

# Reducing Greenhouse Gas Emissions from Transportation Fuel with Low Carbon Fuel Standards

The transportation system on the Pacific Coast accounts for at least 40% of regional greenhouse gas emissions. Using cleaner fuels in transportation is an important strategy to meet the region's goal of cutting greenhouse gas emissions by 80% over the next 30 years. British Columbia, California, and Oregon have programs in place that are creating a market for low carbon-intensity fuels. Together, these jurisdictions are collaborating on best practices for program design and implementation, and policy alignment to create an integrated West Coast market for clean, low-carbon fuels.

## WHAT IS A LOW CARBON FUEL STANDARD?

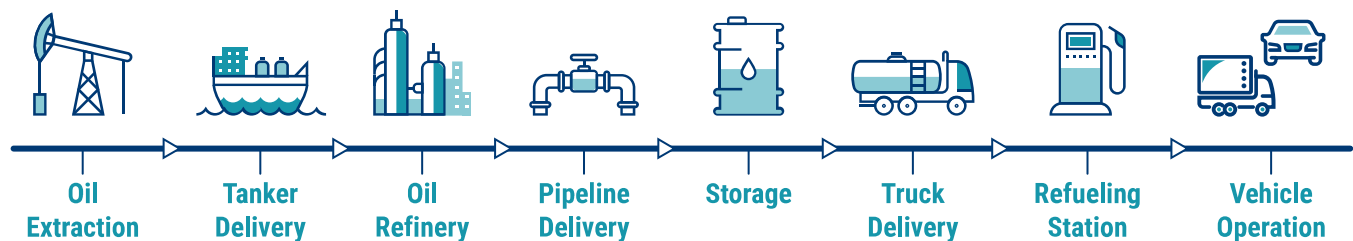
**Low carbon fuel standards (LCFS)**, also called clean fuel standards, require a reduction in the carbon intensity of transportation fuels supplied within a jurisdiction. **Carbon intensity** is a measure of the greenhouse gas emissions released by the full lifecycle of a fuel, from extraction to vehicle operation, as illustrated below for fossil fuels. Fuel suppliers have the flexibility to lower the carbon intensity of gasoline and diesel fuel by providing lower carbon pollution fuel alternatives or through credit trading. Credits can be generated by all kinds of alternative transportation fuels, including electricity, biofuels, renewable natural gas, and hydrogen.

### ABOUT THE PCC

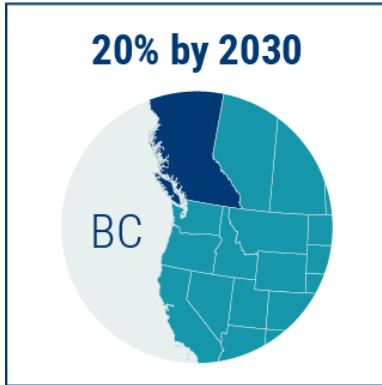
The Pacific Coast of North America represents the world's fifth largest economy, a thriving region of 55 million people with a combined GDP of \$3 trillion. Through the Pacific Coast Collaborative, British Columbia, Washington, Oregon, California, and the cities of Vancouver, Seattle, Portland, San Francisco, Oakland, and Los Angeles are working together to build the low carbon economy of the future.

In 2016, PCC jurisdictions renewed their 2013 commitment to creating a robust regional market for low carbon transportation fuels.

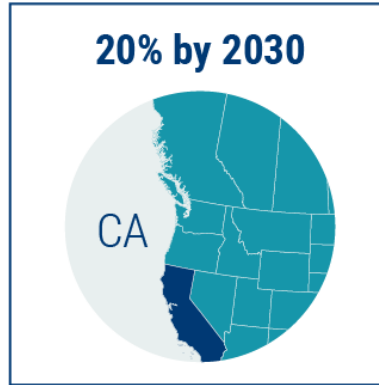
### Fossil Transportation Fuel Lifecycle



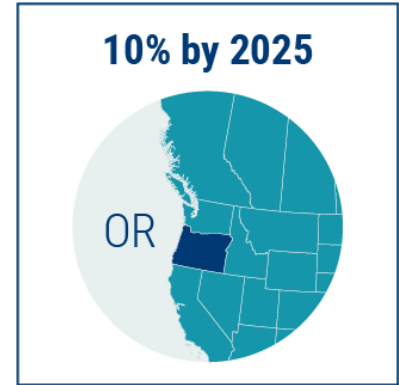
## Low Carbon Fuel Policies on the West Coast



**British Columbia** began implementing a Low Carbon Fuel Standard in 2010. Their standard phases in a 10% reduction in the carbon intensity of gasoline and diesel by 2020.<sup>1</sup> The province has committed to requiring a 20% reduction by 2030.<sup>2</sup>



**California** began implementing a Low Carbon Fuel Standard in 2011 to phase in a 10% reduction in the carbon intensity of gasoline and diesel by 2020. In 2018, the California Air Resources Board established a 20% reduction in fuel carbon intensity by 2030.<sup>3</sup>



**Oregon** began implementing a Low Carbon Fuel Standard in 2016. Otherwise known as the Clean Fuels Program, their standard phases in a 10% reduction in the carbon intensity of gasoline and diesel by 2025.

### FIRST EVER BIOFUELS ENTERPRISE ACQUISITION OF PETROLEUM REFINERY

The World Energy facility in Paramount, California (formerly AltAir), is the first refinery in the world built for commercial-scale production of alternative jet fuel. The project converted an existing petroleum refinery. World Energy Paramount now produces 35 million gallons per year of renewable fuels through the conversion of sustainable feedstocks, such as non-edible natural oils and agricultural wastes. With its use of domestic feedstocks receiving some federal support, the fuel is price-competitive with traditional, petroleum-based jet fuel, but achieves a greater than 60% reduction in carbon dioxide emissions over its full lifecycle when compared to traditional jet fuel.

Source: Lane, J. (2018, March 19). The Paramount Deal: World Energy takes off with audacious \$72M acquisition of AltAir and the Paramount oil refinery. Retrieved September 5, 2018 from <http://www.biofuelsdigest.com/bdigest/2018/03/19/the-paramount-deal-world-energy-takes-off-with-audacious-72m-acquisition-of-altair-and-the-paramount-oil-refinery/>

## WHY IS IT IMPORTANT?

Low carbon fuel standards are transforming the fuels market on the West Coast by incentivizing innovation and investment in clean fuels.

<sup>1</sup>Province of British Columbia. (n.d.). Renewable & Low Carbon Fuel Requirements Regulation. Retrieved March 22, 2019, from <https://www2.gov.bc.ca/gov/content/industry/electricity-alternative-energy/transportation-energies/renewable-low-carbon-fuels>.

<sup>2</sup>Office of the Premier. (5 Dec 2018). CleanBC plan to reduce climate pollution, build a low-carbon economy. Retrieved March 22, 2019, from <https://news.gov.bc.ca/releases/2018PREM0088-002338>.

<sup>3</sup>Green Car Congress. (28 Sept 2018). CARB extends Low Carbon Fuel Standard by 10 years, doubles the intensity reduction target to 20%. Retrieved March 22, 2019, from <https://www.greencarcongress.com/2018/09/20180928-lcfs.html>

- Under low carbon fuel standards in British Columbia, Oregon, and California, alternative fuels have provided the **transportation energy equivalent of 9 billion gallons of gasoline and diesel fuel**.
- The use of alternative fuels in place of fossil fuels has resulted in nearly **53 million metric tons fewer greenhouse gas emissions**<sup>4</sup> on the West Coast, according to the most recent data from each program, an amount equivalent to removing 11 million passenger cars from the road for an entire year.<sup>5</sup>
- Credits generated by the low carbon fuel standards are **boosting the market for electric vehicles**. California and Oregon have sold more than 528,000 battery electric vehicles through December 2018. The proceeds from credit sales in California fund EV rebate programs, electric buses in transit fleets, charging stations, and can be applied to lower the cost of charging.<sup>6</sup>

## The Benefits of Low Carbon Fuel Standards

Increasing the use of low carbon fuels offers several complementary benefits beyond reducing greenhouse gas emissions.

- **Expanded Clean Fuel Options and Increased Competition:** Low carbon fuel standards create incentives for the development of many different types of clean fuels, including biodiesel, ethanol, renewable diesel, electricity, and hydrogen, providing more options for consumers, businesses, and transit agencies.<sup>7</sup> The programs also create competition among low carbon fuel producers to innovate and find ways to drive the carbon intensity of the products even lower.<sup>8</sup>
- **Price Advantages for Consumers of Low Carbon Fuels:** Some alternatives to gasoline and diesel incentivized by low carbon fuel standards, such as renewable natural gas and electricity, have lower costs for consumers than petroleum-based fuels. As the use of low-carbon alternative liquid fuels and infrastructure increases, it will decrease demand for petroleum-based fuels and, in time, may help insulate users from global oil price swings. The price of low-carbon alternative fuels is also expected to decline as production volume increases.
- **Improved Public Health Outcomes:** Many cleaner fuel options generate fewer emissions at the tailpipe compared to petroleum-based fuels, which can improve air quality and public health. A study by the American Lung Association<sup>9</sup> estimated that, by 2025, implementation of the LCFS in California would:
  - Reduce criteria pollutant emissions by almost 180,000 tons
  - Prevent 38,000 asthma attacks, 600 heart attacks, 880 premature deaths, and 75,000 lost work days
  - Save \$8.3 billion in pollution-related health costs

## RENEWABLE NATURAL GAS GOODS DISTRIBUTION

**Fred Meyer** was one of the first companies in Oregon to take advantage of the Clean Fuel Program. The grocery chain, part of Kroger Co., is using renewable natural gas (RNG) from landfills in its fleet of 40 trucks based out of their distribution center in Clackamas, Oregon, reducing 5,328 metric tons of greenhouse gas emissions annually.

Source: Work Truck. (2016, May 2). Fred Meyer Calls for Up to 500,000 Gallons of RNG. Retrieved July 24, 2018 from <https://www.worktruckonline.com/134913/fred-meyer-calls-for-up-to-500-000-gallons-of-rng>

<sup>4</sup> Includes 2 MMT from Oregon's Clean Fuels Program through Q3 2018 ([program data](#)), 43 MMT from California's Low Carbon Fuel Standard program through Q3 2018 ([program data](#)), and 7.7 MMT from British Columbia's Renewable and Low Carbon Fuels Regulation through Q4 2017 ([program data](#)).

<sup>5</sup> Calculated using EPA's Greenhouse Gas Equivalencies calculator (<https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator/>); the equivalent GHG emissions of 53 MMT carbon dioxide or carbon dioxide equivalent.

<sup>6</sup> Auto Alliance, (n.d.). Advanced Technology Vehicle Sales Dashboard. Retrieved March 22, 2019, from <https://autoalliance.org/energy-environment/advanced-technology-vehicle-sales-dashboard/>.

<sup>7</sup> California Delivers. (n.d.). Low Carbon Fuel Standard. Retrieved July 5, 2018, from <http://www.cadelivers.org/low-carbon-fuel-standard/>.

<sup>8</sup> Renew Oregon. (n.d.). Low Carbon Fuel Standard. Retrieved July 5, 2018, from [http://www.reneworegon.org/clean\\_fuels\\_standard](http://www.reneworegon.org/clean_fuels_standard).

<sup>9</sup> O'Connor, T., Hsia-Kiung, K., Koehler, L., Holmes-Gen, B., Barrett, W., Chan, M., & Law, K. Driving California Forward. Retrieved July 5, 2018, from [https://www.edf.org/sites/default/files/content/edf\\_driving\\_california\\_forward.pdf](https://www.edf.org/sites/default/files/content/edf_driving_california_forward.pdf)

## THE ADVANTAGE OF WORKING TOGETHER

Since 2013, the PCC has created a forum for British Columbia, California, and Oregon to collaborate on questions of regional supply, and work together to harmonize policies, program implementation, and enforcement to create a robust West Coast market. Working together offers several advantages:

- **Address Questions of Regional Supply:** The collaboration has helped the jurisdictions respond to questions of capacity to supply the entire West Coast, were Washington also to enact low carbon fuel standards. In 2015, the International Council on Clean Transportation (ICCT) conducted a [study of regional supply](#) of low-carbon fuels in British Columbia, California, Oregon, and Washington. ICCT's analysis concluded that there could be sufficient low-carbon fuels available to reduce petroleum gasoline and diesel consumption 25% by 2030 and the overall carbon intensity of transportation fuels by up to 21% over the same period.<sup>10</sup>
- **Share Information and Expertise:** Collaboration allows the PCC jurisdictions to share information about not only their programs, but also fuel technologies and industry developments happening across the region and more broadly that could have supply or policy implications. Connecting on regular calls and annual workshops in person creates the opportunity for technical staff to trade expertise and tackle program challenges together so they can develop more durable solutions for their states and province.
- **Send a Stronger Market Signal:** The commonalities in program design within British Columbia, California, and Oregon's low carbon fuel standards send a stronger signal to fuel providers and create a larger market for low carbon fuel producers to supply.
- **Pave a Trail for Others to Follow:** The low carbon fuel standards on the West Coast have paved the way for other jurisdictions looking to reduce greenhouse gas emissions. A national Clean Fuel Standard is under development for adoption in Canada, with final regulations for liquid fuels anticipated in 2020, to be followed one year later by regulations for solid and gaseous fuels.<sup>11</sup> Brazil is developing a low-carbon fuels program called RenovaBio.<sup>12</sup> In both cases, PCC staff are sharing technical resources and lessons learned from the Pacific Coast.

### CNG-POWERED WASTE COLLECTION

The City of Surrey in British Columbia is the first municipality in Canada to require waste collection trucks to use renewable gas. Since 2012, the City has been operating their waste collection fleet with compressed natural gas. The BFI Canada trucks provide organics waste pickup services 5 days a week, averaging over 15,500 miles a year! Replacing one diesel truck with a CNG truck is the equivalent of eliminating emissions from an estimated 475 cars each year and each truck replaced reduces nitrogen oxide and diesel particulate emissions 90%.

Source: The City of Surrey. (2016, November 23). Waste Collection Fleet. Retrieved August 21, 2018 from <https://www.surreybiofuel.ca/news-media/blog/waste-collection-fleet>

<sup>10</sup> Malins, C., Lutsey, N., Galarza, S., Shao, Z., Searle, S., Chudziak, C., & van den Berg, M. (2015). Potential low-carbon fuel supply to the Pacific Coast region of North America. The International Council on Clean Transportation. Washington, D.C. Retrieved August 23, 2018 from <https://www.theicct.org/publications/potential-low-carbon-fuel-supply-pacific-coast-region-north-america>.

<sup>11</sup> Clean Fuel Standard. (2018, July 19). Government of Canada, Retrieved August 23, 2018 from <https://www.canada.ca/en/environment-climate-change/services/managing-pollution/energy-production/fuel-regulations/clean-fuel-standard.html>. The program is to cover transportation, industry, home and buildings. <https://www.canada.ca/en/environment-climate-change/services/canadian-environmental-protection-act-registry/clean-fuel-standard-discussion-paper.html>

<sup>12</sup> Brazil ethanol output could double by 2030 - gov't study. (2018, July 11). Reuters. Retrieved August 23, 2018 from <https://in.reuters.com/article/brazil-ethanol/brazil-ethanol-output-could-double-by-2030-govt-study-id1N1U70U1>. The program is to cover renewable fuels only.