

E85: A California Success Story



A Propel Fuels White Paper, June 2015

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1. Executive Summary

Driven by strong consumer value, innovative fuel retailers and progressive state policies, California has emerged as the national leader in E85 market growth. California's E85 market has expanded 600% over the past five years to exceed 11 million gallons in 2014. E85 is high blend ethanol fuel typically containing 85% ethanol and 15% gasoline. Flex fuel vehicles (FFV's) can utilize E85 interchangeably with conventional gasoline with no need for modification. FFV's are the world's most underutilized alternative fuel vehicles with more than one million FFV's currently operating in California alone. California's rapid E85 growth occurred while gasoline demand in the state decreased by 100 million gallons.

The E85 supplied to California's retail stations is uniquely clean, sustainable and cost-effective because California policies incentivize cleaner and lower carbon fuels. Originally established by Governor Ronald Reagan in 1967, California's Air Resources Board pioneered clean fuel standards for gasoline and diesel fuel resulting in the development of "CARBOB" and "CARB Diesel;" fuels engineered to reduce the criteria pollutants that harm human health. More recently, California's Low Carbon Fuel Standard (LCFS) established the first limits on the carbon intensity (CI) of transportation fuels in the US. The LCFS mandates that the CI of gasoline and diesel fuel used in California must decrease 10% between 2010 and 2020. To further improve public health and reduce petroleum dependence, Governor Jerry Brown and Senator Pro Tem Kevin De Leon recently announced policy goals to reduce petroleum use in the state 50% by 2030.

These state energy initiatives have helped California become the national leader in E85. The state is now poised to surpass its closest Midwest corn belt competitors, Iowa and Minnesota, while simultaneously improving ethanol's environmental performance. Through a market mechanism developed by the ARB, California's LCFS program incentivizes corn ethanol producers to develop more efficient farming and production processes, and to integrate renewable energy into their plants. The LCFS has also motivated ethanol producers to develop and utilize lower carbon feedstocks such as sweet sorghum, sugarcane, agricultural waste residue, and municipal solid waste as alternative feedstocks to corn.

California is achieving E85 success in the neighborhoods that need it most: disadvantaged communities that suffer the adverse impacts of close proximity to vehicle and freight corridors. These communities have been the first to recognize the economic value that E85 presents and have become loyal users of the fuel. As California strives to further reduce the harmful impacts of air pollutants in disadvantaged communities, E85 offers an immediate and proven solution that delivers both environmental and economic benefits.

These findings have been established by cutting edge customer research conducted by the primary retailer fueling California's E85 success, Propel Fuels. Utilizing research data developed by Propel coupled with work done by the ARB and others, this white paper examines the role that E85 has played to date in enabling California to meet its GHG and CI reduction goals to date. More importantly, the paper examines the important role that E85 must continue to play to enable California to achieve its increasingly aggressive GHG reduction goals, while

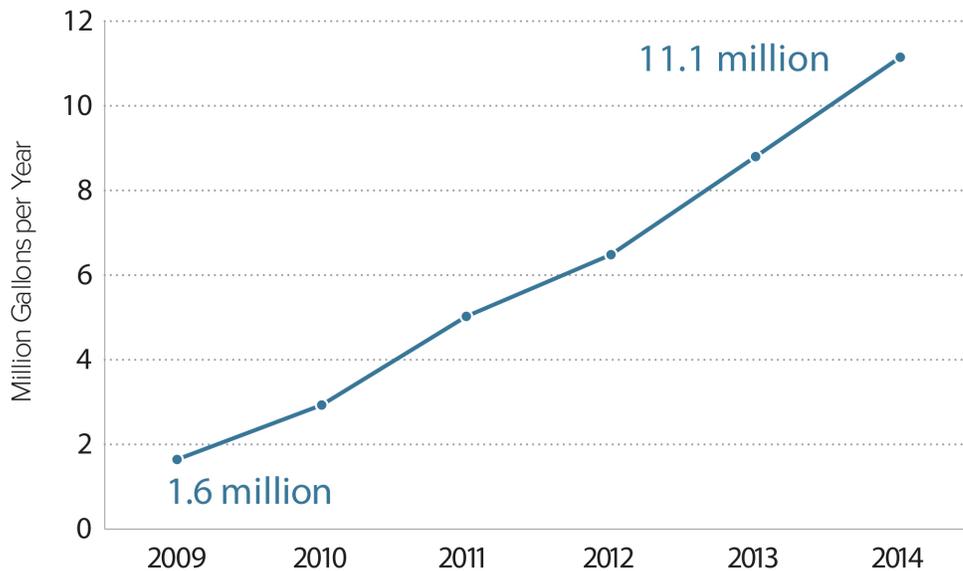
also meeting its petroleum reduction targets, and providing economic and environmental benefits to disadvantaged communities. Key findings include:

1. E85 sales volume in California has grown over 600% in the past five years to 11.1 million total gallons with retail location averaging 140,585 gallons per year in 2014.
2. E85 in California has the potential to displace 600 million gallons of petroleum annually through the state's existing 1 million FFV fleet.
3. California has reduced the carbon intensity of the ethanol it utilizes enabling E85 to provide a 32% reduction in greenhouse gas emissions and 18-53% reduction in smog forming nitrogen oxides (NOx) when compared to petroleum.
4. California's highest volume E85 retail locations are located in areas determined by EPA to be extreme non-attainment for ozone (San Joaquin Valley, Los Angeles, and Inland Empire). These stations are providing significant local emissions benefits by selling between 325,000 – 445,000 gallons of cleaner burning E85 per year.
5. California E85 customers recognize E85's value proposition, with 92% of customers reporting the same or better value compared to petroleum. A recent scientific study by a federal laboratory supported customer observations that E85 vehicles usually achieve better fuel economy per unit of energy than gasoline.
6. Propel Fuels' innovative sales strategies have been the primary source of California's E85 market growth since 2009, and have enabled the company to capture 70% of California market share.
7. Despite success, significant barriers still exist for E85 growth including policy uncertainty, interference from Big Oil, and lack of customer knowledge about the benefits of E85 fuels and the capabilities of FFV's.

2. California E85 Growth

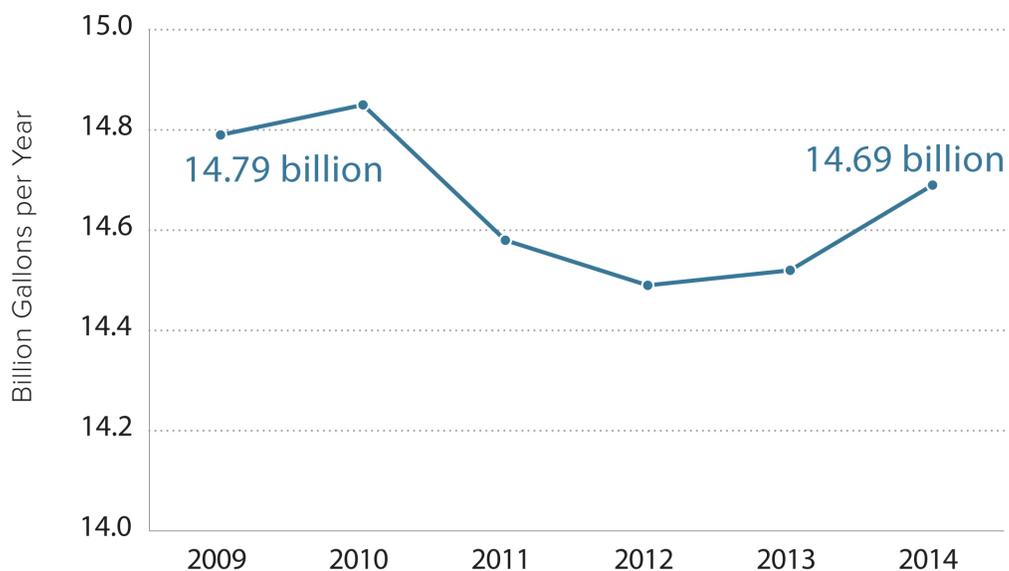
California's E85 consumption has grown more than 600% in the five years since 2009 from 1.6 million gallons per year (GPY) to 11.1 million gallons per year.¹

California E85 Annual Volume



California's rapid E85 growth has occurred during a time period when gasoline demand in the state has decreased by 100 million gallons.²

California Gasoline Annual Volume

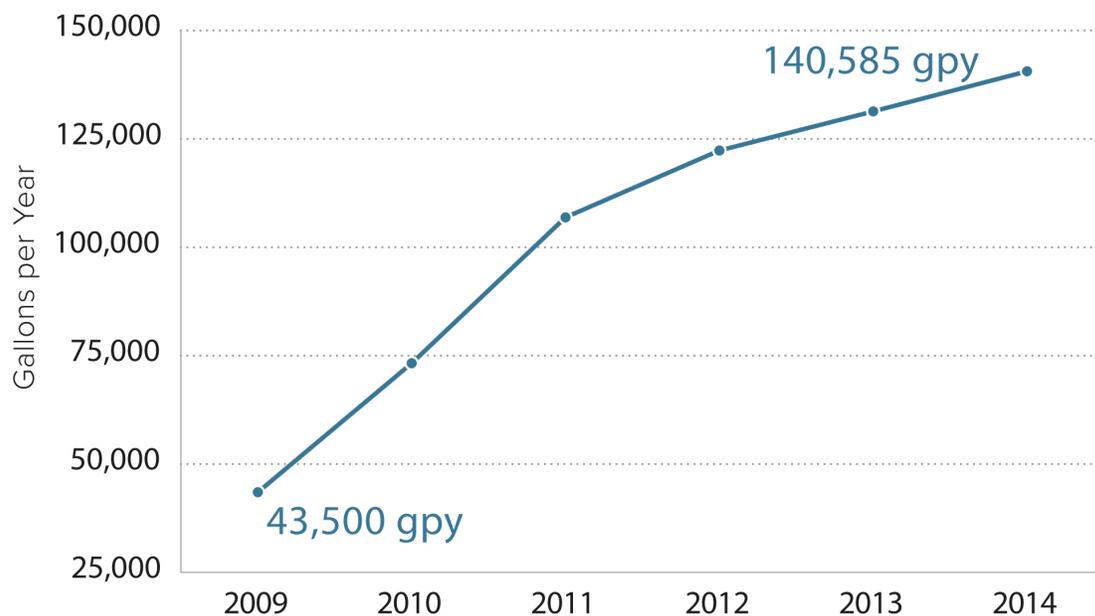


¹ California Air Resources Board, Alternative Fuels Branch, May 14, 2015; California Energy Commission Integrated

² California Board of Equalization Taxable Gasoline & Aviation Gallons 10 Year Report, <http://www.boe.ca.gov/sptaxprog/spftrpts.htm>

E85 is sold through two primary channels in California: (1) retail sites located on existing petroleum stations and (2) bulk delivery to business, federal, state, and local government fleets. Roughly 382,000 GPY is sold through bulk fleet sales, with the large majority of E85 sales provided by E85 retail locations throughout the state. The number of E85 retail locations has grown from 29 retail locations in 2009 to 76 in 2014, a 160% increase.³ Meanwhile the average E85 sales per location have increased 223% from 43,500 GPY in 2009 to 140,585 GPY in 2014.

E85 Gallons per Location



3. California FFV Market & Potential Petroleum Displacement

The rising demand of E85 in California establishes a tremendous opportunity for the state to better achieve its GHG and petroleum reduction goals. Such a strategy harnesses the health and economic co-benefits of ethanol by better enabling its existing fleet of FFV's to utilize E85.

Existing Vehicle Infrastructure

There are over 100 FFV vehicle makes and models available in the US, with models represented by nearly all manufacturers and at all price points. FFVs are available in a number of body styles, from compacts and sedans to business-friendly work trucks and minivans. FFVs are also widely available in the Used and Certified Used vehicle markets. The Energy Information Agency (EIA) estimates that there were 10 million flex fuel vehicles in the US in 2011.⁴ It is estimated that California is home to over 1 million of these FFVs, traveling

³ Alternative Fuels Data Center, http://www.afdc.energy.gov/fuels/ethanol_locations.html (last viewed 15 April 2015)

⁴ U.S. Energy Information Agency, <http://www.eia.gov/tools/faqs/faq.cfm?id=93&t=4> (last viewed 18 May 2015)

approximately 14 billion miles per year.⁵ To the extent that all of the FFVs in California utilize E85, there is a petroleum reduction opportunity of approximately 600 million gallons per year as one gallon of E85 displaces roughly 0.615 gallons of petroleum.

California's E85 Market



1 Million

Flex Fuel Vehicles



14 Billion

Miles Driven/Year



600 Million

Petroleum Gallons
Displaced

4. California Ethanol Carbon Intensity

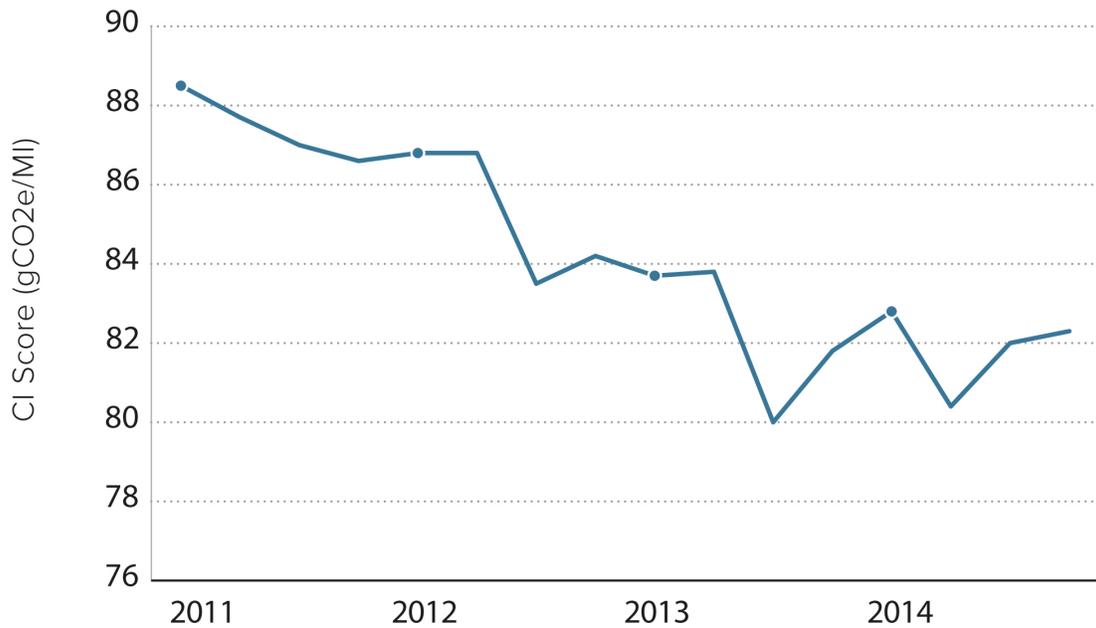
The California Global Warming Solutions Act of 2006 (AB 32) established California as a global leader in reducing GHGs. AB 32 set a goal for the state of reducing GHGs to 1990 levels by 2020. The LCFS is a key component of the overall strategy to reduce GHG emissions in California and focuses on transportation sector emissions. Due to the unique demands of the sector, transportation remains highly dependent on fossil fuels and particularly liquid petroleum fuels.

During the period from 2011-2014, California achieved reductions of over 10 million metric tons of GHG's as a result of the LCFS. The average fuel carbon intensity of all alternative fuels included in the LCFS declined 15% between 2011 and 2014. Pure corn starch derived ethanol was the dominant fuel during the first years of the LCFS supplying 70% of the credits in the first two quarters of 2011. However, as a result of the LCFS incentivizing lower carbon feedstocks, the use of pure corn starch feedstock declined to less than 50% of total credits in 2014. Thus while California was expanding its E85 use, the state was simultaneously shrinking the carbon footprint of the ethanol used in the state.⁶

⁵ Federal Highway Administration, US Department of Transportation, Average Annual Miles Driven, <http://www.fhwa.dot.gov/ohim/onh00/bar8.htm> (last viewed 18 May 2015). Note that precise data regarding the number of FFV's in the various states does not appear to be available but the best available data suggests that the estimate of one million California FFV's is reasonable, see http://www.eia.gov/renewable/afv/users.cfm#tabs_charts-5 which refers only to FFV's owned by fleets, not individually owned FFV's.

⁶ Yeh, Sonia, Julie Witcover, James Bushnell (2015), Status Review of California's Low Carbon Fuel Standard - April 2015 Issue. Institute of Transportation Studies, University of California Davis, Research Report UCD-ITS-RR-15-07

Carbon Intensity (CI) of California Ethanol



Of the ethanol consumed in California, 8% came from in-state production from 2000-2010 and the in-state portion increased to 18% during 2011-2013. California is home to the nation's lowest carbon ethanol in the country. Five California ethanol production facilities produce 222 million gallons of ethanol and currently reduce over 358,000 metric tons of CO₂e annually. The five year industry target is 350 million gallons of California produced ethanol with a carbon intensity half of gasoline, thereby reducing over 1,568,875 metric tons of CO₂ per year. Currently, California ethanol reduces GHG's by 32% as compared to conventional unleaded gasoline and reduces smog forming NO_x by 18-53%.⁷

Greenhouse Gas (GHG) Emissions



32%

compared to
unleaded gasoline

Nitrogen Oxide (NO_x) Emissions



18–53%

compared to
unleaded gasoline

⁷ Yanowitz, J., McCormick, R.L., Effect of E85 on Tailpipe Emissions from Light-Duty Vehicles, J. Air & Waste Management, 59:172-182. http://www.afdc.energy.gov/pdfs/technical_paper_feb09.pdf

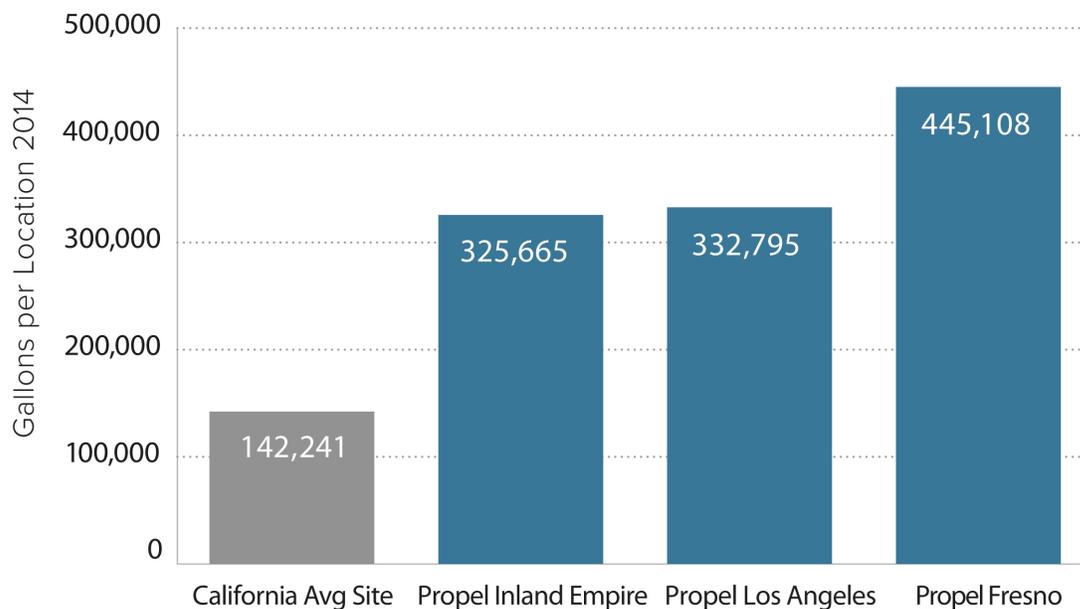
5. California E85 Performance in EPA Non-Attainment Areas

Pursuant to the federal Clean Air Act, EPA established National Ambient Air Quality Standards (NAAQS) for air pollutants which negatively impact public health above specified concentrations. Criteria pollutants that are monitored include ozone, particulate matter, NO_x, SO_x, carbon monoxide, and lead. Nonattainment areas are regions that do not meet the NAAQS standard for one of those pollutants.⁸

In November 2014 based on scientific evidence about ozone's effects on public health, the US EPA proposed to strengthen the current 2008 NAAQS for ground-level ozone from the current threshold of 75 parts per billion. The San Joaquin and South Coast air basins are both in extreme nonattainment areas regarding ozone.

California's E85 stations in Fresno, Los Angeles and the Inland Empire⁹ are within the extreme nonattainment areas identified by EPA. These are areas facing some of California's most severe air quality issues. Through E85 use in these areas, criteria pollutants such as NO_x are reduced. Through the supply of E85 to these locations, criteria pollutants are reduced as compared to CARBOB gasoline.

E85 Use in EPA Extreme Non-Attainment Areas



⁸ See generally EPA Regulatory Activities Pertaining to Ground Level Ozone, <http://www.epa.gov/groundlevelozone/actions.html> (last viewed 18 May 2015).

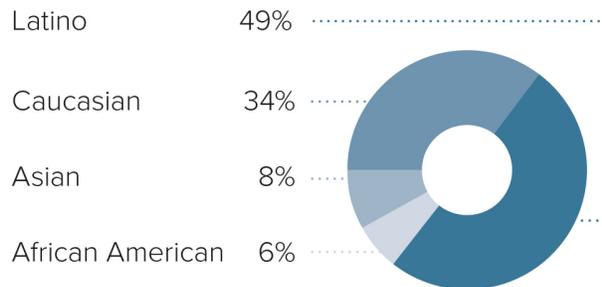
⁹ South Coast Air Quality Management District, map of Southern California Air Basin, <http://www.aqmd.gov/docs/default-source/default-document-library/map-of-jurisdiction.pdf> (last viewed 25 May 2015).

6. E85 Customers in California

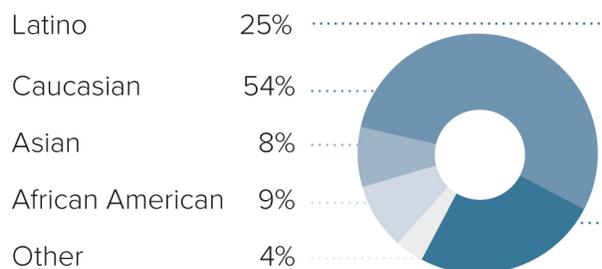
As a cost-effective, high quality fuel with widespread vehicle compatibility, E85 sales reflect California's diverse populations. Between 2012 and 2014, Propel Fuels conducted extensive low carbon fuel customer surveys via LUX Research, an independent analytics firm.^{10,11} Survey respondents were intercepted while fueling at Propel locations throughout California. The survey results offer important insights into the demography of low carbon fuel use and illuminate opportunities to significantly advance California's low carbon, petroleum reduction and health benefit goals.

E85 Customer Demographics

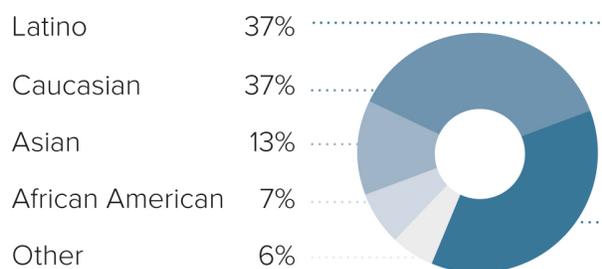
SAN JOAQUIN VALLEY & INLAND EMPIRE E85 USERS



STATEWIDE E85 USERS



CALIFORNIA GENERAL POPULATION



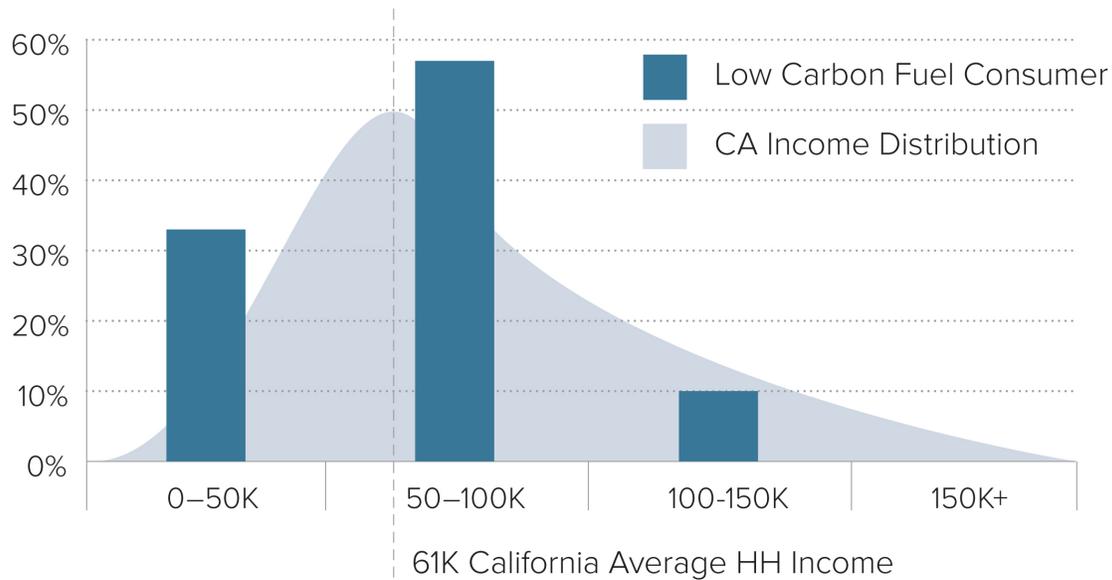
¹⁰ Propel Low Carbon Fuel Customer Statewide Survey, Lux Insights: 2012 (responses 1007, margin of error 3.3%)

¹¹ Propel Low Carbon Fuel Customer San Joaquin Valley/Inland Empire Survey: 2014

E85 User Income

Consistent with California’s goal of ensuring that all Californians receive the health and economic benefits of state policies, E85 fuel use is highest among middle and lower income households with 32% earning less than \$50,000 a year and 90% of users earning less than \$100,000 per year.⁶

E85 User Household Income



Customer Behavior

E85 users demonstrate strong loyalty to E85 fuels. Despite limited access to the fuels relative to conventional gasoline, Propel E85 users are choosing E85 75% of the time, 3.4 out of 4.2 times every month. Studies further found that 58% of customers fill exclusively with E85 fuel, no longer using petroleum gasoline.¹³

E85 User Loyalty



Choose E85 75% of the time
3.4 out of 4.2 fills/month



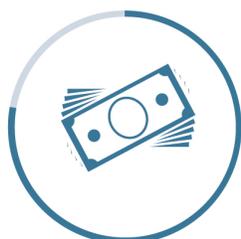
58% fuel exclusively with E85
No longer using petroleum

⁶ Low Carbon Biofuel Customer Income Data: Claritas/Nielsen PRIZM Segmentation Systems, 2012, 2014

¹³ Propel Low Carbon Fuel Customer Statewide Survey, Lux Insights: 2012 (responses 1007, margin of error 3.3%)

7. E85 Pricing and Energy Content Value Proposition.

Propel's research data reveals that customers are first attracted to renewable fuels by the two primary conventional motivators – convenience and price. E85 offers California's diverse driver base the highest value proposition of any fuel readily available in the state. Based on customer studies, 78% of Propel customers report seeing a better value with E85 compared to gasoline; 92% of customers describe the value as the same or better than gasoline.⁷



78%

E85 better value
vs. gasoline



92%

E85 same or better value
vs. gasoline

E85 and the energy loss pricing myth

The findings of a recent study confirm what E85 users have long reported: that E85 fuel economy as compared to gasoline varies by vehicle, duty cycle and environmental conditions and is not simply correlated to energy content. The recent study, conducted by Oak Ridge National Laboratory (ORNL), analyzed the effects of different ethanol blends in a variety of FFV's. Vehicles in the study utilizing high blend ethanol performed significantly better on fuel economy than energy content would suggest. Overall, the city and highway mpg loss for higher ethanol blends in FFV's performed roughly 10-17% better versus the energy density loss. A 100+ octane number and wide open throttle performance improvements were also observed with higher ethanol blends. From these observations, the study established that there is not a 1:1 relationship between ethanol blend percentage and fuel economy.⁸

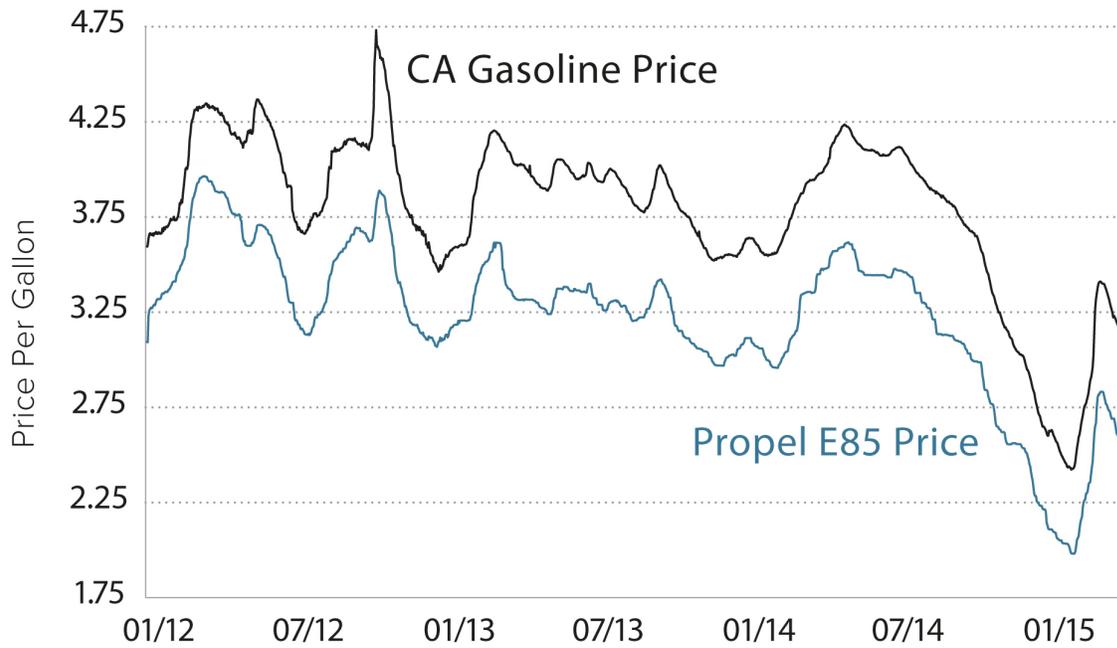
Higher Ethanol Blends in FFV's compared to E10		
Road Test	MPG Loss vs Energy Density Loss	MPG Loss
City (FTP)	+17%	-7.9%
Highway (HFET)	+10%	-8.5%

⁷ Propel Low Carbon Fuel Customer Statewide Survey, Lux Insights: 2012 (responses 1007, margin of error 3.3%)

⁸ Thomas, J., West, B., Huss, S., Effects of High Octane Ethanol Blends on Four Legacy Flex-Fuel Vehicles, and a Turbocharged GDI Vehicle, Oak Ridge National Laboratory, March 2015, ORNL/TM-2015/116
[https://www.fueleconomy.gov/feg/pdfs/ORNL_High_Octane_Legacy_Vehicles_Report\(final\).pdf](https://www.fueleconomy.gov/feg/pdfs/ORNL_High_Octane_Legacy_Vehicles_Report(final).pdf)

Within this context, it is Propel's reliable discount to gasoline that has consistently enabled Propel customers to achieve savings and satisfaction through their purchase of E85.

Propel E85 Discount to Gasoline



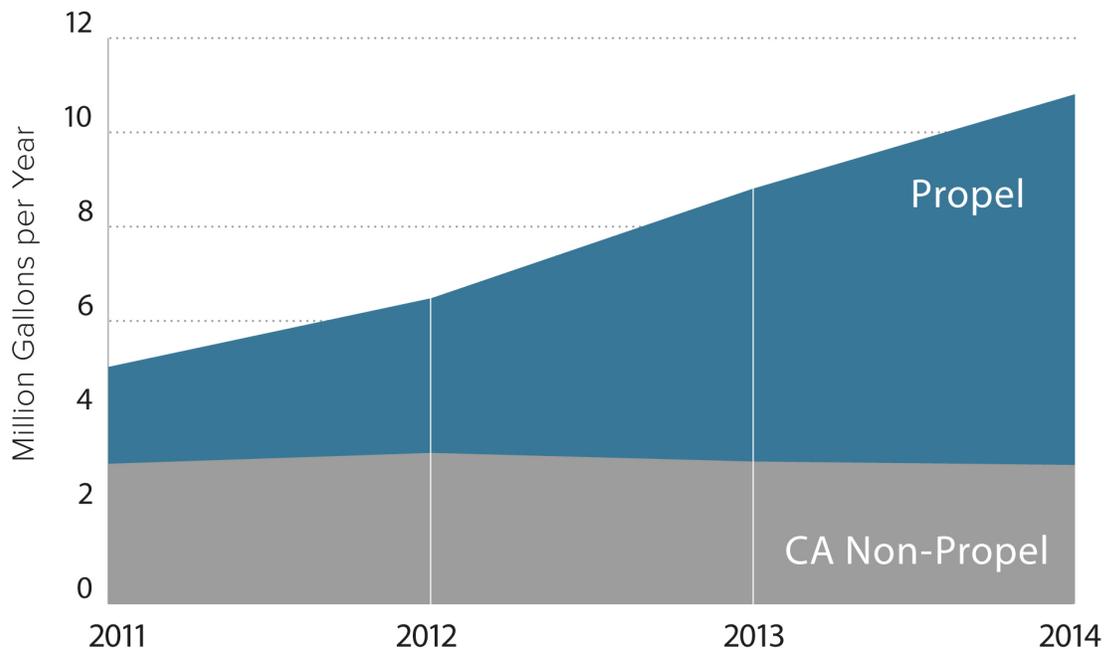
8. Propel Fuels California E85 Market Contribution

Propel Fuels is the largest E85 retailer in California operating or supplying 47 of the states 76 E85 retail locations. In order to advance its business model, Propel has developed systematic data analytics, customer acquisition and loyalty models through its Silicon Valley Workshop.

Propel's success in the growing California's E85 marketplace is illustrated by comparing the company's sales volumes against the other E85 fueling locations in the state. While all E85 stations have had the opportunity to benefit from the LCFS, only Propel has leveraged this opportunity to more than double its E85 sales in three years.

Since 2011, overall California E85 sales have grown from 5 million GPY to 11.1 million in 2014, a growth of 6.1 million GPY. Propel was responsible for 95% of this growth, growing from 2 million GPY to 7.8 million GPY. By 2014, Propel supplied 70% of the total CA E85 market while operating only 57% of the retail locations.

California E85 Annual Sales Volume



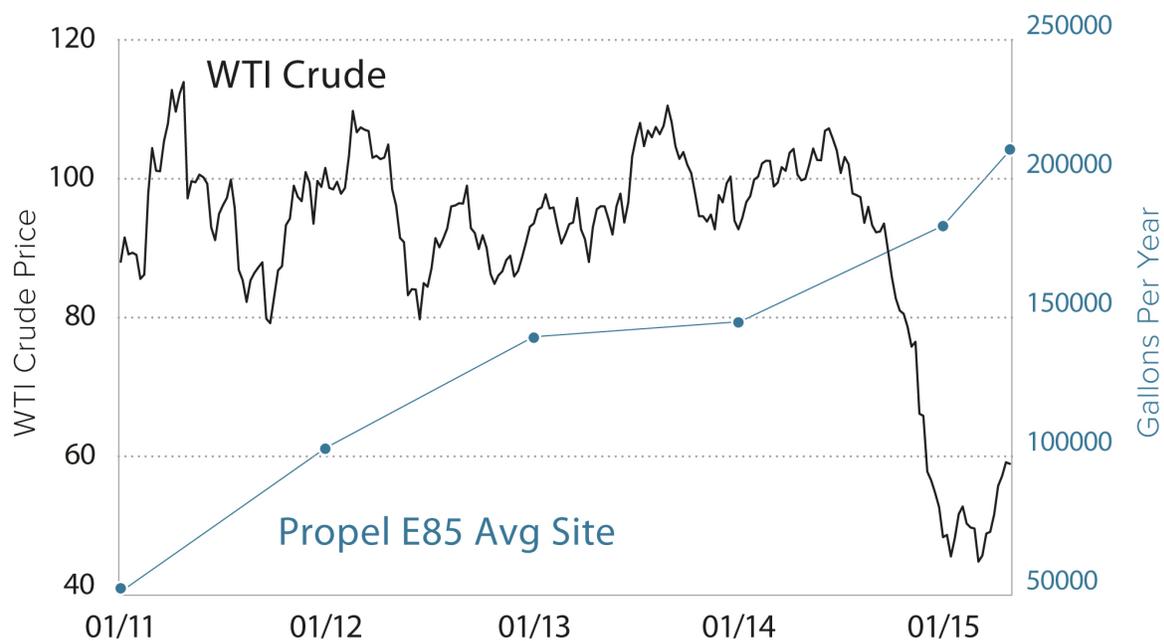
9. E85 Growth in a Volatile & Challenging Market

California has succeeded in growing its E85 volumes during a challenging period of falling oil and gasoline prices; robust subsidies for fossil fuels; wavering federal policy support for ethanol; and determined resistance to E85 by the major oil companies.

Falling Oil and Gasoline Prices

Since July of 2014, the average price of crude oil has tumbled from over \$100 to below \$60 a barrel. Similarly the price of gasoline has decreased over the past year. Despite this change in competitive economics, average sales at Propel's E85 locations have more than quadrupled in the past four years from 50,000 GPY in 2011 to a 220,000 GPY annualized rate in 2015.

Crude Price vs. Propel E85 Sales



Fossil Fuel Subsidies

According to the International Energy Agency (“IEA”), fossil fuels received more than \$550 billion in subsidies in 2014, more than four times the support received by renewables including wind, solar and biofuels. As stated by Fatih Birol, chief economist at the IEA, “The huge subsidies fossil fuels enjoy worldwide gives incentives to their consumption, which means that I’m paying you to pollute the world and use energy inefficiently.”¹⁶

VEETC Expiration

On December 31, 2011, the Volumetric Ethanol Excise Tax Credit (VEETC) expired. The VEETC was an incentive program established in 2004 to increase the amount of ethanol

¹⁶ Alex Morales, Bloomberg Business, November 11, 2014, Fossil Fuels with \$550 billion in Subsidy Hurt Renewables,” <http://www.bloomberg.com/news/articles/2014-11-12/fossil-fuels-with-550-billion-in-subsidy-hurt-renewables> (last reviewed 18 May 2015).

produced in the US. At its time of expiration, VEETC provided a \$0.45 per gallon tax credit provided to blenders of ethanol with gasoline. The VEETC was criticized as being duplicative of the Renewable Fuel Standard (“RFS”), and therefore unnecessary. The repeal of VEETC eliminated a major federal policy support for E85, and increased the importance of the RFS to the ethanol industry.

RFS Paralysis

The Energy Policy Act of 2005 established the original RFS. The RFS was expanded by the Energy Independence Act of 2007 (“EISA”), and thereafter became known as RFS2. RFS2 contains four categories of renewable fuel, imposes GHG reduction requirements, and escalates the overall renewable fuel requirement to 36 billion gallons per year by the year 2022. Beginning in 2015, EISA establishes a maximum ceiling of 15 billion gallons per year for corn starch ethanol with the remaining 21 billion gallons to be supplied by advanced biofuels that deliver at least a 50% GHG reduction. Congress charged the U.S. Environmental Protection Agency (“EPA”) with developing and enforcing the RFS2 program. A central component of EPA’s responsibility is to establish annual renewable volume obligations (“RVO’s”) by November of the preceding year.

Beginning in November of 2013, EPA abdicated its RVO setting obligation. Specifically, EPA never finalized the RVO’s for 2014, and failed to release proposed RVO’s for 2015 in a timely manner. To rectify this situation, EPA recently entered into a settlement agreement that sets a mandatory timetable for the Agency to finalize RVO’s for 2014, and 2015.¹⁷ Unfortunately, during the past year and a half the effectiveness of the RFS as a demand driver for ethanol, E85 and other renewable fuels has been severely compromised.

Active Resistance to E85 by Oil Majors

In addition to the economic and policy challenges to E85, the major petroleum brands have resisted the sale of E85 through their own infrastructure and their branded distribution networks. The largest publicly owned major oil companies (“Majors”) do not produce or sell renewable fuels and have adopted contracting strategies to thwart E85 expansion. Petroleum industry analysis reveals that:

- Branded agreements with the Majors can have terms of 20 years or longer, typically require supplier exclusivity, and allow distributors to sell only those fuels supplied by the Major.
- Branded agreements with the Majors typically require minimum sales volumes of branded fuels, meaning increased sales of E85 could jeopardize the retailer’s ability to meet minimum volume quotas for fossil-based fuels.

¹⁷ American Fuel & Petrochemical Manufacturers and American Petroleum Institute initiated an action against EPA with a complaint filed March 18, 2015, alleging that EPA has violated a nondiscretionary duty under the Clean Air Act, 42 U.S.C. § 7545(o)(3)(B), to establish renewable fuel obligations applicable to the calendar years 2014 and 2015. The consent decree is available at <http://www.epa.gov/oms/fuels/renewablefuels/documents/consent-decree-proposed-2015-04-10.pdf> (last viewed 18 May 2015).

- Some branded agreements with the Majors require E85 fuel dispensers to be isolated from other fueling dispensers.
- Branded agreements with the Majors often discourage or prohibit retailers from promoting or advertising the availability of E85.

10. Conclusion & Recommendations

This review of California's recent success in rapidly expanding the E85 market establishes that there is tremendous additional opportunity for the state to better achieve its GHG and petroleum reduction goals, and to achieve health benefits and economic growth by further enabling its existing fleet of FFV's to utilize E85. Recommendations based on key findings include:

1. Delivering to all of California. California's carbon reduction policies can work for all of California's communities, and should be expanded with a focus on disadvantaged communities. With the support of LCFS, customers have welcomed fuels that are more affordable and higher performing. Key performance enhancements include lower carbon intensity and lower criteria pollutants, including PM and NOx. Investment in E85 retail infrastructure in targeted areas delivers these fuels that final mile, to the consumer, producing measurable benefits to California's most impacted communities.

2. Creating an onramp to the Low Carbon Economy. Low carbon fuels empower the average California family to contribute to California's low carbon future. Access to low carbon fuels through support for fueling infrastructure is equitable public policy, promoting widespread involvement by communities that lack other viable methods to directly and immediately participate.

3. Demonstrating progress to stakeholders. Low carbon fuels offer a unique opportunity for showcasing success, as their impact is significant, measurable, and near term. GHG reductions and gains for human health provide an occasion to report positive public health outcomes and affirm California's commitment to a lower carbon and healthier future for all of her citizens.