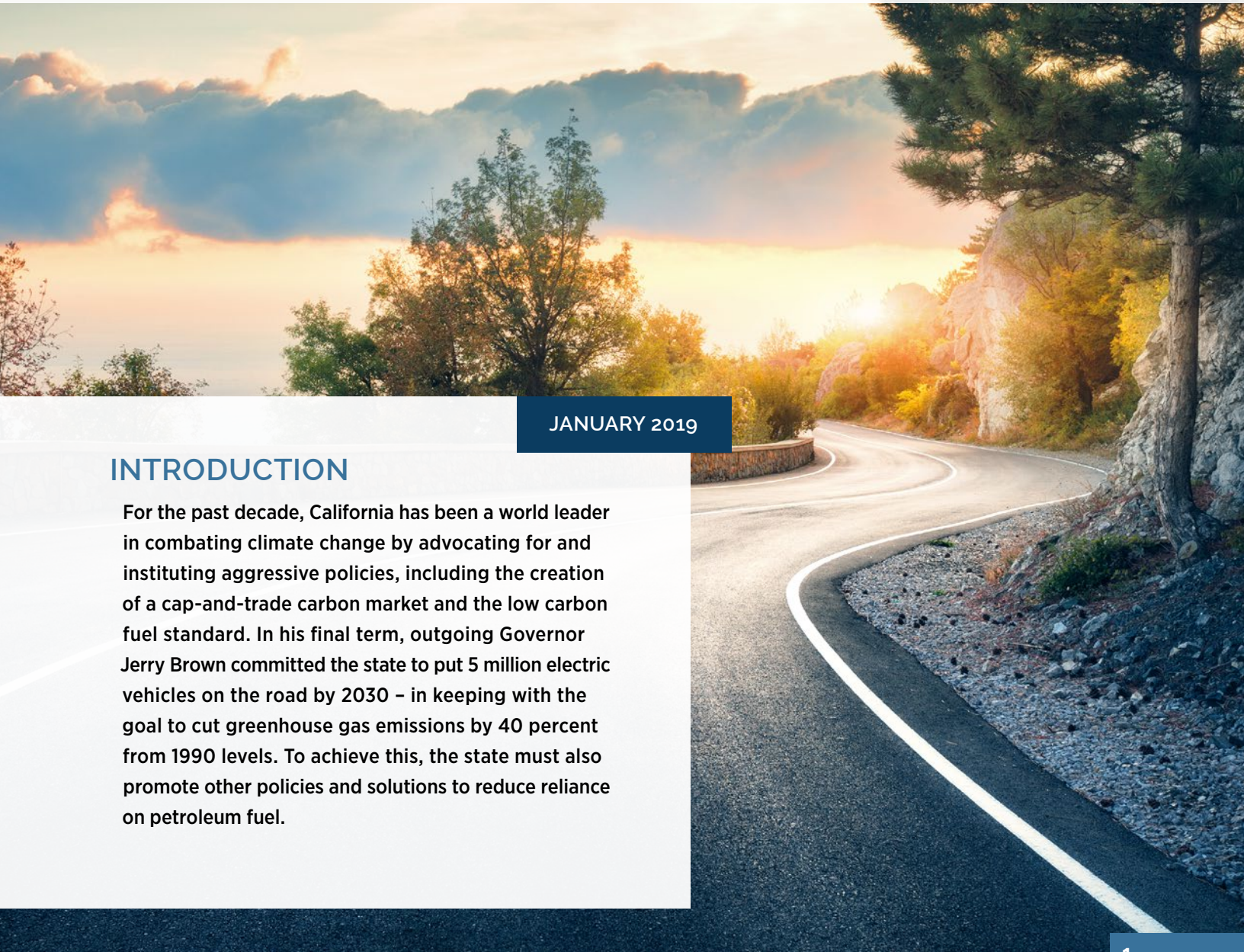
A Roadmap for Eliminating Petroleum Diesel in California by 2030

A California Advanced Biofuels Alliance (CABA) Report



JANUARY 2019

INTRODUCTION

For the past decade, California has been a world leader in combating climate change by advocating for and instituting aggressive policies, including the creation of a cap-and-trade carbon market and the low carbon fuel standard. In his final term, outgoing Governor Jerry Brown committed the state to put 5 million electric vehicles on the road by 2030 – in keeping with the goal to cut greenhouse gas emissions by 40 percent from 1990 levels. To achieve this, the state must also promote other policies and solutions to reduce reliance on petroleum fuel.

Introduction Cont.

Governor Gavin Newsom recognizes this reality and has called for the elimination of petroleum diesel emissions in California by 2030. The key to this is to continue growing the market for sustainable, clean diesel fuel made from vegetable oils and animal fats. These sustainable non-petroleum diesel fuels are clean, viable sources of energy that are helping California achieve its goals to reduce greenhouse gas emissions and improve air quality.

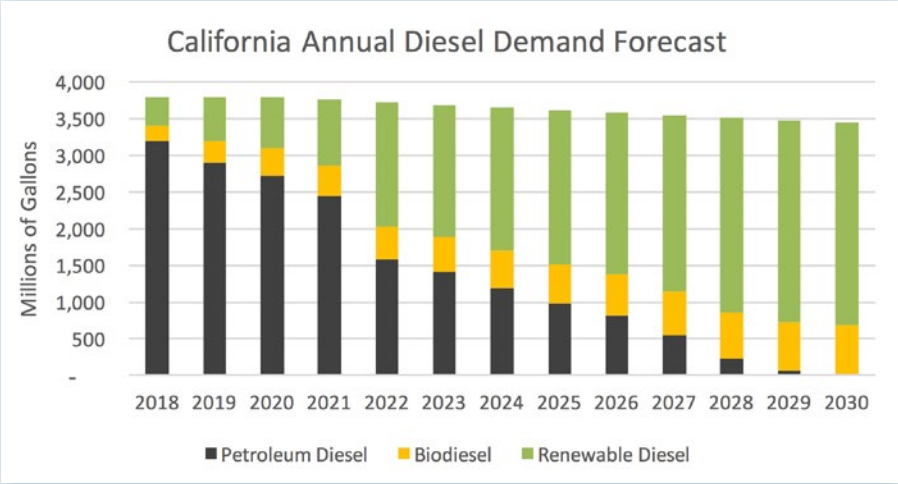
With an anticipated 80% supply of renewable diesel and 20% of biodiesel, clean diesel can completely replace petroleum diesel by 2030.

Accomplishing this goal will significantly improve air quality for millions of Californians and substantially reduce greenhouse gas emissions that contribute to climate change. As the California trade association representing the producers of sustainable advanced biofuels, we applaud Governor Newsom – not just for setting a bold goal to eliminate petroleum diesel, but for recognizing that the industry and technology has matured to the point it can meet demand.

For decades critics derided such ambitious petroleum reduction goals as unachievable. While there was some merit to that position years ago, such criticism is no longer valid in the year 2019. In fact, these goals are very achievable; California has made significant progress for years. For example, billions of gallons of petroleum have already been displaced with an array of biofuels (ethanol, renewable diesel, biodiesel, renewable natural gas) and electricity.

Most recently, petroleum diesel displacement has been a huge and largely unnoticed success. Since 2010, the renewable portion of California's diesel use has increased from less than 1% to approximately 15%. California can realistically eliminate the use of petroleum diesel by 2030 through a combination of efficiency improvements, further electrification of vehicles currently using diesel, an increased use of renewable natural gas vehicles, and continued growth in the use of sustainable diesel fuels (renewable diesel and biodiesel) as evidenced in the chart below.

> **Sustainable diesel fuels (renewable and biodiesel) represent a critical and viable substitute for petroleum diesel, thereby helping California achieve its 2030 petroleum diesel elimination goal.**



Notes

(1) Diesel fuel demand assumed stable through 2020 then decreasing 1% per year based on efficiency gains, electrification and RNG.

(2) Renewable Diesel volume includes both neat (100%) and co-processed renewable diesel from both lipid and non-lipid feedstocks.

Diesel Fuel Demand in California

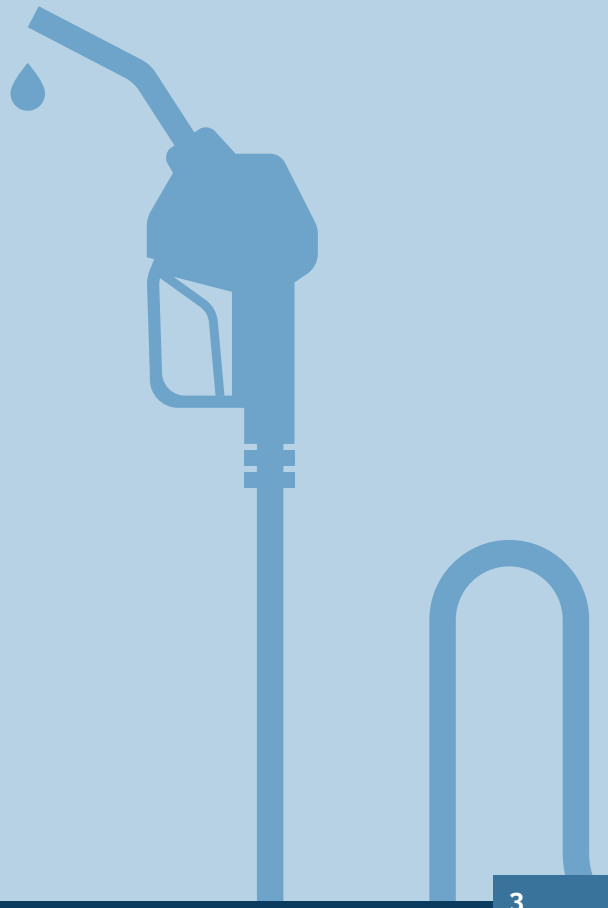
California consumed 3.79 billion gallons of diesel in 2017, the most recent full year data available from the California Energy Commission. Historically, California's diesel consumption has been highly correlated with economic growth. This has been borne out during the past decade when diesel consumption peaked in 2007 at approximately 3.8 billion gallons, falling to approximately 3.3 billion gallons in 2009 while the economy was mired in the Great Recession before then rising again with a vigorous economy in 2011, thereafter sustaining a 2% annual growth rate into 2018.

It is the opinion of the California Advanced Biofuels Alliance that this general pattern will hold. Demand for vehicles in diesel type service (trucks, buses, agriculture) will continue to be highly correlated with the economic cycle. That said, we believe the trend of companies switching vehicles from liquid diesel fuel into renewable natural gas, electric and hydrogen will accelerate in the years ahead. Given these factors, it is our opinion that demand for liquid diesel fuels will decrease from today's level to approximately 3.4 billion gallons by 2030. As such, this is the volume of non-petroleum diesel fuel that will need to be available to achieve the Governor's goal.

As the next section of this report outlines, this is a very achievable goal when we consider the viability of the two major types of sustainable diesel fuels – renewable diesel and biodiesel.

They are similar in that they are made essentially from the same feedstocks (raw materials), including vegetable oils, animal fats, used cooking oil (UCO) and second-use fats. The primary difference is in how they are processed from raw materials into sustainable diesel.

> "Production of our clean, sustainable diesel fuels continues to rapidly expand and will produce enough supply to completely replace petroleum diesel...



Renewable Diesel

Renewable diesel is a diesel fuel made in a manner similar to traditional petroleum diesel with the exceptions being that the feedstocks (vegetable oils and animal fats) are renewable, rather than petroleum based. Additionally, the renewable diesel refinery is typically optimized to maximize the production of renewable diesel rather than renewable gasoline.

Renewable diesel first entered the California market in 2011 along with the introduction of the low carbon fuel standard. Since then, the volume of renewable diesel has grown rapidly. Renewable diesel now satisfies about 10% of California's total diesel needs. As the chart above shows, renewable diesel is able to grow to meet 80% of California's diesel needs in 2030. This growth is not speculative. Much of the infrastructure for this growth is already under construction.

> "Renewable diesel is able to grow to meet 80% of California's diesel needs in 2030.

In 2018, over one billion gallons of additional renewable diesel production capacity was announced by major renewable diesel producers. For example:

- World Energy announced the expansion of its renewable diesel facility in the Los Angeles area from its current 40 million of gallons per year to over 300 million gallons per year.
- Diamond Green Diesel, a joint venture between Valero and Darling International, which operates the largest renewable diesel plant in the United States today, announced it would be expanding its refinery by another 400 million gallons.
- Neste, the largest global producer of renewable diesel and the first company to supply California with renewable diesel, announced it is expanding its Singapore refinery by 440 million gallons per year.
- Renewable Energy Group, the largest producer of renewable diesel fuels in the United States, announced it was exploring a strategic partnership with Phillips 66 to produce large volumes of renewable diesel in the Pacific Northwest and that it is actively evaluating expanding its existing renewable diesel refinery.
- And newcomers Ryze Renewables announced they too have partnered with Phillips 66 to produce 150 million gallons of renewable diesel per year in Nevada at two facilities.

Many more projects are in the works that have not yet been announced. All of this new production capacity is intended to serve the world's growing appetite for low carbon fuels, especially in California, which is considered the largest and most important market.

Biodiesel

Biodiesel is America's largest advanced biofuel by volume. Biodiesel has contributed to cleaner air and reduced greenhouse gas emissions for over 20 years. Biodiesel is similar to renewable diesel in that it is made from renewable feedstocks. Most biodiesel in California is made from second use materials like used cooking oil, distillers corn oil and animal fats. Those feedstocks are refined into biodiesel through a chemical process called transesterification.

Once processed, biodiesel can be used neat (100%) or can be blended with petroleum diesel and/or renewable diesel. Most biodiesel in California today is blended with petroleum and/or renewable diesel. In California, biodiesel is limited by law to 20% of the fuel blend for general commercial use. In specialty applications nationwide, biodiesel is used in higher blends, up to 100%. Approximately 2-billion gallons of biodiesel is consumed in the United States annually. Biodiesel use has grown substantially over the last decade – from approximately 300 million gallons in 2008 to an estimated 2-billion gallons in 2018. As shown in the diesel fuel demand chart above, we are forecasting biodiesel's portion of the California diesel market to significantly increase – from its current level of 5% to 20% by 2030.

> "(Sustainable clean diesel) represents a 71% decrease in greenhouse gas (GHG) emissions compared to petroleum diesel...a cumulative reduction of 263 million tons of GHG emissions by 2030.

Feedstock Supply

For those who have followed the renewable diesel and biodiesel market for years, one of the key questions has always been if there are sufficient feedstocks available to meet the projected growth in demand.

The unequivocal answer is "yes," as we've seen since the explosive growth of the industry around the year 2000. Since then, production has increased from 10 million to 2.5 billion gallons. Production of our clean, sustainable diesel fuels continues to rapidly expand and will produce enough supply to completely replace petroleum diesel by the year 2030, serving as a critical link to California's ultimate goal of a low-carbon (carbon neutral) future.

The California Advanced Biofuels Alliance believes this momentum is irreversible and will continue as feedstock supply expands to accommodate the increasing demand for both renewable diesel and biodiesel. Driving this growth will be California's mandate to further embrace these cleaner burning lower carbon fuels as the best way to displace petroleum diesel in California, the nation and the world.

Carbon Intensity

The average carbon intensity (CI) for renewable diesel and biodiesel in California today is 31.4. This represents a 71% decrease in greenhouse gas (GHG) emissions compared to petroleum diesel. We believe that as renewable diesel and biodiesel grow and provide an increasing percentage of California's diesel fuel needs that the average CI will remain in this ultra-low GHG range, representing a cumulative reduction of 263 million tons of GHG emissions by 2030. This will be accomplished by a combination of continued use of low CI feedstocks combined with the use of increasingly low carbon sources of process energy (renewable electricity for power, biogas for heat, etc.).

Air Quality Benefits

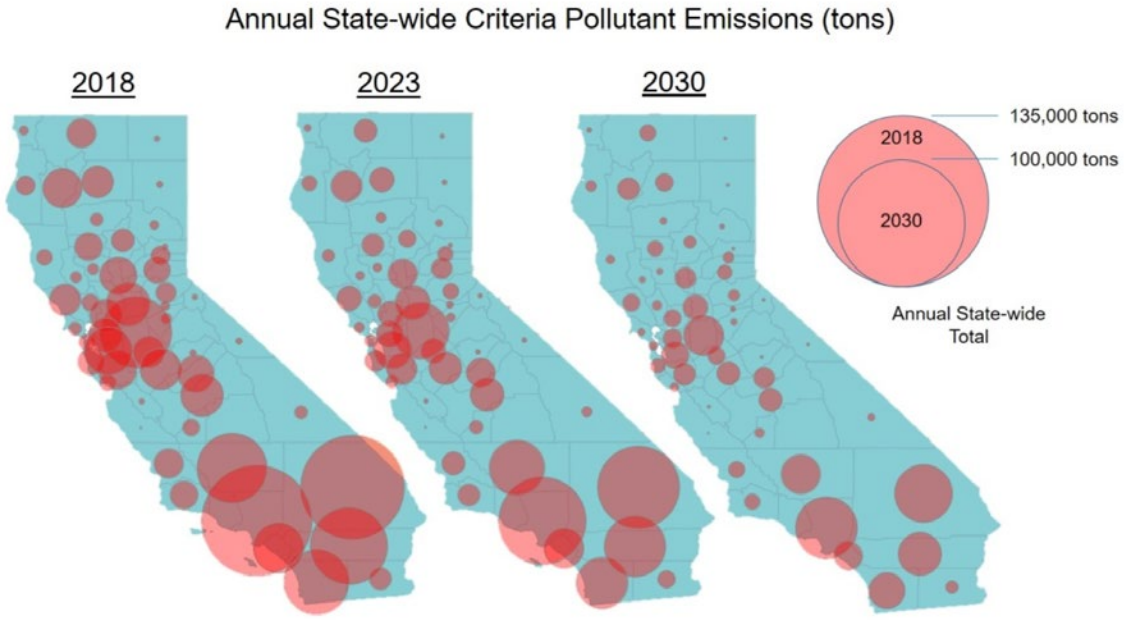
Biodiesel and renewable diesel produce far fewer emissions than petroleum diesel. On average, biodiesel reduces particulate matter (PM) by 58%, total hydrocarbons (THC) by 57%, and carbon monoxide (CO) by 34% compared to California CARB diesel and Renewable diesel reduces these pollutants by 29%, 14%, and 26% respectively, and also reduces nitrogen oxides (NOx) by 14%.

The elimination of petroleum diesel emissions from California is a huge health improvement opportunity making a real difference in the daily lives of millions of Californians. By eliminating petroleum diesel and switching to renewable diesel and biodiesel as we have outlined in this report, we can eliminate over one-third of the PM related to diesel vehicles, improving the health of all Californians by reducing rates of asthma, lung cancer, respiratory diseases, cardiovascular disease, premature delivery, birth defects, low birth weight, and premature death.

It should be noted that most of California's diesel use is in low-income areas that are disproportionally impacted by dirty petroleum diesel exhaust. Most diesel fuel in California is burned in the South Coast and the Central Valley, the two areas with the worst air quality in California. As shown in the figures below, eliminating petroleum diesel from California will have an enormous health benefit to those Californians who have suffered from poor air quality for far too long. We advocate that the priority for our cleaner fuels should be to use them first in these low-income, high-impact areas so the air quality benefits can be achieved more rapidly.

Zero Emission Vehicles

The California Advanced Biofuels Alliance supports the State's goal to increase the number of zero emission vehicles by 2030. However, we believe that many vehicle types will be difficult to replace with zero emission vehicles by 2030 and thus advocate for the use of renewable diesel, biodiesel and renewable natural gas as a complement to a zero emission vehicle future.



Conclusion: Governor Newsom's 2030 Goal is Achievable

We applaud Governor Newsom for his bold and visionary goal to eliminate petroleum diesel emissions in California by 2030. We believe this goal is eminently achievable. As this report lays out, we are already well on our way and simply need to continue to push in the direction we are heading to provide the necessary momentum.

We do not believe there is any one magical solution to help California to achieve its ambitious goals. All cleaner energy options need to be available to our society as we transition to a zero-emission future.

During this transition, cleaner burning, lower carbon biofuels such as renewable diesel, biodiesel and renewable natural gas are essential. California has done an amazing job blazing the trail with its market leading low carbon fuel standard.

Combining the power and market friendly design of the low carbon fuel standard with an aggressive zero petroleum diesel goal by 2030 is a powerful way to send a message to the market to bring its innovation and capital to California. This inducement will help achieve the 2030 goal and lead the way to a better, more sustainable transportation future.

Our industry stands ready to work with the Newsom Administration in support of policies and programs to reduce reliance on petroleum fuel that results in climate-changing greenhouse gas emissions and poor air quality – and pose significant harm to low-income urban communities.

The members of the California Advanced Biofuels Alliance are here to meet this challenge and look forward to making California's ambitious climate and air quality goals a reality.

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ABOUT THE CALIFORNIA ADVANCED BIOFUELS ALLIANCE

The California Advanced Biofuels Alliance's (CABA) mission is to promote the production and use of advanced biofuels in California. Founded in 2006, CABA has worked both in-state and at the national level to address regulatory, policy, and legislative issues to enable a growing market for biofuels in California.

More info at **caadvancedbiofuelsalliance.org**

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