

Carbon Pricing and Low-Carbon Fuel Programs

Two California Policies Critical to Reducing Emissions from Cars and Trucks

HIGHLIGHTS

California's Low Carbon Fuel Standard (LCFS) and Cap-and-Trade Program are playing a major role in cutting global warming emissions from the state's transportation sector. The LCFS, by requiring a gradual reduction in the carbon intensity of fuels sold in the state, is fostering innovation in new and better clean fuel options; meanwhile, the cap-and-trade program is helping integrate the costs of climate change into business decisions, and is supporting investments in deployment of clean vehicles and fuels. To ensure these two policies can continue working together to help decarbonize the state's transportation system and transition toward a clean transportation future, policy makers should extend these programs through 2030.

The burning of fossil fuels for cars, trucks, and other vehicles is the largest source of global warming emissions in California, contributing 36 percent of the state's total (CARB 2016a). To cut these emissions in line with California's climate goals, a wholesale transformation of the transportation sector is required over the next few decades, shifting to technologies that generate few, if any, global warming emissions.

There are many public policies that are important to changing the way we move people and goods in California. California's Low Carbon Fuel Standard (LCFS) and Cap-and-Trade Program are two such policies, working in concert to cut the use of high-carbon fuels for transportation and also create affordable low-carbon alternatives and the infrastructure needed to support their use. These policies, in turn, are spurring investors, entrepreneurs, scientists, and engineers to develop innovative low-carbon transportation technologies and strategies.

The LCFS and Cap-and-Trade Program work not only together, but also as part of a broader suite of economy-wide emissions reduction policies. These include the deployment of clean vehicle and fuel technologies (such as electricity, hydrogen, and sustainable biofuels), a build-out of clean fueling infrastructure, further research in advanced technologies, continued improvements in the fuel efficiency of gasoline- and diesel-powered cars and trucks, and increasing access to transit, biking, and walking.

California's Low Carbon Fuel Standard

California's LCFS requires petroleum refineries and fuel importers to reduce global warming pollution associated with the fuels they sell. The program regulates the "carbon intensity" of fuels, which is a measurement of global warming



Renewable diesel (above) and other clean fuels are gaining greater market share thanks to California's Low Carbon Fuel Standard, helping to not only reduce the transportation sector's global warming impact but also give consumers more clean fuel options.

emissions per unit of fuel over the fuel's life cycle. (See the box on p. 3 for more information on life cycle emissions.) The LCFS requires a gradual reduction in carbon intensity, reaching a 10 percent reduction in 2020 relative to 2010 (CARB 2016b). The state is considering extending the program to 2030 to support continued growth of clean fuels. The program provides refineries and fuel importers with considerable flexibility, allowing them to meet the standard by selling any fuel that has carbon intensity below the standard, or by purchasing credits generated by other sellers of lower-carbon fuels.

Because gasoline and diesel fuel have carbon intensities above the standard, the LCFS creates a ready market for lower-carbon fuels such as electricity, hydrogen, and biofuels. Indeed, between 2011 and 2016, use of alternative fuels grew by 50 percent, while the average carbon intensity assigned to these fuels declined by 30 percent. During this period, the program reported 25 million tons of reduced carbon emissions overall (CARB 2017). As the program has matured, increases in lower-carbon fuel use have come primarily from biodiesel, renewable diesel, and biomethane; these three sources accounted for half the emission reductions from the program in 2016. Electricity has also played an increasingly important role, rising from less than 1 percent of LCFS-

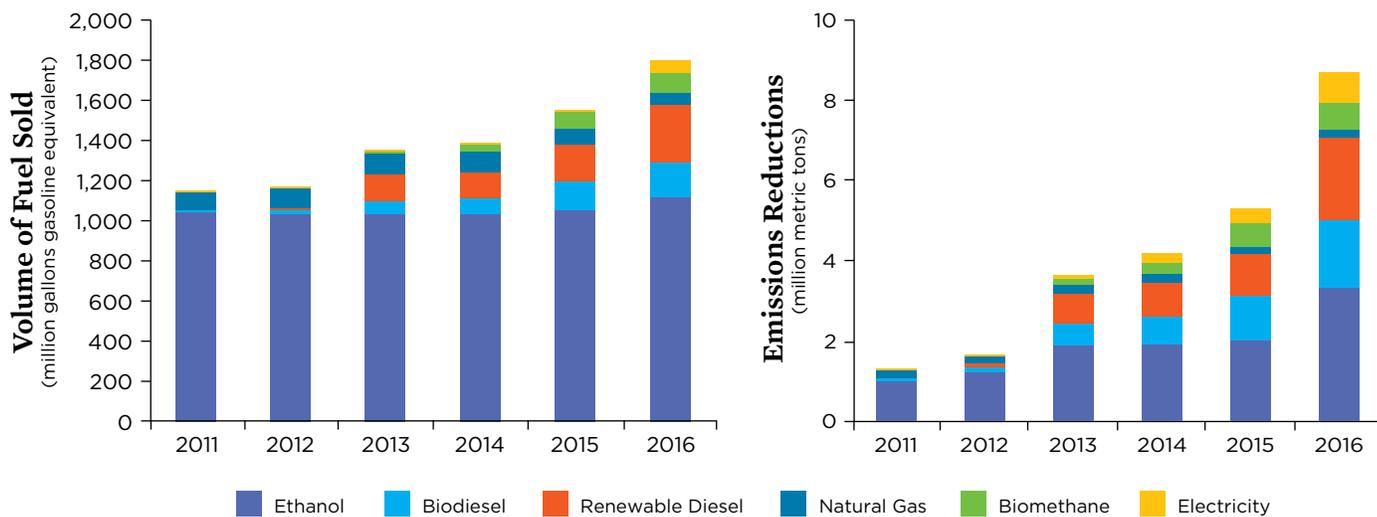
related emissions reductions in 2011 to 9 percent in 2016 (see the figure)—a number that will continue to rise as more electric vehicles hit the road and more electricity is generated from renewable sources (CARB 2017).

California's Cap-and-Trade Program

California's Cap-and-Trade Program sets a collective limit (or "cap") on carbon emissions from sources that account for 85 percent of California's global warming emissions, including transportation fuels, industrial facilities, electricity generation, and natural gas utilities. This cap declines by about 3 percent annually out to 2020 (CARB 2015), with the goal of reducing emissions to 1990 levels. The state has proposed extending the program, reducing the cap to 40 percent below 1990 levels by 2030.

Every source covered by the program must hold pollution permits, known as "allowances," equal to the emissions they produce. Because the allowances are limited and therefore valuable, those subject to the cap try to cut their emissions as a way to reduce the number of allowances they must hold. This interaction between the demand and supply of allowances in the carbon market determines the price of an allowance.

Low-Carbon Fuels on the Rise in California



California's Low-Carbon Fuel Standard has helped the state's clean fuels market grow by 50 percent between 2011 and 2016, with biodiesel, renewable diesel, biomethane, and electricity accounting for most the growth. Ethanol is the largest source of alternative fuel, and its volume has been fairly steady; however, emission reductions from ethanol have increased because of carbon intensity improvements.

NOTES: Fuel production is measured in millions of gasoline equivalent gallons, based on in-state fuel sales. Emissions reductions are measured by emissions credits generated under the Low Carbon Fuel Standard, and each credit represents a reduction of one metric ton of carbon dioxide equivalent (CO₂e) over the fuel's life cycle.

SOURCE: SOURCE: CARB 2017.



California's LCFS and cap-and-trade program are both helping transit agencies add electric buses into their fleets. Revenue from the cap-and-trade program is funding rebates to support the purchase of electric buses, while Foothill Transit is just one of several in California that are earning—and then selling—credits through the LCFS, providing a valuable revenue stream.

Transportation fuels were first regulated under California's Cap-and-Trade Program in January 2015, at the beginning of the program's second compliance period. Fuel providers must now acquire allowances for the emissions that result from using the fossil fuels they supply, which totaled more than 158 million metric tons of carbon dioxide equivalent in 2015 (CARB 2016c). At current allowance prices of around \$13 per ton, fuel providers have to purchase approximately \$2 billion worth of allowances to cover their 2015 emissions, sending an economic signal that steers fuel providers and consumers to less carbon-intensive fuel choices. Meanwhile, through the end of 2016, the state appropriated \$3.2 billion in proceeds from the sale of allowances for investments in programs that reduce global warming pollution.

Clean Fuel and Carbon Pricing Policies Are a Synergistic Pair

Putting a price on global warming emissions, either through a cap-and-trade program or a carbon tax, helps integrate the costs of climate change into the cost of doing business. In the transportation sector, carbon pricing helps ensure that the costs of pollution from fossil fuels—and the value of low-carbon technologies—are better reflected in decisions fuel providers make about what fuels to produce, as well as the decisions consumers make about what cars to buy. In this sector, producers and consumers usually respond by choosing the easiest and least-costly opportunities to reduce heat-trapping emissions in the short-term.

Another feature of a carbon pricing policy is that it generates significant revenue from the sale of emissions allowances. The revenue can be used in many ways, including in the development and deployment of cleaner vehicles and

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fuels. Through 2016, California has directed \$688 million of cap-and-trade proceeds to initiatives that promote low-carbon vehicle and fuel technologies. These include consumer rebates for the purchase of zero-emission cars and trucks, demonstration projects for advanced technology vehicles, and targeted projects to bring electric cars to communities burdened by pollution from nearby refineries and busy roads.

However, a carbon price alone is not enough to decarbonize our transportation system over the next few decades. Current allowance prices—which translate to pennies per gallon in increased fuel cost—cannot adequately motivate

Fuels' Climate Impacts Extend beyond the Tailpipe

California's LCFS takes into account not only the emissions generated by a vehicle when using a given fuel, but also the emissions that come from producing and transporting the fuel—known together as “life cycle” emissions. A life cycle analysis of emissions measures the full climate impact of a fuel, thereby identifying multiple areas in which fuel producers can address emissions. For example, about a quarter of global warming emissions associated with using gasoline come from extracting and refining the oil to make the gasoline (Martin 2016). Emissions associated with biofuels depend greatly on which crops are used, how they are grown, and how the fuel is produced. Electric vehicles produce no tailpipe emissions, so the life cycle emissions of electricity depend primarily on how the electricity is generated (whether from fossil fuels or renewable sources such as wind and solar).

Extending the LCFS and cap-and-trade program to at least 2030 would provide the long-term stability needed for major infrastructure improvements to take shape.

investments in innovative cleaner fuels. That's why it is important to have standards in place to limit heat-trapping emissions from fuels directly. California's LCFS facilitates research, development, and deployment of transformational low-carbon technologies. In short, California's LCFS creates a market for cleaner, lower-carbon fuels and ensures that this market grows steadily over time, regardless of the price of gasoline.

Keep Low-Carbon Fuel and Carbon Pricing Programs Strong for Years to Come

By fostering investments in advanced fuels and fuel-production processes today, the LCFS and Cap-and-Trade Program enable innovators and businesses to learn what works and what does not, and get a head start creating economies of scale for tomorrow. Extending both policies to at least 2030 would provide the long-term stability needed for major investments to take shape. Indeed, given the long lifetime of vehicles (at least 10 years) and fueling infrastructure (at least 20 years), it will be less expensive in the long run if we start scaling up these technologies now, allowing for a more gradual transition (NRC 2013).

Cutting transportation sector emissions requires a set of policies that, together, can reduce the carbon content of fuels, improve the fuel efficiency of vehicles, and reduce miles traveled. California's Cap-and-Trade Program and LCFS are two key components of the state's multifaceted approach to addressing this challenge, so it is critical that policy makers extend them at least another decade. Together, they can help the transportation sector shift from the single biggest source of California's global warming emissions to a major driver of innovative climate solutions.

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