

# The Low Carbon Solution

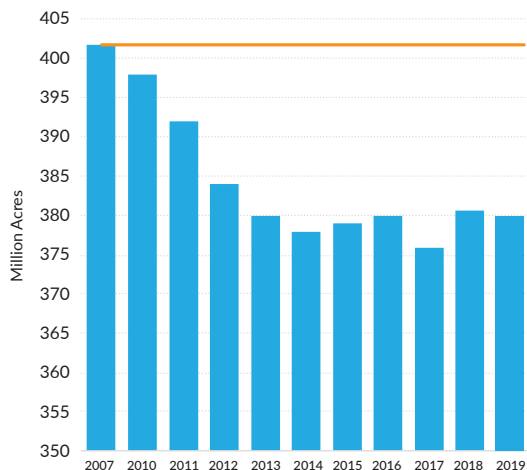
**2014** through 2018 ranked as the earth's five warmest years on record, and 2019 is likely to top them all. Moreover, unprecedented fires in Australia, record ice melt in the Arctic, and increasingly volatile weather patterns have sparked a global dialogue about the growing imperative to reduce carbon.

From RFA's perspective, the ethanol industry should be helping to lead the conversation because we have a great story to tell. The U.S. Department of Energy, California Air Resources Board (CARB), Oregon Department of Environmental Quality, U.S. Department of Agriculture (USDA) and others already recognize that grain-based ethanol reduces greenhouse gas (GHG) emissions by 35 to 50 percent compared to gasoline. Emerging technologies promise to boost that reduction to around 70 percent in just the next few years, according to

USDA. Further, CARB data show that ethanol is responsible for 22 million metric tons of GHG reduction from California's transportation sector since 2011—more than any other low carbon fuel.

Thankfully, the United States already has a framework in place to drive future policy. The Renewable Fuel Standard has been an important and effective policy reducing greenhouse gas emissions from fuels for 15 years and has reduced CO<sub>2</sub>-equivalent GHGs by an astounding 600 million metric tons since its implementation. That is the equivalent of removing roughly half of the cars on the road in America for an entire year or eliminating the annual emissions from 13 coal-fired power plants. With ethanol, we don't have to wait and hope for major technological or economic breakthroughs; the fuel is available now at a low cost to drive decarbonization of our liquid fuels.

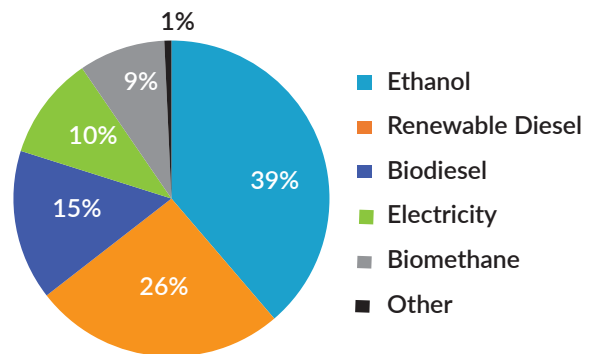
**U.S. EPA Determination of Agricultural Land Use vs. 2007 Baseline**



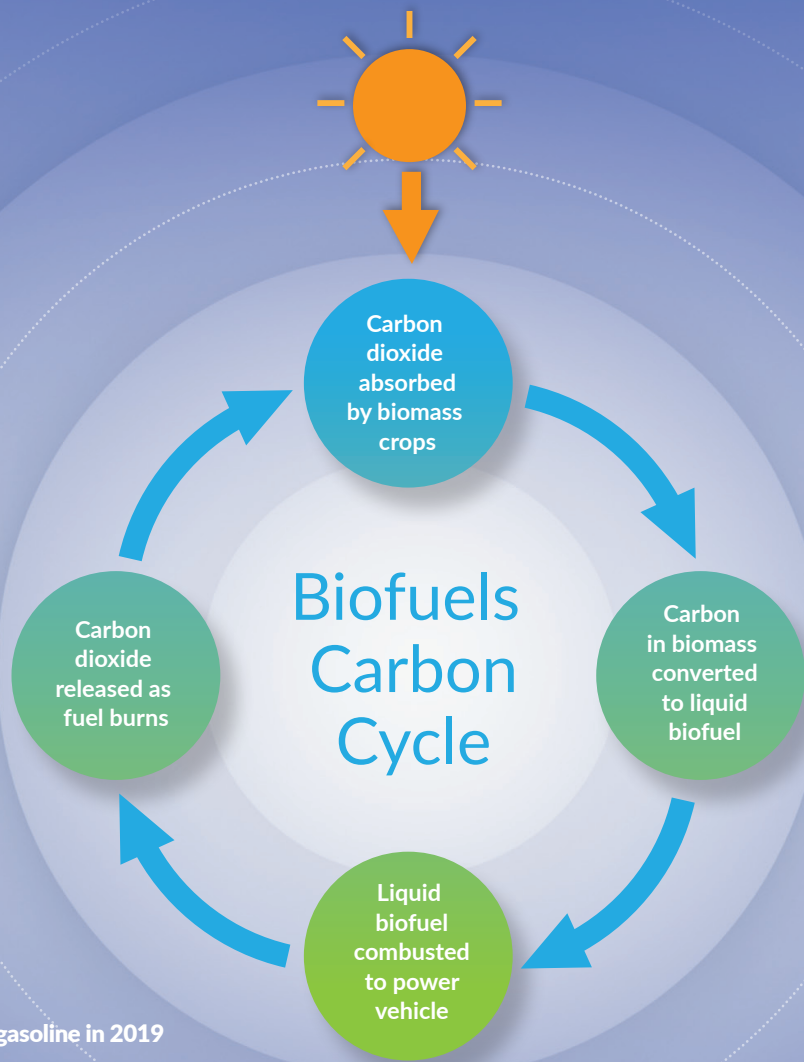
*Overall agricultural land use has dropped significantly since EPA established the 2007 baseline with the expansion of the Renewable Fuel Standard.*

Source: RFA using U.S. Environmental Protection Agency data

**California LCFS Credit Percentage by Fuel, Q1 2011 - Q2 2019**



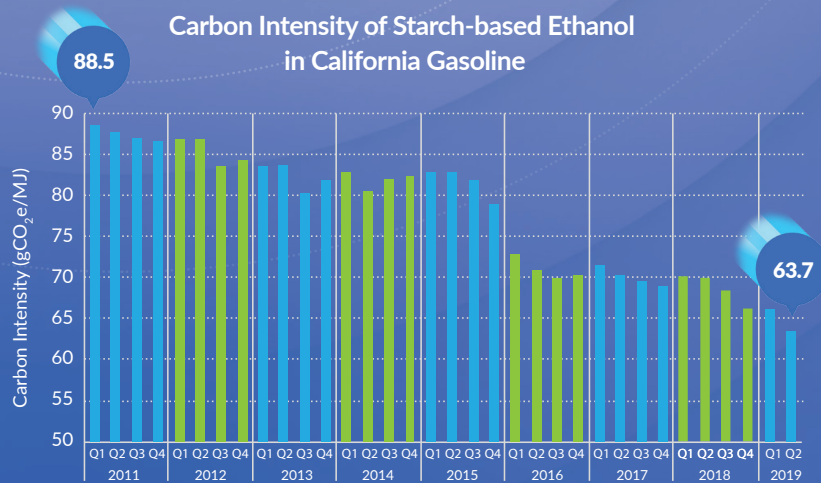
Source: RFA using California Air Resources Board data



The use of ethanol in gasoline in 2019 reduced CO<sub>2</sub>-equivalent greenhouse gas emissions from the transportation sector by 54.1 million metric tons. That's equivalent to removing 11.5 million cars from the road for an entire year, or eliminating the annual emissions from 13 coal-fired power plants.

Source: RFA analysis using U.S. Dept. of Energy GREET model

**Carbon Intensity of Starch-based Ethanol in California Gasoline**



Source: RFA using California Air Resources Board data