



Lower Carbon Intensity Solution —

How Biodiesel Has Become the Answer
to Emission-cutting Initiatives





The Low Carbon Fuel Standard is undeniably altering the transportation landscape in California. The regulation — commonly called the LCFS — aims to reduce greenhouse gas emissions, and almost nothing related to fleet management occurs without taking it into consideration.

Many obligated parties and fleets have turned to biodiesel as a lower carbon solution. Here is a sampling of facts and figures showing why:



Among liquid fuels, biodiesel consistently has the **lowest average carbon intensity (CI) value.**



Biodiesel accounted for nearly **20 percent** of the LCFS credits generated in 2016.



Biodiesel volumes in California **increased 1,196 percent** over the past six years and are projected to **increase another 471 percent** between 2017 and 2023.



The average biodiesel blend level in California recently experienced a **65.7 percent year-over-year increase.**

“Californians want clean air and have voted to do so with both the LCFS and the cap and trade program, and now the state is looking to extend the programs and achieve even greater emission reductions,” says Todd Ellis, Executive Director, West Region Sales, at Renewable Energy Group, Inc. (REG). “Biodiesel is an ideal fuel to help parties meet requirements of these programs, and the biodiesel industry is in a position to meet demand.”

LCFS — What you need to know

The LCFS took effect in 2011 and was reauthorized in 2015. Here are some of the basics of the program.

Objective

Its goal is to reduce the carbon intensity of transportation fuels by 10 percent by 2020. It is one of several measures included in a scoping plan by the California Air Resources Board (CARB) to reduce greenhouse gas (GHG) emissions. A proposed update to the broader scoping plan released in early 2017 calls for a 40 percent reduction in GHG emissions by 2030.¹

Carbon intensity

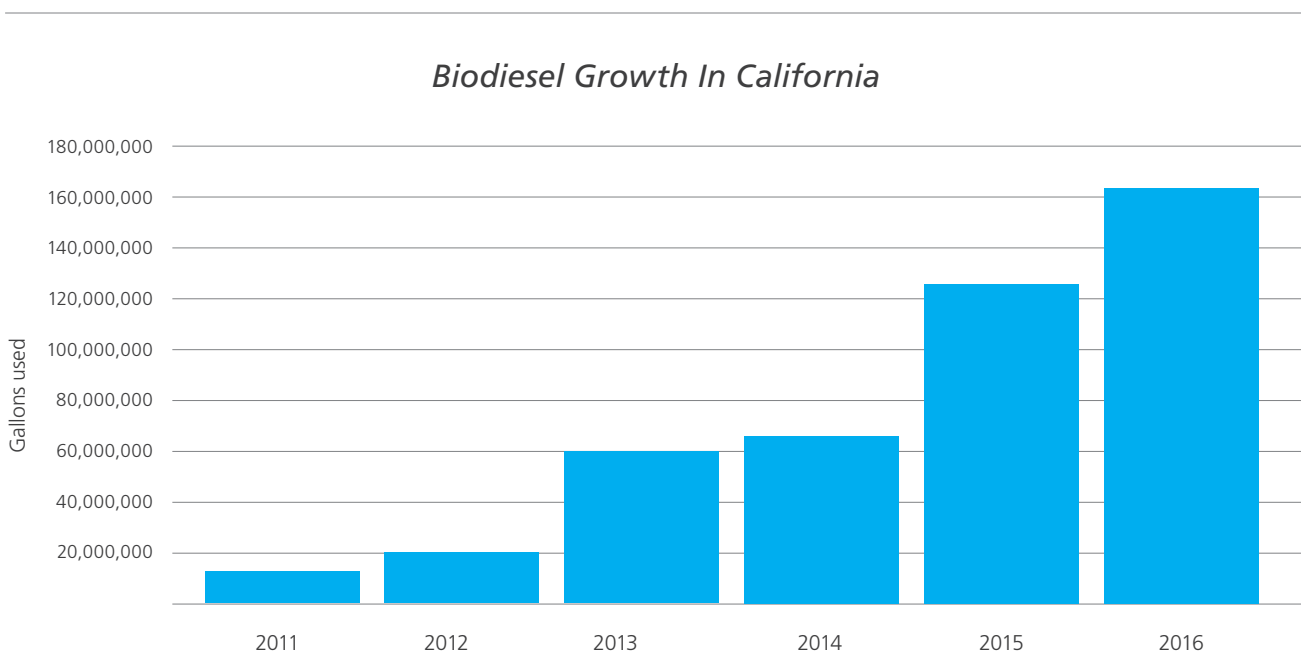
CARB defines carbon intensity as the measure of GHG emissions associated with producing and consuming a fuel. Simply put, the LCFS promotes the production and use of cleaner transportation fuels, thereby reducing emissions.

Compliance

Regulated parties are often the fuel producer, but the obligation can be passed downstream as far as the rack. Obligation is tracked through credits and deficits. Fuels with a CI score lower than the annual standard earn a credit. Fuels that are higher than the standard result in a deficit, which must be reconciled annually. Credits can be traded between regulated parties.

Market picks fuels

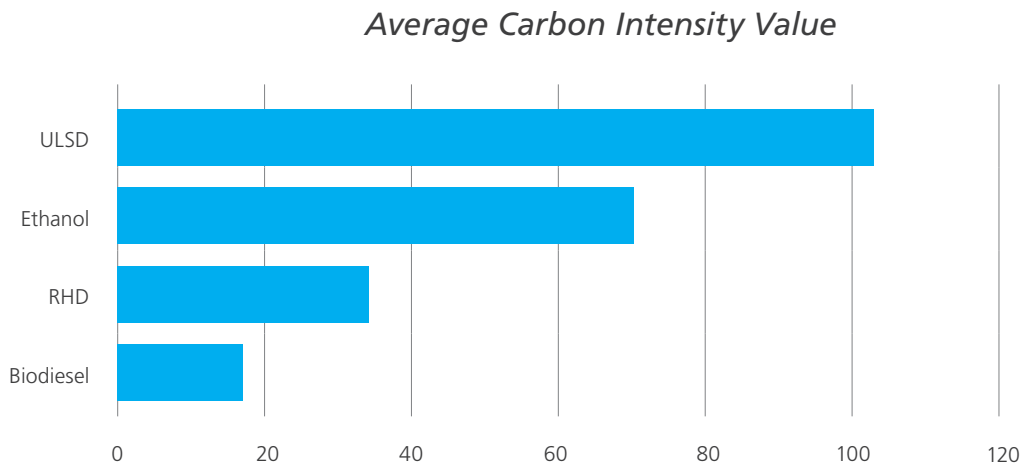
CARB says the LCFS is fuel-neutral and performance-based, allowing the market to decide which fuels are used to meet the CI goals.²



Source: <https://arb.ca.gov/fuels/lcfs/lrtqsummaries.htm>

Biodiesel has the right stuff

The backbone of the LCFS is carbon intensity — and no liquid fuel can match biodiesel. (See chart.)



Source: California Air Resources Board, Q4 2016

CARB uses a model to calculate the CI of each fuel. The model takes into account the total amount of GHG emitted during the full lifecycle of a fuel — a “well to wheels” approach that captures direct and indirect effects. Producers submit fuel pathway applications for each combination of feedstock and fuel.

According to Dave Slade, Executive Director, Biofuel Technology and Services at REG, biodiesel scores so well for three primary reasons:

1. CARB assigns CI values to feedstocks, and biodiesel can be made from feedstocks that are waste or by-products, such as used cooking oil and inedible corn oil.
2. The energy used in the production of biodiesel is lower compared with other fuels.
3. Shipping also factors in. Biodiesel from the Midwest is shipped by rail, which has a lower CI than shipping by truck.

“Biodiesel feedstock, production and transportation all receive lower CI values from CARB,” Slade says. “And when biodiesel is used in a vehicle, it has lower hydrocarbon, particulate matter and carbon monoxide emissions than other fuels.”

Renewable hydrocarbon diesel

Renewable hydrocarbon diesel (RHD) is another attractive option for meeting LCFS requirements. Like biodiesel, RHD significantly cuts emissions and has high cetane. It also meets the ASTM diesel fuel spec and is a drop-in replacement for petroleum diesel.

The issue with RHD has been a lack of supply to meet high demand. Biodiesel is a more widely available product with a lower average CI value.

A new solution for the market is RHD and biodiesel blended fuel. Biodiesel is blended with RHD instead of traditional diesel, creating a 100 percent renewable product that captures the best qualities of the two fuels and lowers emissions more than either fuel by itself.

Biodiesel market strong in California

The California market has embraced biodiesel for several reasons.

- **CI score** — Biodiesel sets the standard among liquid fuels for lower carbon intensity.
- **Ease of implementation** — No infrastructure or vehicle modifications are necessary with biodiesel blends.
- **Supply** — Domestic producers can meet the demand.

Ellis, of REG, says the state is leading the nation in blending infrastructure and is using higher blends, which also helps obligated parties to meet their volume obligations under the federal government’s Renewable Fuel Standard (RFS) program.

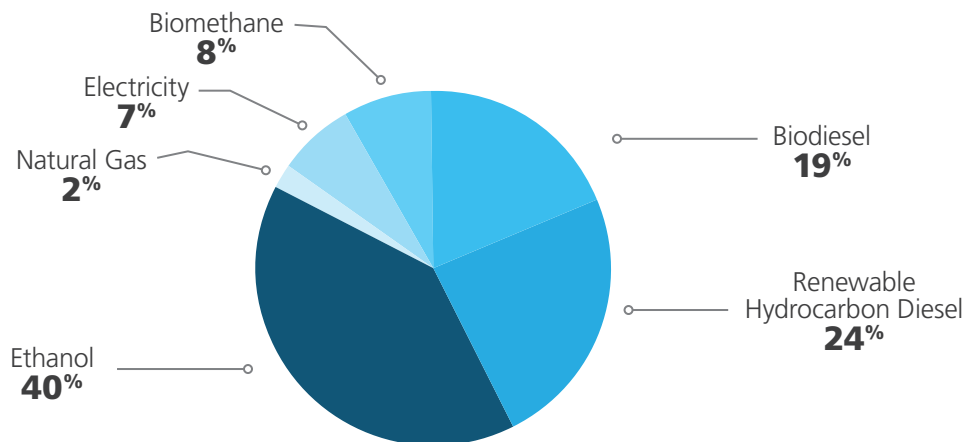
The average biodiesel blend in on-road taxable diesel in California was 4.89 percent in Q3 2015 to Q2 2016, up from 2.95 percent in the four quarters preceding that, according to data supplied by CARB. As a percentage change, that’s a 65.7 percent increase in blend level over that short period.

“The largest biodiesel consumers are fleets — municipal, private and commercial,” Ellis says. “They are using biodiesel because it is cheaper than diesel and also meets their sustainability and climate goals.”

Among the recent trends Ellis has seen:

- Acceptance among end-users for higher blends, including B20.
- Infrastructure development to provide access to higher blends. B5–B20 is now offered at most racks.
- The overall economics in California have incentivized fleets to use biodiesel, and they’re seeing significant economic value with B20 blends in addition to the environmental benefits.

2016 LCFS Credit Generation

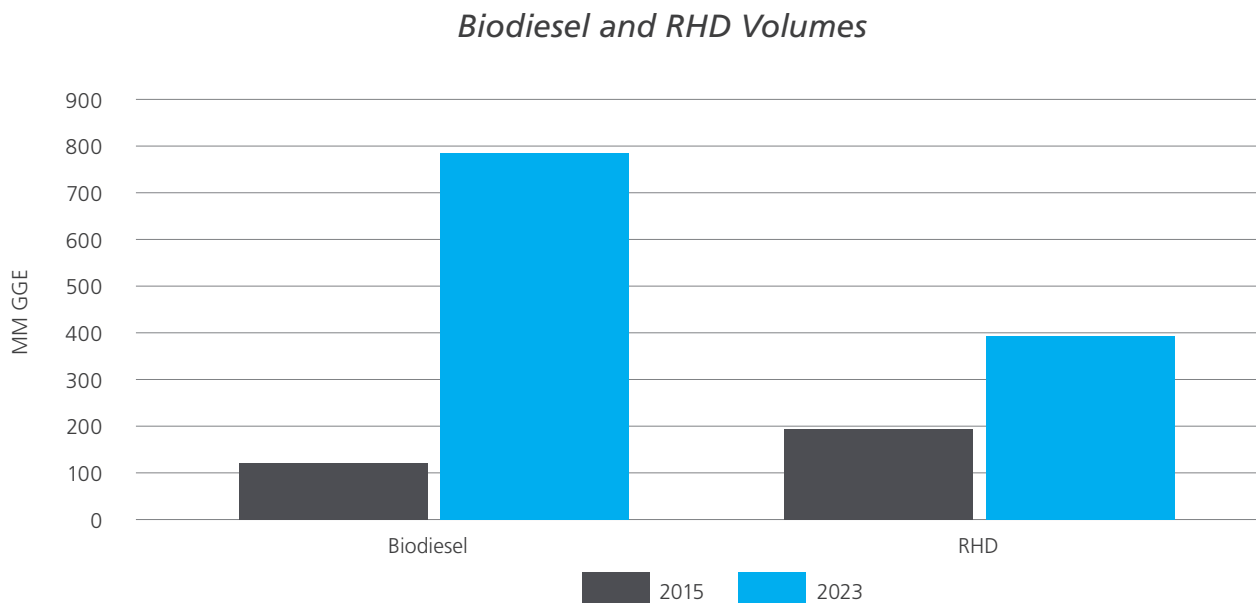


Source: <https://www.arb.ca.gov/fuels/lcfs/lrtqsummaries.htm>

Biodiesel market projected to grow

The California market will continue to present opportunities for biodiesel.

CARB projections show biodiesel volumes growing 471 percent between 2015 and 2023, reaching 783 million gallons. In that same period, RHD volumes are projected to grow 105 percent, to 380 million gallons. (See chart.)



Source: www.arb.ca.gov/cc/scopingplan/meetings/090716/bfsmv83b.zip

It's not hard to figure out why biodiesel consumption will continue to increase, says Ryan Lamberg, who has more than a decade of experience in the California biodiesel industry and serves as environmental and technical consultant for the National Biodiesel Board.

"Biomass-based diesel solutions will remain the lowest cost, lowest carbon intensive and easiest way to meet state requirements," he says.

Lamberg's market forecast includes these points:

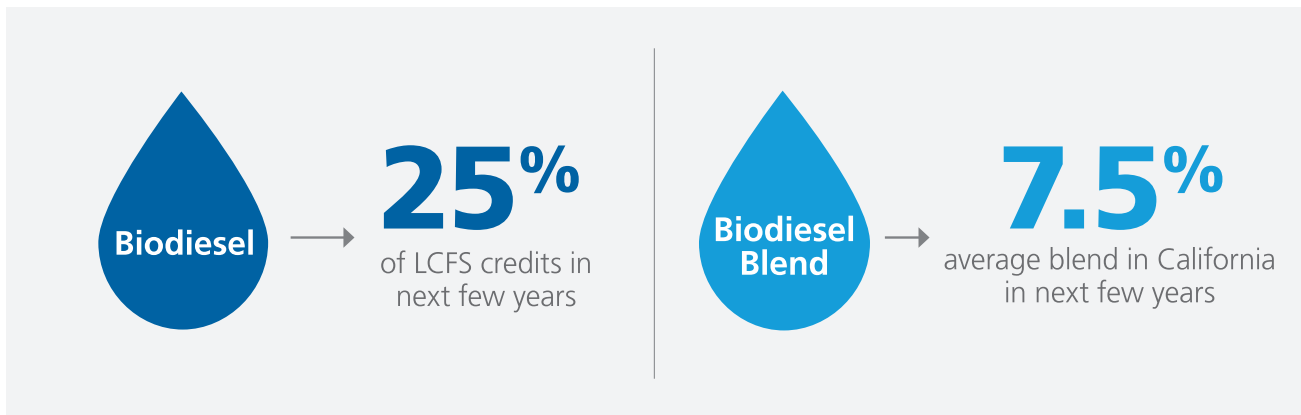
- CARB proposes even greater CI reductions by 2030.
- The board may pursue a target of 50 percent renewable content by 2030, as mentioned in the scoping plan it released in early 2017.
- Biodiesel and RHD could meet upwards of 50 percent of the LCFS credits by 2030.

Room to grow in California

Projections completed by Lamberg show the market for biodiesel remaining strong in California. Using CARB data, he concludes the average biodiesel blend level in California will increase to approximately 7.5 percent within the next few years. He also estimates that biodiesel will generate 25 percent of the LCFS credits.

When it comes to supplying increased demand, the U.S. biodiesel industry says it is up to the task. “Our industry is underutilized and has ample room to grow,” Lamberg says.

Ellis agrees: “The idle production and incremental gallons that can be optimized at biodiesel production plants today is close to 1 billion gallons. In addition, if the market signals are there, companies will invest in new production capacity.”



California supply chain

The operations of REG show how the domestic market can supply California. REG has several pathways approved by CARB, including for its Grays Harbor facility, a biorefinery in Washington with a nameplate capacity of 100 million gallons annually, and several midwest biorefineries. Product is shipped to California by rail, which has a lower carbon intensity than shipping by truck.

Impact outside California

The LCFS matters beyond the borders of the Golden State. One reason is the sheer size of the California economy. It's an oft-cited statistic that if the state were a country, it would have the sixth-highest GDP in the world. Another reason is that while "LCFS" has become shorthand for the California program, it's not the only place with emission-cutting regulations.

Oregon recently implemented a low carbon fuel standard that is similar to California's — a 10 percent reduction in the carbon intensity of transportation fuels over 10 years. As in California, biodiesel has lower CI scores and is a key fuel in helping regulated parties meet their obligations.³ In Canada, the province of British Columbia has a low carbon policy. Additionally, Canada is considering a national standard.

"Over time, these LCFS programs will build an integrated West Coast market for low-carbon fuels that will create greater market pull, increased confidence for investors of low-carbon alternative fuels, and synergistic implementation and enforcement programs," CARB says on its website.⁴

“There is a distinct growth trend with respect to low carbon policies.”

"There is a distinct growth trend with respect to low carbon policies," says Shelby Neal, Director of State Governmental Affairs at the National Biodiesel Board. "A lot of people are tired of being dependent on fossil fuels and they want cleaner fuels and cleaner air. Carbon policies have become a proven way of accomplishing those goals."

As Neal talks to lawmakers throughout the U.S., opinions of the California LCFS vary, but one thing is constant — the topic comes up frequently.

"There's definitely a sense that the LCFS will spread beyond the West Coast," he says. "Up to this point in time, the LCFS has proved to be a very effective means of decarbonizing and diversifying transportation fuels."

And as the market-based approach used by California has shown, biodiesel has proved to be an effective means for regulated parties and fleets to meet their low carbon goals.

Want to learn more?

If you'd like to talk more about the LCFS and biodiesel, we'd welcome the opportunity to have a conversation. Contact **Todd Ellis** at **(515) 239-8104** or **Todd.Ellis@regi.com**. For more information on REG, visit **regi.com**.

Sources:

¹ www.arb.ca.gov/cc/scopingplan/scopingplan.htm

² www.arb.ca.gov/fuels/lcfs/lcfs.htm

³ www.deq.state.or.us/aq/cleanFuel/docs/All-CIs.pdf

⁴ www.arb.ca.gov/fuels/lcfs/lcfs.htm

