATS reduction target is 30% by 2030. The reduction target trajectories for the 30% target in this study and in the CATS model are shown in Table 8. The impact of the CATS target trajectory is discussed in more depth in Section 3.4. In this section, post-2030 target increases for the LCT and DtZ scenarios are set to match the CATS assumption of 4.5 percentage points per year, to facilitate comparison between the two models.

Table 8. Reduction target trajectories for the comparison between this study and the CATS model for the primary 30% target described in this report, the front-loaded 30% target (30% F) and the 30% target trajectory presented in CATS modeling results.

Scenario	2024	2025	2026	2027	2028	2029	2030	2031
30%	12.5	15.5	18.5	21	24	27	30	34.5
30% F	12.5	16.5	20	22.5	25	27.5	30	34.5
CATS	12.5	18.75	21	23.25	25.5	27.75	30	34.5

Based on scenarios and assumptions for the CATS model, net credit balance and credit bank were calculated using the FPSM. Under all target trajectories, the results with the default assumptions showed less net credit balance and thus faster depletion of the credit bank. This is largely due to higher volumes of BD and RD and lower volumes of petroleum diesel with the CATS assumptions. Except for the case with the CATS assumptions and regular 30% target, other cases drop the LCFS market into net deficit generation in the late-2020s. The results with the CATS fuel demand scenario using the CATS control parameter scheme and the results using the default scheme (Table 4) are shown in Figure 18.

These results, considered in context with those presented in sections 3.2 and 3.5, indicate that the combination of modeling assumptions and target trajectory reflected in the CATS model may represent the maximum, or near-maximum limit of ambition for LCFS target increases through 2030. The CATS scenario and modeling assumptions draw down the bank of LCFS credits significantly by 2035 under both the underlying model assumptions from CATS as well as FPSM defaults. While the bank remains positive through 2030, even a relatively gradual post-2030 target acceleration schedule draws the bank down to zero in the early- to mid-2030s. This follows the relationship between pre- and post-2030 target ambition discussed in Section 3.6.

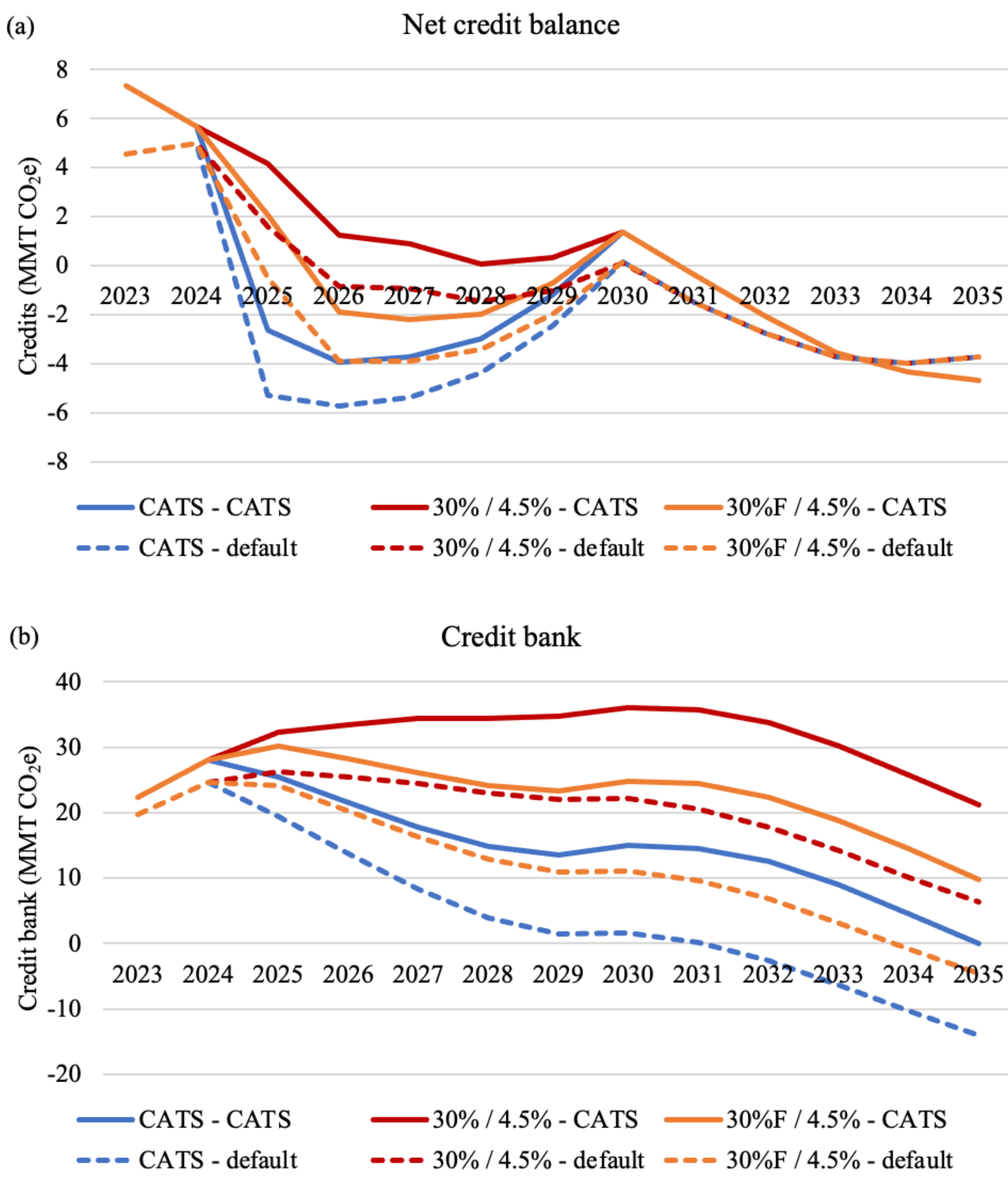


Figure 18. Net credit balance (a) and credit bank (b) for the CATS fuel demand scenario using the CATS control parameter scheme and the default control parameter scheme as shown in Table 4.

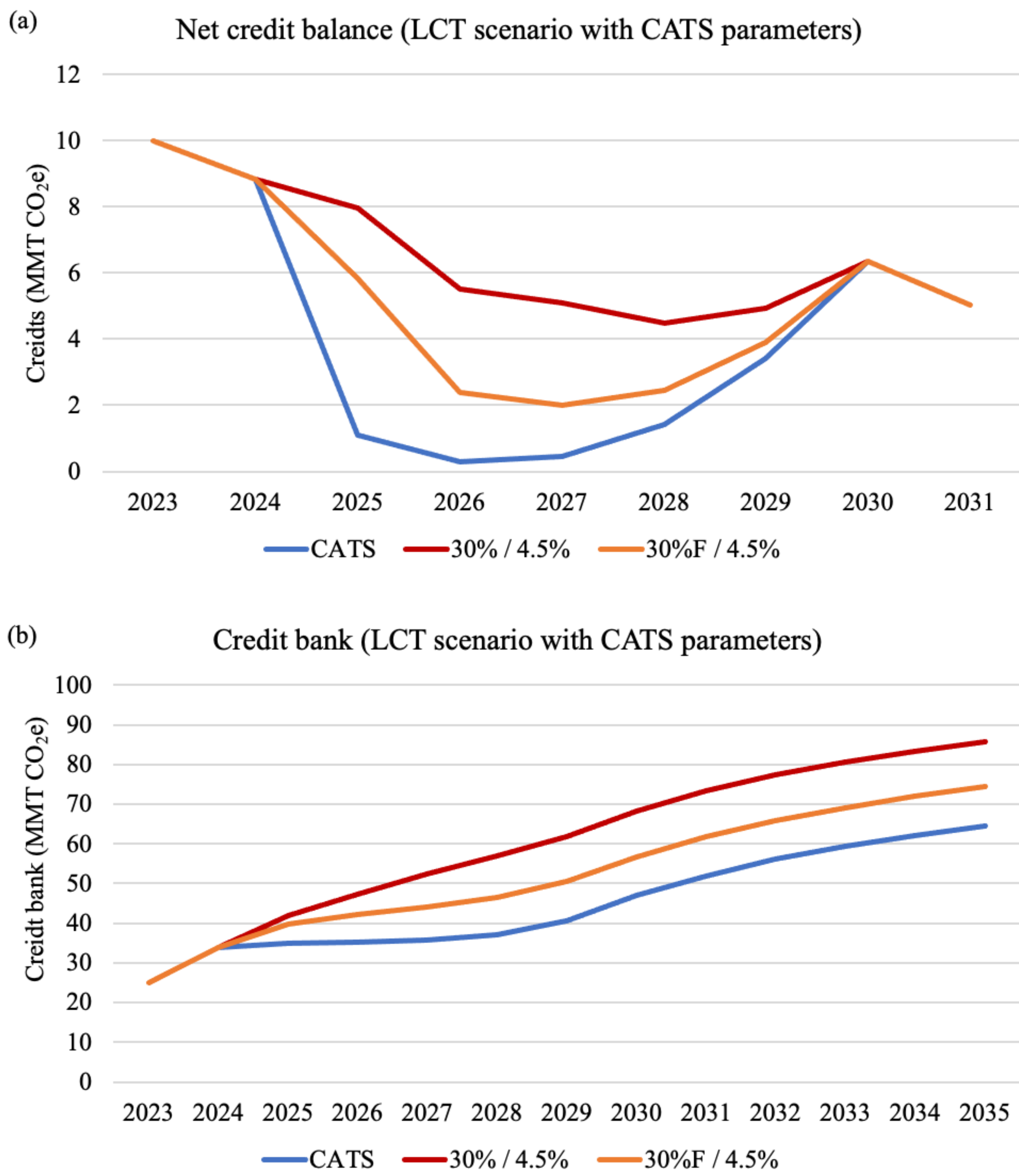


Figure 19. Net credit balance (a) and credit bank (b) for the LCT scenario using the CATS control parameter scheme.

Conclusions

Results of FPSM modeling of several target scenarios under consideration for California's LCFS in a rulemaking anticipated in late 2023 show that the current 20% target is unlikely to support a balanced supply and demand for LCFS credits and that the 30% target proposed by CARB is likely to yield a more balanced market. Targets significantly above 30% risk drawing down the credit bank and leading to growing net deficits. Targets significantly below 30% may not adequately address the existing oversupply of credits. It is important to note that program parameters other than the top-level program target may be changed during the anticipated rulemaking. These changes were not modeled in the work presented here and they would likely have a significant impact on credit supply and demand. Future work is recommended to confirm the approximate balance between credit supply and demand under a wider range of technology, economic, or policy scenarios. This report demonstrates the capacity of FPSM to explore a wide range of policy-relevant scenarios to inform policy development.

The modeling presented here considers two primary scenarios: Low Carbon Transportation (LCT) and Driving to Zero (DtZ), each based on similar assumptions but notably different in the amount of petroleum gasoline consumptions they project. The DtZ scenario assumes significantly more gasoline consumption than LCT. Comparing results from both scenarios offers a sense of the sensitivity of different parameters to assumptions about gasoline demand. The magnitude of this difference was approximately 750 million gallons of gasoline in the mid-2020s and declines slightly over time as fleets shift to EVs. The lower gasoline demand of LCT reduced deficit generation and allowed targets to be around 2-3% higher than DtZ scenarios with comparable credit balance and bank trajectories. This shows the critical importance of accurately projecting gasoline demand as part of fuel portfolio modeling exercises like this. The gap between LCT and DtZ gasoline demand projections is largely due to assumptions about the rebound in post-COVID driving behavior. DtZ assumes a full rebound to pre-COVID driving behavior, LCT assumes that 2022 data reflect the beginning of a new long-term trend; the truth is likely to lie somewhere in between these two points, however they still serve as useful high- and low-demand bounding cases for this analysis. As such, neither should be taken as independently indicative of future behavior.

Another notable finding is the need for rapid target acceleration post-2030. The current target trajectory calls for 1.25% per year annual target increases, and even under a 30% 2030 target, the average annual target increases through the mid-to-late 2020s would average around 3% per year. Given the rapid transition to very high EV sales fractions, however, target increases of 5-6% per year are required to avoid a rapid accumulation of credits that would likely lead to low credit prices. This implies a 55-60% 2035 target following a 30% 2030 target. The rapid acceleration of target levels highlights the need for careful modeling to align expected credit supply and demand to prevent future market imbalances. The FPSM can contribute to this work.

The FPSM modeling presented here also evaluates the impact of different target trajectories to a 30% target. The transition from current target levels to a higher 2030 target can follow a number of different trajectories.

Comparison of several of these, including the default target trajectory from recently released CATS modeling demonstrates that there is considerable flexibility to change the rate at which the target increases during the 2020s without risking credit bank depletion. Even the most front-loaded target trajectory, the one presented in CATS modeling, still maintains a credit bank over 10 million in 2030. Comparison of post-2030 targets, however, shows that the smaller 2030 credit banks associated with higher early ambition reduce the capacity of the LCFS market to support higher post-2030 ambition. In short, this means that there may be a trade-off between pre-2030 ambition and post-2030 ambition. This trade off may have important impacts on the process of transition in California's fuel markets, as well as on the magnitude and distribution of price impacts resulting from higher LCFS targets. The FPSM allows for rapid adjustment of target trajectories for comparative analysis. Further evaluation of such trajectories can help inform decision making.

Evaluation of high-biofuel sensitivity scenarios demonstrate that targets significantly above 30% require assumed ethanol CI increases significantly above historical trends, as well as the consumption of nearly 3 billion gallons per year of lipid-based fuels like renewable diesel, biodiesel, and hydrotreated SAF. While it may be nominally possible for the LCFS program to attain a 40% target in 2030, significant concerns about the sustainability and land use change impacts of that level of biofuel consumption must be addressed. Lower targets would likely support continued modest growth of lipid-based fuels, while relying more on ZEVs to provide the bulk of compliance credit.

The work presented in this paper describes the use of the FPSM model to inform policy making by evaluating policy scenarios that are highly relevant to imminent policy actions. By using models like FPSM, policy makers can design and implement effective fuel decarbonization policies and support the LCFS continued role as part of California's GHG reduction portfolio.

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Comment 401 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Tess
Last Name	Dornfeld
Email Address	tedornfeld@gmail.com
Affiliation	
Subject	Stop propping up fossil fuels and climate scams

Comment

It is extremely difficult not to throw up my hands and give in to cynicism when a policy supposedly meant to lower carbon emissions is in fact incentivizing more fossil fuel production, more pipelines, more CAFOs, more food crops diverted to fuel.

I spent most of 2021 fighting to stop a new tar sands pipeline her in Minnesota, only to learn that the next pipeline proposals threatening our water, our land, our safety and our health are carbon pipelines, carrying emissions from ethanol plants to North Dakota to be used for Enhanced Oil Recovery. I didn't know much about any of these things at the time, but one fact stuck with me the ethanol producers need to lower their carbon intensity so they can take advantage of California's LCFS.

It's not rocket science to know that when carbon emissions are being sent to an area known above all else for fossil fuel production, that's how it's going to be used. But even if you're gullible enough to believe the hype about CCS - after years of empty promises and no time left to be proven wrong - propping up ethanol with this policy is no better anyway.

There's no possible way to justify incentivizing a fuel that's at least as bad and up to 24% worse than gasoline in carbon intensity What is the point of the LCFS? If it's to make money off harming small farmers in Minnesota, off the trafficking of Native women an girls during pipeline construction, off destroying rural water sources with pollution and overuse, then job well done.

392.2 You have more than enough information to address the damage of the LCFS when it comes to ethanol and CCS, and methane crediting, lifecycle assessment, and factory farm biogas. This is your "what did you do when you had the chance" moment. It might not seem like the most glamorous one, but it matters a hell of a lot to all of u whose lives are directly impacted by your decisions.

Attachment

Original File Name	
Date and Time Comment Was Submitted	2024-02-20 23:57:49

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Comment 402 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	John
Last Name	Thornton
Email Address	john@CleanFuture.us
Affiliation	CleanFuture, Inc.
Subject	Comments to LCFS Draft Rules of 19 Dec 2023
Comment	
Attachment	www.arb.ca.gov/lists/com-attach/7087-lcfs2024-VDdTOQdjWGoCagZg.pdf
Original File Name	CleanFuture Comment RE LCFS draft rules posed Dec 19 2023.pdf
Date and Time Comment Was Submitted	2024-02-20 23:59:09

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

CleanFuture, Inc.
P.O. Box 23813
Portland, OR 97281-3813
office: +1 503 427-1968
e-mail: john@CleanFuture.us

February 20, 2024
Liane M. Randolph
Chair, California Air Resources Board
1001 I Street
Sacramento, CA 95812

(Comment submitted electronically)

RE: CleanFuture Comments on the Low Carbon Fuel Standard Rulemaking Package

Dear Chair Randolph:

CleanFuture appreciates the opportunity to provide written comments on the Proposed Amendments to the Low Carbon Fuel Standard Regulation, posted on December 19, 2023. This letter focuses on selected elements of the proposed amendment:

1. Align Deliverability of Low-CI Electricity with other Clean Fuel Standards
2. Establish a temporary CI for biogas to electricity
3. CARB's Proposed Remedy of 4x Penalty for CI Exceedance is Excessive
4. Allow Book and Claim of Biomethane to Off-site Electric Generators
5. Third-party Verification (3PV) of Electricity and Hydrogen for Quarterly Fuel Transaction Reporting (QFTR)

CleanFuture is a leading environmental company that has worked for over a decade to electrify and improve the efficiency of a wide range of vehicle fleets. CleanFuture, Inc. has built a strong platform connecting clean vehicle fleet customers with low carbon fuels (electricity and other fuels), particularly zero and sub-zero CI fuels, serving both on the supply and demand side in multiple programs and jurisdictions.

CleanFuture is an industry leading company connecting clean vehicle fleet customers with low carbon intensity fuels, serving both on the supply and demand side in California's Low Carbon Fuel Standard ("LCFS"), Oregon's Clean Fuels Program ("CFP"), Washington's Clean Fuels Standard ("CFS"), and other emerging clean fuel standards. CleanFuture is a designated credit generator and aggregator for hundreds of fleets and thousands of vehicle units for these state CFS programs. CleanFuture provides full-service low carbon consulting to its clients including fleet efficiency; low carbon fuel utilization; clean vehicles and vehicle technologies; and monetization strategies. CleanFuture has worked for over a decade to improve the efficiency of a wide range of vehicle fleets. CleanFuture is the leading supplier of renewable electricity from biogas as a transportation fuel to heavy-duty EVs in California's LCFS and Oregon's CFP. We also serve as a third-party aggregator and supply funding to fleets to incentivize and advance heavy-duty vehicle electrification and charging stations, while improving economics for biogas to renewable energy projects.

1) Align Deliverability of Low-CI Electricity with other Clean Fuel Standards

Under the existing LCFS regulation, biogas-to-electricity projects participating in the LCFS
must physically wheel the power into California, while RNG projects may be located anywhere
in North America and use book-and-claim accounting to demonstrate use for LCFS
compliance., We acknowledge CARB's proposal to limit book-and-claim accounting for RNG
starting in 2040 but that is a long time away. The most efficient, cost- effective way to make
sure the LCFS program enables the most beneficial projects is to maintain a level playing field
393.1 for pathways that rely on the same feedstock. A major step towards aligning requirements for
projects with the same feedstock (biogas), and unlocking the untapped emissions reductions of
biogas-to-electricity, would be to let such projects utilize book-and-claim accounting anywhere
in the Western Electricity Coordinating Council (WECC), as is already the case in Oregon
under their Clean Fuels Program and in Washington under their Clean Fuel Standard. In the
ISOR staff mention exportability of the LCFS into other jurisdictions, and other jurisdictions
are adopting or aligning their respective clean fuel standards with the LCFS. CleanFuture
requests that CARB reciprocate and adopt beneficial rules and practices that may originate
outside of California.

2) Establish a temporary CI for biogas to electricity

No temporary CI exists for dairy biogas-to-electricity projects and CARB's failure to correct
this discriminates and disadvantages the use of Low-CI electricity in electric vehicles.
CleanFuture received the first certification on a dairy biogas-to-electricity pathway in the LCFS
in 2019 and CleanFuture has certified many Low-CI electricity pathways since and has been
denied a temporary pathway on all pathway certifications. This disadvantages the use of biogas
393.2 into electric transportation fuel for EVS, as compared to biogas to biomethane projects which
have a temporary CI pathway available, especially as CARB's backlog for pathway approvals
has lengthened from a few months into 15 to 24 months.

Project economics for biogas-to-electricity projects is more challenging because they are not eligible to participate in the federal Renewable Fuel Standard. Failure to allow a temporary CI for biogas-to-electricity further disadvantages dairy biogas electricity projects than if those projects were to upgrade and clean that same biogas into biomethane for vehicles.

3) CARB's Proposed Remedy of 4x Penalty for CI Exceedance is Excessive

393.3 CleanFuture incorporates by reference the comments submitted by the RNG Coalition dated
February 20, 2024, which reflect our stance on CARB's proposed penalty for CI exceedance.
agrees that on CARB's. Other stakeholders have expressed similar objections on the proposed

CI exceedance penalty, yet section 2.2 of the RNG Coalition provides substantive comment on this topic.

4) Allow Book and Claim of Biomethane to Off-site Electric Generators

393.4 The current LCFS regulation requires direct connection of biogas to the generator, however we urge CARB to allow book and claim biomethane to electricity if for electric vehicle charging. CleanFuture has many large fleet clients with inadequate electric supply capacity at fleet depot locations, with Advanced Clean Fleets (ACF) and other requirements for zero emission vehicles this is a monumental challenge. Allowing book and claim electricity for biomethane (offsite from the digester) yet local to electric vehicle fleet fueling would bolster and alleviate electric distribution constraints at freight and goods movement facilities.

5) Third-party Verification (3PV) of Electricity and Hydrogen for Quarterly Fuel Transaction Reporting (QFTR)

CleanFuture is supportive of moving towards 3PV of quarterly fuel transaction reports (QFTR) if the verification protocols and guidelines for electricity and hydrogen can be reasonably matched with the characteristics of dispensing these fuels high transaction counts of relatively low transaction value across diffuse and diverse vehicle applications.

393.5 The established third-party verification (3PV) of QFTR in liquid and gaseous fuels is at the wholesale distribution level, however CARB fails to recognize that verification of QFTR for electricity and hydrogen would be analogous to 3PV of every retail gasoline or diesel fuel fill-up. This is excessively burdensome and costly.

CleanFuture recognizes the “less intensive verification” in the proposed rule text as a step in the right direction. However, this is excessive to require site visits to every electricity and hydrogen dispensing location. Or perhaps staff intend this to mean a site visit to a reporting entity or aggregator, yet this is overly costly and burdensome even at a central office location where a remote desk audit of electronic transaction data could work. While CARB staff surveyed verification bodies (VB) on potential 3PV of QFTRs for EVs and hydrogen for preliminary scoping, however VBs are unfamiliar with EVs and hydrogen fueling and as such provided inadequate or flawed feedback to staff.

CleanFuture encourages CARB to reconsider proposed 3PV requirements related to electricity and hydrogen QFTR, CARB must more carefully consider protocols and requirements for zero emission vehicle transactions at the retail level. We suggest CARB should defer and instead phase in 3PV of these QFTR until after CARB convenes workgroups with fuel reporting entities and third-party verification bodies to allow development of specifics on sampling plans and verification requirements. f

CleanFuture comments CARB on the success of the LCFS of incentivizing the adoption of low carbon fuels and technologies. Thank you for your consideration of these comments. Please advise if any further input on these issues would be constructive.

Sincerely,

John A. Thornton, President
CleanFuture, Inc.

Comment Log Display

Here is the comment you selected to display.

Comment 403 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Barry
Last Name	Sedlik
Email Address	barry.sedlik@calbizventures.com
Affiliation	California Business Ventures
Subject	Comments on LCFS2024
Comment	Please see attached file.
Attachment	www.arb.ca.gov/lists/com-attach/3-0-BnVXNABlBTpQP1A7.pdf
Original File Name	sedlikcomment.pdf
Date and Time Comment Was Submitted	2024-02-21 11:24:10

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

California Business Ventures

Barry R. Sedlik, President
barry.sedlik@calbizventures.com

February 19, 2024

Clerks' Office
California Air Resources Board
1001 I Street
Sacramento, California 95814

Re: Comments on Proposed Low Carbon Fuel Standard Amendments

Electronic Submission

Dear California Air Resources Board:

The attachment to this letter constitutes my comments on CARB's Proposed Low Carbon Fuel Standard Amendment (lcfs2024) in response to the Request for Comments solicited on December 19, 2023.

My comments focus on four areas related to the computation of Carbon Intensity ("CI") values using the CA-GREET models and suggestions to enhance the value of the Current Pathways Database. Specifically, these include the following:

1. Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways.
2. Insufficient identification of source data.
3. Prospective inconsistencies in statistical methods used to compute CI values.
4. Comparable use of emission factors.
5. Suggestions to enhance the value of the Current Pathways Database.

For the public, fuel producers, and fuel users to have confidence in the LCFS process, it is essential to have consistent and transparent computation of CIs. Such attention will aid CARB in tracking progress on attaining state goals, assuring compliance and help fuel producers and users make informed investment and selection decisions.

Thank you for the opportunity to comment on the proposed amendments.

Sincerely,

Barry R. Sedlik

Attachment

O: (323) 256-1927 M: (213) 610-1010 · Fax: (323) 254-4997
415 Elmwood Drive · Pasadena, CA 91105

COMMENTS OF BARRY R. SEDLIK REGARDING PROPOSED LOW CARBON FUEL STANDARD 2024 AMENDMENTS

My comments focus on four areas related to the computation of Carbon Intensity ("CI") values using the CA-GREET models and suggestions to enhance the value of the Current Pathways Database. Specifically, these include the following:

394.1
1. Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways.

394.2
2. Insufficient identification of source data.

394.3
3. Prospective inconsistencies in statistical methods used to compute CI values.

394.4
4. Comparable use of emission factors.

394.5
5. Suggestions to enhance the value of the Current Pathways Database.

For the public, fuel producers and fuel users to have confidence in the LCFS process, it is essential to have consistent and transparent computation of CIs. Such attention will aid CARB in tracking progress on attaining state goals, assuring compliance and help fuel producers and users make informed investment and selection decisions.

I address each of these items briefly below.

394.1 cont
1. **<u>Ability to independently replicate computation of the Carbon Intensity (CI) values using the CA-GREET models relative to published Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways.</u>** After a concerted effort to use either the CA-GREET3.0 or CA-GREET4.0 models downloaded from the CARB's LCFS website, I was unable to replicate the computation of the CI's presented in the "Low Carbon Fuel Standard Annual Updates to Lookup Table Pathways" document posted on January 23, 2024. I believe there are several reasons for this:
    a. Both the CA-GREET3.0 and CA-GREET 4.0 models have an incomplete and inconsistent indexing process to map various regions with their respective technology and emission factors. The original GREET model used the 10-region North American Electric Reliability Corporation ("NERC") breakdown to define regional characteristics regarding electric system technology configurations and operations. The GREET models later adopted the finer-grained USEPA, eGRID region map that contains 26 subregions. In neither the 3.0 nor 4.0 models are data mapped correctly. There appears to be no eGRID specific data in either version, but the model reverts to a table containing only the 10 NERC region data. In addition, when specifying "User Defined" data elements, the indexing mechanism selects NERC Region 2 data, which reflect data for NERC Region ASCC, the Alaska Systems Coordinating Council. This error is significant as it is not clear to the user that User Defined data are being used in the computations.
    b. On a related matter, the GREET4.0 model contains a table of factors on a state basis, but there is no means to access that table directly. It appears that a user would have to cut and paste the state-specific data into the NERC ASCC column of Alaska factors and relabel in order to use that data. The same applies to entering California specific data as provided in the Annual Update document.

394.1 cont

c. With respect to the Lookup Table Pathways document, the text states that "Feedstock Production" is computed from the "U.S Average Mix" (page 4). However, in the various computations of feedstock production CIs in the document (p9, p10, p11, p12, and p13), it appears that California rather than US average fuel mixes are used.

d. In the CA-GREET4.0 model, the separate pulldown menus for "Feedstock" and "Fuel" to calculate respective emissions from two regions has either been dropped or otherwise obscured. This is an important distinction as Feedstock emissions are computed on an U.S. Average basis and Fuel emissions from use are computed on a localized basis, e.g., California state. Without a clear distinction and labeling, a user of CA-GREET4.0 would otherwise have to compute results in two separate computation sets and independently add the results to compute the total.

As a consequence of the above errors and discrepancies, proper computation of CIs would require substantial independent analysis and validation. It is essential that these errors be corrected. In addition, future releases of the Annual Updates to Lookup Table Pathways should be accompanied with a populated data set of the proposed changes in the CA-GREET model so users can follow how the CIs are computed in the model.

394.2 cont

2. **Insufficient identification of source data.** The CA-GREET3.0 and CA-GREET4.0 models have no internal documentation other than a few generic cell comments about the sources of the various data sets used by the model. Without such documentation, it is impossible to determine the source data for emission factors, efficiencies, fuel characteristics, resource mixes, technology mixes, etc. The problem is compounded as the model draws upon U.S.EPA date from its eGrid model and AP-42 emissions data, U.S. Energy Information Administration for its State Energy Data System ("SEDS"), the California Energy Commission for California generation data by fuel and source, as well as CARB's own Emission Factor ("EMFAC") database, among other sources.

   As most of the data sources are compiled on an ongoing basis, it is also important to know the year or vintage of each to make sure that computations can be constructed on a consistent basis as well as to facilitate data validation.

   Many of the data items in CA-GREET3.0 and CA-GREET4.0 appear to be cut and paste entries from other sources without appropriate attribution. While the Update document attempts to provide some source documentation, it is also incomplete. For example, in the current January 23, 2024 update, various references to Form EIA-923 data are made that state, "2022 Form EIA-2023 dataset for NG plants located in California [are being used whereas] in prior annual updates, the 2017 Form EIA-923 national dataset for NG plants was used." However, no such references are provided for data items used for oil, coal, or biomass. Were the oil, coal, and biomass data items similarly updated or are the 2017 data items still being used?

   Another example of an inconsistent data item of substantial importance is the estimated electric system transmission and distribution losses. In the CA-GREET models, the loss factor is defined as 6.5 percent (Electric Sheet Cell D101). However, the US EPA eGRID 2022 database shows estimated average NERC WSCC Region (including California) and US wide T&D losses at 5.1 percent (eGRID2022,tab GGK22, Cells F7 and F8, respectively). There is no data source defined

394.2 cont

for the 6.5% loss factor. Should the loss factor be in error, the higher loss factor contributes to an across the board increase in CIs for all electric production.

In the interests of transparency and data integrity, all data items within the CA-GREET model should have a definitive source and vintage embedded within the model. A separate reference page with complete citations with a corresponding entry for each data table or data item (e.g., T&D losses) would be a substantial improvement. In addition, the annual updates should apply equal rigor to data sources.

394.3 cont

3. **Prospective inconsistencies in statistical methods used to compute CI values.** While there may be documentation that describes various motivations for using certain statistical and technical conventions within the CA-GREET model and its GREET model predecessor, I was unable to determine reasoning for a few items that may have modest or significant impact on the computation of CIs.

   With respect to statistical computations, two different methods are used to compute averages. In the Electric sheet for Power Plant Conversion Efficiencies for each technology within a fuel type, the average for the fuel type is calculated using a weighted harmonic mean. This appears to be consistent with good statistical practice that weighted harmonic mean determinations are appropriate when applied to rates as is the case with computations for Power Plant Energy Conversion Efficiency (e.g., Cells H60, H64, H69,and H72 on the Electric Sheet).

   However, when computing the average emission factors for each fuel based on the same relative proportion of technology types for the fuel, arithmetic weighted averages are used (e.g., Cell B107 on the Electric sheet and Cell B579).

   As both sets of computations deal with rates, it would be helpful to know if these disparate methods are intentional or an artifact of model construction. If an artifact, then appropriate reformulation of the calculations should be undertaken to maintain computational integrity. All mean calculations throughout the model should be examined and reformulated as required.

394.4 cont

4. **Comparable use of emission factors.** The CA-GREET model provides several different sources to compute emission factors. Among these are computations from emission testing/monitoring of in-use combustion processes (e.g., oil-fired boilers, natural gas-fired combustion turbines, and IC engines) and theoretical computations based on the stoichiometric carbon content of the fuel of interest coupled with an estimate of the conversion efficiency of the corresponding technology. For example, it appears that US EPA's eGRID database uses emission factors based on actual prime mover performance whereas the CA-GREET model computes stochiometric-based emission factors (see CO2 Emission Factor in Cell B16 on EF Sheet).

   While it may be appropriate to use both emission factor methods to determine aggregate CO2e emission estimates for a particular fuel, there should be some discussion to maintain an "apples to apples" basis.

   Specifically, the operation of any fuel combustion prime mover whether steam-fired boiler, combustion turbine, or IC engine, requires excess air to reduce NOx formation and optimization of efficiency.

394.4 cont For a gas-fired steam boiler, optimal excess air is approximately 10 percent, for a natural gas-fired combustion turbine, the optimal excess air percentage is 10 percent to 15 percent, and for an IC engine driven genset, the excess air optimal range is approximately 10 percent to 30 percent

As the CO_2 in atmospheric air is non-reactive in the combustion process but just passes through as part of the excess air mix, its presence in boiler, turbine, or engine exhaust is not derived from the carbon within the fuel.

Consequently, emission factors derived from exhaust measurements of combustion processes should be corrected to account for the portion of the non-reactive CO_2 component of excess air in the CI computation.

394.5 cont

5. **Suggestions to aid fuel users make informed decisions regarding fuel supplier selections.** At the end of the day, it would be desirable for California fuel users to access the posted Current Pathways database so they can make an informed decision regarding the CIs of available fuels to help them make an informed economic decision for the alternative fuel and technology that best meets their needs. That is not possible at the moment since fundamental fuel characteristics such as heat content and fuel density are not displayed in the Current Pathways database. Furthermore, it appears that fuel providers consider such information proprietary and redacted from most Application Packages. Consequently, rather than be able to conduct their own investigation of available fuel alternatives, fuel users need to rely on third party providers or direct contact with the producer to determine if a particular fuel will meet their needs.

   It is unclear why such basic information is considered proprietary. Disclosure of such fundamental characteristics would facilitate more efficient market performance.

   CARB should consider revising the current practice of withholding basic fuel specification as proprietary and encourage producers to post such information voluntarily.

This concludes my comments.

/s/

Barry R. Sedlik
California Business Ventures

Comment Log Display

Here is the comment you selected to display.

Comment 404 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Caroline
Last Name	Hobbs
Email Address	chobbs@portofsandiego.org
Affiliation	Port of San Diego
Subject	Port of San Diego LCFS Amendments Letter of Support
Comment	Please attached document
Attachment	www.arb.ca.gov/lists/com-attach/4-0-B2RRNlIhBDhXPVc+.pdf
Original File Name	Caroline Hobbs - LCFS Comment - Signed 2.20.24 Support Proposed Low Carbon Fuel.pdf
Date and Time Comment Was Submitted	2024-02-21 12:01:34

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

PORT of SAN DIEGO

February 20, 2024

California Air Resources Board
1001 I Street
Sacramento, CA 95814

RE: Proposed Low Carbon Fuel Standard Amendments – SUPPORT

Dear Members of the California Air Resources Board,

395.1 The Port of San Diego (District) is pleased to express its strong support for the proposed Low Carbon Fuel Standard (LCFS) Amendments, as presented during the public workshop on August 16, 2023, and detailed in the Standardized Regulatory Impact Assessment of September 8, 2023.

395.2 The District fully endorses the objective of increasing carbon intensity reduction targets and extending the LCFS program through 2045. These amendments align with its commitments outlined in the Maritime Clean Air Strategy (MCAS) and are pivotal for achieving significant progress in reducing carbon emissions associated with its operations.

Under the groundbreaking Intergovernmental Support Agreement (IGSA) between Navy and Port of San Diego in 2022, funds generated from the sale of LCFS credits are used to begin significant upgrades to the electrical infrastructure at Naval Base San Diego and the Port of San Diego. Since the signing of that agreement, $14.5 million has been generated from the sale of LCFS credits. The Navy's participation in this program is the first-ever participation by the Department of Defense in this type of carbon reduction effort.

To date, the District has utilized the funds to implement two new shore power systems, acquire two pickup trucks for the Port's own fleet of vehicles, and procure five new yard tractors. Furthermore, the District's ambitious plans for future projects include two additional shore power implementations, ten electric yard tractors, Electric Vehicle Supply Equipment (EVSE), and a substantial expansion of electric trucks within the District's own fleet, of approximately 80 vehicles.

395.3 However, low prices of LCFS credits challenge the Port's ability to fund these essential projects. The District understands the dynamic balance between supply and demand in the LCFS credit market, but kindly requests the California Air Resources Board (CARB) consider expediting the timeline for implementing these amendments.

While the District acknowledges the prevailing surplus and the influx of renewable diesel into the state, it is concerned about the foreseeable bear market predicted for 2024 and 2025. Therefore, **the District appreciates your careful consideration of its request to expedite the implementation of the proposed LCFS Amendments**.

Thank you for your shared dedication to advancing environmental sustainability and your ongoing partnership with the District's efforts to improve air quality in California. The District looks forward to continued collaboration with CARB to create a cleaner and more sustainable future.

Sincerely,

Job Nelson
Vice President, Strategy & Policy

Comment Log Display

Here is the comment you selected to display.

Comment 405 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Kristina
Last Name	Gallagher
Email Address	kgallagher@counties.org
Affiliation	California State Association of Counties
Subject	CSAC Comments - Proposed Low Carbon Fuel Standard
Comment	Hello - Please see the attached California State Association of Counties (CSAC) letter on the Proposed Low Carbon Fuel Standard Amendments.
Attachment	www.arb.ca.gov/lists/com-attach/5-0-BW5TJ1E5UXFQIglg.pdf
Original File Name	Kristina Gallagher - LCFS Comment.pdf
Date and Time Comment Was Submitted	2024-02-21 12:18:30

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

February 20, 2024

California Air Resources Board
1001 Street
Sacramento, CA, 95814

Subject: Concerns on the proposed Low Carbon Fuel Standards Rulemaking

Dear Members of the California Air Resources Board:

On behalf of the California State Association of Counties (CSAC), representing all 58 counties in the state, I write to express concerns on the regulatory proposal by the California Air Resources Board (CARB) to regulate jet fuel under the Low Carbon Fuel Standard (LCFS) program.

396.1 CSAC is committed to environmental stewardship and recognizes airports' critical role in a balanced transportation system. We are proud of our county airports' advances towards reducing their carbon emissions. Although we recognize how these proposed regulations support the State's broader goals for sustainability and environmental protection, the proposal to regulate jet fuel usage presents several challenges that could disproportionately affect county airports. Many county airports are not equipped with the infrastructure necessary for Sustainable Aviation Fuel (SAF) and Jet A blending, nor do they have the financial resources to undertake such significant upgrades. Implementing these upgrades will negatively impact their operations and services, exposing them to be in violation of federally mandated grant assurances and Federal Aviation Administration (FAA) policy.

We recognize and appreciate California's leadership in adopting SAF. However, we are concerned that the proposed regulations do not account for the significant infrastructure upgrades required for SAF and Jet A blending, particularly at general aviation airports. The logistics of transportation and storage for SAF, which differ from conventional jet fuel, pose additional challenges. Implementing this proposal could impose substantial operational burdens on county airports, potentially disrupting the progress toward our state's sustainable aviation future.

County airports play a vital role in the state transportation system and support numerous ancillary industries, it is imperative to consider the operational implications of this regulation carefully, not to mention the risk of losing federal entitlement monies by being in violation of federal grant assurance policies. We must avoid creating an aviation environment within our State where regulatory compliance costs undermine the viability of county airports. County airports are a vital part of the transportation system and delivery of emergency fire services in communities across California.

We urge CARB to reconsider this proposal, given the unique circumstances of county general aviation airports. Instead of a one-size-fits-all approach, we advocate for a strategy that includes grants for infrastructure upgrades and a phased implementation plan that allows county airports to transition to SAF usage without compromising their federal obligations and operational or financial stability.

In conclusion, we respectfully request that CARB preserve the existing opt-in approach for SAF, collaborate with county airports to address the complexities of SAF integration and focus on realistic policies that facilitate a smooth transition to a greener aviation future in California.

Thank you for your attention to this critical matter.

Sincerely,

Mark Neuburger
Legislative Advocate
California State Association of Counties

Comment Log Display

Here is the comment you selected to display.

Comment 406 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Susana
Last Name	Gonzalez Edmond
Email Address	susana@edmondgroupllc.com
Affiliation	Edmond Group
Subject	Public Comment for Proposal to Regulate Jet Fuel
Comment	Please see attached file. Submitted on behalf of commenter having technical difficulties by Clerk of the Board.
Attachment	www.arb.ca.gov/lists/com-attach/7-0-B2ICYFY6VGgAaAJm.pdf
Original File Name	edmondcomment1.pdf
Date and Time Comment Was Submitted	2024-02-21 15:58:00

If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

COTB@ARB

From:	Susana Gonzalez Edmond <susana@edmondgroupllc.com>
Sent:	Wednesday, February 21, 2024 11:29 AM
To:	ARB Clerk of the Board
Subject:	Public Comment for Proposal to Regulate Jet Fuel
Attachments:	2024-02-20- LetterofOpposition_CARB proposal - 20240118.pdf
Follow Up Flag:	Follow up
Flag Status:	Flagged
Categories:	

CAUTION: This email originated from outside of the organization. Do not click links or open attachments unless you recognize the sender and know the content is safe.

Good morning,
I have been experiencing technical difficulties since yesterday to submit public comments on behalf of the Long Beach Area Chamber of Commerce to the CARB Board regarding the plans to regulate jet fuel. Please accept our attached letter and let me know if there is anything else I would need to do. Thank you for your attention. Susana

Susana Gonzalez Edmond, Principal
susana@edmondgroupllc.com
O (562) 532-7600 **M** (562) 519-1563
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The Chamber
Long Beach Area Chamber of Commerce

February 20, 2024

Liane M. Randolph
John Eisenhut
Susan Shaheen, Ph.D.
John R. Balmes, MD
Diane Takvorian
Cliff Rechtschaffen
Dean Florez
Hector De La Torre
Davina Hurt
V. Manuel Perez
Eric Guerra
Nora Vargas
Tania Pacheco-Werner, Ph.D.
Gideon Kracov
Henry Stern, Senator, Ex Officio Member
Eduardo Garcis, Ex Officio Member

California Air Resources Board
P.O. 2815
Sacramento, CA 95812

Re: Opposition to California Air Resources Board Proposal to Regulate Jet Fuel

Dear CARB Board Members,

The Long Beach Area Chamber of Commerce is writing to share our serious concern and opposition to the recent California Air Resources Board (CARB) proposal to regulate jet fuel under its Low Carb Fuel Standard (LCFS) program.

The Long Beach Area Chamber of Commerce is a non-profit business association with approximately 800 members, both individual and corporate, representing the majority of the city's private sector and virtually every economic interest of the city. The Long Beach Chamber acts on behalf of the business community to improve the city's economic and jobs climate by representing businesses on a broad range of legislative, regulatory, and legal issues.

-continued-

1 World Trade Center, Suite 1650, Long Beach, CA 90831-1650
Phone (562) 436-1251 • Fax (562) 436-7099 • info@lbchamber.com

The U.S. airline industry plays a vital role in California's economy. Furthermore, the industry is committed to reducing its climate impact and achieving "net zero" carbon emissions by 2050. Transitioning to Sustainable Aviation Fuels (SAF) is core to this commitment, and the industry has pledged to work with governments and other stakeholders to make three billion gallons of SAF available in the United States by 2030. Achieving these goals requires new and additional policy incentives, streamlined permitting processes, and close collaboration among airlines, fuels industry, manufacturers, environmental organizations and governments, among others.

With respect to SAF, California has established itself as an early leader in attracting investment, production, and use of SAF through the existing Low Carbon Fuels Standard (LCFS) Program, which provides an opt-in credit for SAF that helps reduce the price difference between SAF and conventional jet fuel. This voluntary regulatory structure has been successful in enabling the growth of the SAF market in California and across the country. CA has the most viable market for SAF today in the United States and as airlines increase their demand for SAF the market continues to grow.

Aviation accounts for 2.6% of the US GHG emissions but 5% of US GDP and 4.1% of CA's GDP. There are 380 thousand employees of US Commercial aviation firms based in California, with an overall economic impact of $194 billion[1]. Aviation is critical to driving California's economy and it's rank as the 5th largest economy in the world, enabling $114 Billion in annual trade flows and underpinning the of many of the rest of California's biggest economic drivers such as agriculture, tourism, manufacturing, banking, technology and small business. Ensuring a healthy and vibrant aviation industry is essential to California's future, and leveraging CARB's early leadership on SAF can enable California leadership in the emerging SAF production industry, creating new jobs and economic development opportunities.

With this context, we express our serious concern with a new proposal by the California
Air Resources Board (CARB) to regulate jet fuel as an obligated fuel under the LCFS
397.1 Program. CARB's proposed changes to the LCFS program include a proposal to
eliminate the existing exemption for conventional jet fuel use for flights within the state
of California. This proposed change is unlikely to result in increased SAF production,
availability, or use in California, but would lead to higher jet fuel prices. The primary
impediment to increased SAF production and availability in California remains the
higher cost of SAF for producers and buyers relative to conventional jet fuel and
renewable diesel. The CARB proposal would not meaningfully address this fundamental
challenge and therefore unlikely to meaningfully increase SAF supply or use.

The proposal seeks to regulate jet fuel and reduce emissions from aviation, both of
397.2 which are pre-empted under federal law a fact that CARB recognized when it
exempted jet fuel in 2018.[2]. Aviation has unique circumstances, that go beyond

[1] The Economic Impact of Civil Aviation on the U.S. Economy, State Supplement, US Department of Transportation, November 2020

[2] CARB stated that "[s]ubjecting aircraft fuels to annual carbon intensity standards would raise federal preemption issues" *available at*

considerations of interstate commerce, for the safe operation and maintenance of aircraft that the federal government has recognized in the EPA's Clean Air Act and the jurisdiction of the FAA. These statutory authorities establish clear and broad federal authority for regulating jet fuel and aircraft engine emissions that pre-empts California from regulating jet fuel under the LCFS program.

Moving forward with eliminating the fossil jet fuel exemption and implementation of a new obligation will likely result in litigation that will be lengthy, costly and do nothing to advance the mission of more SAF production and uplift. Engaging in litigation will divert resources from the state and the aviation industry that would be better spent enabling greater SAF production. Our mutual interest is to increase SAF production, availability, and use and the most effective way to accomplish this is to continue the positive, collaborative approach represented by the existing "opt-in" mechanism developed by CARB and the aviation community.

Based on these considerations, we urge CARB to reconsider and withdraw the proposal to remove the exemption for jet fuel for intrastate flights and instead preserve the existing opt-in approach for SAF and partner with the aviation sector and stakeholders across the emerging SAF ecosystem on new policies and approaches to rapidly increase the availability of SAF in California. We urge CARB to focus on the ultimate goal – how to get more SAF into planes in California by reducing barriers to production, availability and use.

Sincerely,

Jeremy Harris
President & CEO
Long Beach Area Chamber of Commerce

JH:sge

---

https://ww2.arb.ca.gov/sites/default/files/barcu/regact/2018/lcfs18/isor.pdf?_ga=2.259407882.1202437490.1641231788-253234234.1573227006

Comment Log Display

Here is the comment you selected to display.

Comment 407 for Proposed Low Carbon Fuel Standard Amendments (lcfs2024) - 45 Day.

First Name	Brittany
Last Name	Benesi
Email Address	brittany.benesi@aspca.org
Affiliation	ASPCA
Subject	LCFS 2024 Comments - ASPCA
Comment	Please see attached letter. Comment was submitted to LCFSWorkshop@arb.ca.gov on 2/16/24.
Attachment	www.arb.ca.gov/lists/com-attach/4-cosip23-WzoAdV0sWWkCZQlW.pdf
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If you have any questions or comments please contact Clerk of the Board at (916) 322-5594.

Board Comments Home

Liane M. Randolph, Chair
California Air Resources Board
1001 I Street
Sacramento, CA 95814

February 16, 2024

Re: ASPCA Comments on Proposed Low Carbon Fuel Standard Amendments (lcfs2024)

Dear Governor Newsom, Chair Randolph, and Members of the California Air Resources Board (CARB),

Thank you for the opportunity to provide comments to the California Air Resources Board's (the Board) Public Hearing to Consider Proposed Low Carbon Fuel Standard (LCFS) Amendments. This is a great opportunity to enhance California's efforts and commitment to mitigating the climate crisis, establishing the future we envision for our environment, economy, and communities – for people and animals alike. If our vision is for a resilient, thriving, and equitable future, it is imperative that we continue to reflect upon what we can do better, take a critical eye to business as usual, and incentivize the transition to a more humane and sustainable future.

Founded in 1866, the ASPCA® (The American Society for the Prevention of Cruelty to Animals®) was the first animal welfare organization to be established in North America and today serves as the nation's leading voice for vulnerable and victimized animals. As a 501(c)(3) not-for-profit corporation with more than two million supporters nationwide and over 200,000 supporters in California, the ASPCA is committed to preventing cruelty to dogs, cats, equines, and farm animals throughout the United States.

Originally intended as a tool to combat climate pollution in the transportation sector, the LCFS has become one of the nation's largest and most lucrative pollution trading enterprises for factory farm biogas. This shift has inadvertently perpetuated harmful outcomes rather than serving its original environmental objectives. By offering yet another revenue stream, the LCFS is driving the construction of more factory farms and factory farm biogas projects in states far from California, causing significant harm to animals, air, water, public health, rural economies, and overall quality of life. Current practices in the LCFS, such as "avoided methane crediting" and potentially inaccurate life cycle assessments, not only enable pollution but disproportionately harm low-income communities and communities of color where factory farms are often located.

In order to address these issues with the proposed LCFS, the ASPCA asks you to consider the following reforms to the LCFS:

398.1 1. Eliminate "avoided methane crediting" in 2024.

398.2 2. Address the potential for inaccuracies in the Life Cycle Assessment that ignore associated up and downstream greenhouse gas emissions from factory farm gas production.
398.3 3. Remove the 10-year "grace period" for factory farm gas producers.
398.4 4. Stop the potential for “double counting” by allowing factory farm gas projects paid for and claimed by other programs to sell LCFS credits as well.

CARB holds a pivotal opportunity this year to adopt new rules that align the LCFS with California's environmental justice commitments. Environmental justice, zero emission, and climate advocates have presented a clear alternative to the current policies that heap lavish rewards on the biggest polluters through the Comprehensive EJ Scenario. We urge CARB to adopt those recommendations and heed the communities in the state with the most significant exposure to air pollution.

We implore you to lead the charge in creating a resilient, thriving, and equitable future. Now is the time to reform the LCFS to protect communities most affected by its current flaws. Your decisive action in this critical matter will demonstrate your continued commitment to bold climate action rooted in justice.

Thank you for the opportunity to provide comments for the Public Hearing to Consider Proposed Low Carbon Fuel Standard Amendments. For any questions or follow-up, please contact Brittany Benesi at brittany.benesi@aspca.org.

Sincerely,

Brittany Benesi
Senior Legislative Director, California
American Society for the Prevention of Cruelty to Animals