California’s LCFS: Unlocking Value in Low-Carbon Liquid Fuels
Building equitable low-carbon policy

Part 1: California Low-Carbon Fuel Customers

A Propel Fuels White Paper, December 2017
Authors: Rob Elam, Will Faulkner, Chris LaPlante, Parker Chase
Propel Fuels, Inc.
# Table of Contents

- Executive Summary ................................................. 4
- LCFS Programmatic History & Progress ....................... 5
- LCFS Customers .................................................. 7
- Path to LCFS Success: Compliance = Access to High Blend Low-Carbon Fuels 9
- Conclusions ....................................................... 10
Executive Summary

California’s Air Resources Board designed the Low Carbon Fuel Standard (LCFS) as a performance based and fuel neutral program to reduce the carbon intensity of the transportation fuel pool in California. The program targets a 10% reduction below 1990 levels by 2020, and progress to a proposed 18% reduction by 2030. Some expected program outcomes include diversifying the fuel pool and reducing the state’s petroleum dependency. From both climate and air quality perspectives, these are major initiatives: the transportation sector in California accounts for 37% of the GHG emissions, 80% of NOx emissions, and 95% of particulate matter (PM) emissions.

California is one of the world’s largest and most diverse fuel markets, consuming ~19.6 billion gallon equivalent of fuels in various forms. The LCFS program has accelerated low-carbon fuel adoption in California to meet the reduction goals in the first 6 years of the program. The average carbon-intensity (CI) of low-carbon fuels has dropped over 30% since 2011, while the CI of petroleum products has increased.

On closer inspection, the path to LCFS compliance is more complicated, as the CI story for the gasoline and diesel pools have diverged significantly. In 2016, for example, the gasoline pool fell short of its reduction target for the first time, achieving only a 1.4% reduction vs its 2% target. By contrast, the diesel pool achieved a 9.6% reduction, exceeding its target of 2% and almost meeting its 2020 target of 10% reduction four years ahead of schedule. In order to meet the 10% reduction target, the market share of low-carbon fuels will need to grow an additional 2.8 billion equivalent gallons to 5 billion equivalent total gallons, or 25% share of the liquid fuels market.

The significant growth required to achieve LCFS program targets suggests a new question: who will pay for it? Contrary to industry belief, the real customers of the LCFS program are not the obligated parties who purchase credits. The program’s real customers are fuel consumers who bear the financial burden of carbon regulations when the cost of compliance is passed down the supply chain. In light of the real people on the other end of the compliance curve, what appears at first to be in industrial policy between regulators and refiners/blenders turns out to be an inherently political issue. The engagement level of LCFS customers, i.e., voters, is critical to the success of the program’s rapidly steepening compliance curve.

California’s policy makers have promoted a “market transformation” approach to reducing transportation sector emissions. This effectively means EV only, with some token support for hydrogen vehicles. Sometimes referred to as “trickle down carbonomics,” this strategy will be familiar to students of economic policy as “Reaganomics”, or more recently as a Silicon Valley-style high risk VC funding strategy focused on “early adopters” as a path to mainstream market acceptance. Whether or not this model is appropriate in a highly political context, with environmental and human health consequences in the balance, has been the subject of much recent debate.
Through the flagship Clean Vehicle Rebate Program (CVRP), Californians have received $448 million dollars in state rebates for purchases of EVs (hybrids too), with a very large portion going to the wealthiest Californians. The top income quartile have purchased over 10x the amount of EVs versus the bottom income quartile. Wealthier income groups are the first to purchase more efficient, newer models. The trickledown effects hoped for have not materialized as residents of low-income, high-pollution neighborhoods, otherwise known as Disadvantaged Communities, do not purchase EVs. Even though California’s Disadvantaged Communities suffer the worst air quality in the entire nation, they are the group most likely to vote for the complete repeal of AB 32, due to the inequity of “carbonomics” policy design – an unfortunate, rational choice for short term economic relief at the expense of long term health.

How might this outcome be avoided? Low-carbon fuels provide one solution. California’s existing low-carbon fuel consumers are extremely diverse, and highly representative of the socioeconomic demographics of California. Low-carbon fuels are not a premium product that only wealthy, coastal elites can buy today; they are affordable to mainstream populations, including middle- and low-income individuals of all races and age groups. Supporting low-carbon fuels means doing more of what works today. It is inherently progressive, providing relief and inclusion for the state’s most vulnerable citizens, rather than regressive energy taxes and a promise of brighter, cleaner, affordable future. The low-carbon user base needs to grow.

The LCFS program is, by far, the most equitable portion of AB 32, reaching a much broader constituency than other programs, which are either passing through cost (via cap-at-the-rack) and/or distributing funds to wealthiest Californians. If equity and fairness are goals of carbon policies, California should do more of what is already working equitably. At a minimum, California should mandate that every internal combustion vehicle sold in the state be low carbon fuel compatible as FFV or high efficiency diesel.

**LCFS Programmatic History & Progress**

The Low Carbon Fuel Standard (LCFS) was passed to reduce the carbon intensity of the transportation fuel pool in California by 10% by 2020\(^1\). Designed by CARB, the program is performance based and fuel neutral, and expected to work in tandem with California Cap & Trade (AB 32), Advanced Clean Cars Program, and Sustainable Communities Strategies (SB 375). Expected outcomes of the program include diversifying the fuel pool and reducing the state petroleum dependency as the transportation sector in California accounts for 37% of the GHG emissions, 80% of NOx emissions, and 95% of particulate matter (PM) emissions\(^2\). Even though the program is fuel neutral, low-carbon fuels are measured against their respective petroleum product, gasoline or diesel. Ethanol and on-road electric vehicles (EVs) are measured against the gasoline compliance while biomass based diesel and natural gas are measured against the diesel compliance. Fuel producers can either blend low-carbon fuels into the mix of transportation fuels or purchase credits to meet annual compliance.

---

\(^1\) CARB, 2015, [LCFS Final Regulation](http://www.arb.ca.gov/)

\(^2\) CARB, 2017, [LCFS Basics](http://www.arb.ca.gov/)
Since the program started in 2011, California has been able to meet and even beat the annual CI reduction targets set by CARB\(^3\). However, the path to compliance has been nuanced as the compliance trajectories for the gasoline pool\(^4\) and diesel pool\(^5\) are different. In 2016 the gasoline pool fell short of its reduction target for the first time, achieving only a 1.4% reduction vs the 2% target, whereas the diesel pool achieved a 9.6% reduction almost meeting the 2020 target of 10% reduction, four years ahead of schedule.

**LCFS Carbon Intensity Reduction vs. Target**

![Graph showing LCFS Carbon Intensity Reduction vs. Target]

As the largest and most diverse fuel markets in the world, California consumes ~19.6 billion gallon equivalent of fuels in various forms. The gasoline pool makes up 80% of the California market or 15.6 billion equivalent gallons annually, while the diesel makes up the remaining 20%, or 4.0 billion equivalent gallons. Being so far ahead of the compliance curve, the diesel pool contributes 99% of the net credit generation; the gasoline pool has contributed only 1% toward the net credit generation, despite being 80% of the total fuel market.

---

\(^3\) CARB, 2017, *LCFS Quarterly Summary*

\(^4\) Gasoline Pool: CARBOB, Ethanol, on-road EV, Hydrogen

\(^5\) Diesel Pool: Diesel, Renewable Diesel, Biodiesel, Natural Gas, Bio Natural Gas, off-road EV
LCFS Customers

Contrary to industry belief, LCFS customers are not obligated parties, the program’s real customers are fuel consumers. Understanding the engagement of LCFS customers is primary if California is to achieve the scale required to successfully meet program targets.

California is drawing more low-carbon fuels to the state, however the state’s gasoline consumption and vehicle miles travelled (VMT) are at all-time highs, increasing 14% and 6% since 2011 to roughly 365 billion miles and 15.5 billion gallons, respectively.

Median household income in California is $67,739 with 66% of households making less than $100,000. E85 consumers are more weighted around the median household income as 78% make less than $100,000, whereas the renewable diesel consumer is on average wealthier than

---

7 US DOT Federal Highway Administration, 2011-2016, Traffic Volume Trends
8 CA BOE, 2011-2016, Taxable Gasoline Gallons 10 Yr Report
9 US Census Bureau, 2016, Household Income - California
the typical Californian and E85 consumer\textsuperscript{10}. EV customers, by contrast, are drastically wealthier than the average Californian, with 52% of households earning over $150,000 (34% having an income >$250,000)\textsuperscript{11}.

**LCFS Customer - Income**

![Pie charts showing income distribution for Avg. Californian, E85, Renewable Diesel, and EV customers.]

The age demographic of adults in California skew towards the millennials, as 45% of adults are between the ages of 18-35\textsuperscript{12}. The E85 age demographic matches this trend, skewing younger in step with the California population, while the renewable diesel age demographic is split almost evenly between age groups. By contrast, the EV age demographic skews much older as 63% are 45+ years old.

\textsuperscript{10} Propel Fuels, 2016, \textit{The Low-Carbon Fuel Consumer}

\textsuperscript{11} Center for Sustainable Energy, 2017, \textit{EV Consumer Dashboard}

\textsuperscript{12} US Census Bureau, 2016, \textit{Sex by Age - California}
Through the Clean Vehicle Rebate Program (CVRP), Californians have received $448 million dollars given in state rebates for purchases of EVs (hybrids too)\textsuperscript{13} with a very large portion going to the wealthiest Californians. The top income quartile have purchased over 10x the amount of EVs versus the bottom income quartile. Household income is the single greatest predictor of EV sales (hybrids too), which are some of the most fuel efficient vehicles on the market,\textsuperscript{14} matching historical patterns of vehicle sales as wealthier income groups are the first to purchase more efficient, newer models, while lower income households are the last. Lower income households also spend a disproportionate share of their household income on fuel, as they typically drive older model vehicles\textsuperscript{15}. The trickledown effect has not materialized; CalEPA designated Disadvantaged Community residents are not purchasing EVs\textsuperscript{16}. California Disadvantaged Communities are in greatest need of clean air in the entire nation\textsuperscript{17}, however, they are the group most likely to vote for the complete repeal of AB 32.

**Path to LCFS Success: Compliance = Access to High Blend Low-Carbon Fuels**

Thanks to the LCFS program, low-carbon fuels are making their way to California. The average carbon-intensity of low-carbon fuels\textsuperscript{18} have dropped 30+\% since 2011 while petroleum products have increased (note: CARB revised carbon intensity for crude based products in 2013 and 2016 during the readoption process). Market share for low-carbon fuels has increased 700 million gallons to 2.2 billion gallons in 2016. However, to meet the 10\% carbon intensity

\begin{itemize}
\item \textsuperscript{13} Center for Sustainability, 2017, CVRP Rebate Statistics
\item \textsuperscript{14} UCLA, 2017, Factors Affecting Plug-In Electric Vehicle Sales in California
\item \textsuperscript{15} ICF, 2016, Consumer Impacts of California’s Low-Carbon Transportation Policies
\item \textsuperscript{16} UC Davis Institute of Transportation Studies, 2017, Modeling Household Vehicle and Transportation Choice and Usage
\item \textsuperscript{17} American Lung Association, 2017, State of the Air
\item \textsuperscript{18} All fuels except CARBOB and diesel, energy weighted based carbon intensity
\end{itemize}
reduction target, low-carbon fuel market share will need to hit ~25% market share, or more than double to 5 billion equivalent gallons (+2.8 billion equivalent gallons).

Widespread adoption of all low-carbon fuels is needed to meet the program's 10% reduction target. Banked credits will not do it; nor will waiting on broad market adoption of EVs across multiple socio-economic groups, when the majority of vehicles on the road are not high-blend low-carbon compatible (read: gasoline only, non flex-fuel). Success depends on lowering the barrier for engagement of all socio-economic groups, especially those in DACs.

Conclusions
Low-carbon fuel consumption in California needs to more than double to roughly 5 billion gallons by 2020 to achieve the 10% reduction target. It will need to grow even more to reach a proposed reduction 2030 target of 18%. In order to do so, California must remove barriers preventing consumers from accessing low carbon fuels.
California’s existing low-carbon user base is extremely diverse, representing the socioeconomic demographics of California. Because low-carbon fuels are affordable to mainstream populations, including middle- and low-income individuals, consumers are extremely loyal despite fluctuating petroleum prices. Support for low-carbon fuels is progressive and inclusive. This user base needs to grow.

Low-carbon fuels will need to play a more significant role to meet California’s 2020 and 2030 carbon reduction goals. Consumers have demonstrated they will make low carbon purchasing decisions if given the opportunity to do so. To enlist their support, the current policy model must change to allow vastly more low carbon capable vehicles to enter the market. If equity and fairness are goals of California’s carbon policies, the state should incentivize what is working, and mandate that every vehicle sold in California be low carbon fuel compatible as FFV or high efficiency diesel. This, together with existing support for EV and hydrogen would enable California to hit its targets and preserve state’s reputation as a global leader in equitable and achievable climate policy.