



Biofuels: Ethanol

What Is Ethanol?

Ethanol is an alcohol fuel (ethyl alcohol) made by fermenting the sugars and starches found in plants and then distilling them. Any organic material containing cellulose, starch, or sugar can be made into ethanol. The majority of the ethanol produced in the United States comes from corn. New technologies are producing ethanol from cellulose in woody fibers from trees, grasses, and crop residues.

Today nearly all of the gasoline sold in the U.S. contains around 10 percent ethanol and is known as E10. In 2011, the U.S. Environmental Protection Agency (EPA) approved the introduction of E15 (15 percent ethanol, 85 percent gasoline) for use in passenger vehicles from model year 2001 and newer. Fuel containing 85 percent ethanol and 15 percent gasoline (E85) qualifies as an alternative fuel. There are more than 10 million flexible fuel vehicles (FFV) on the road that can run efficiently on E85 or E10. However, just under 10 percent of these vehicles use E85 regularly.

Characteristics of Ethanol

With one of the highest octane ratings of any transportation fuel, ethanol increases the energy efficiency of an engine. When using ethanol blends, vehicles have comparable power, acceleration, payload capacity, and cruising speed to those using gasoline. However, because ethanol contains less energy per gallon than gasoline, vehicle range (the distance a vehicle can travel on a tank of fuel) can be slightly less. Ethanol is also less flammable than gasoline; it is safer to store, transport, and refuel.

Vehicle maintenance for ethanol-powered vehicles is similar to those using gasoline. Oil changes, in fact, are needed less frequently. Due to its detergent properties, ethanol tends to keep fuel lines and injectors cleaner than gasoline. Because ethanol has a tendency to absorb moisture, using ethanol fuel can help reduce the possibility of fuel-line-freeze-up during the winter.

Distribution of Ethanol

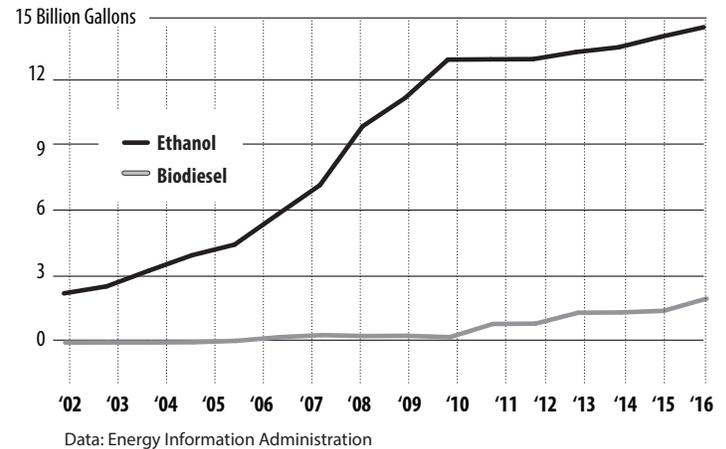
In 2016, ethanol plants in the U.S. produced more than 14.9 billion gallons of ethanol. There are 198 plants operating nationwide. These plants are located mostly in the Midwest. Many new plants are in the planning stages. There are currently over 3,000 E85 fueling stations in 43 states and the District of Columbia. Ethanol fuels for heavy-duty applications are available only through bulk suppliers.

Economics of Ethanol

The Federal Government mandated that by 2012, 12 billion gallons of renewable fuels be produced per year. The U.S. is exceeding this mark, producing nearly 15 billion gallons of ethanol alone in 2016. For comparison, however, the U.S. consumed over 143 billion gallons of gasoline in 2016. Today, it costs more to produce ethanol than gasoline, however, federal and state tax advantages make ethanol competitive in the marketplace.

Since it is the second largest use of corn, ethanol production adds value to crops for farmers. As new technologies for producing ethanol from all parts of plants and trees become cost-effective, the production and use of ethanol will increase dramatically.

U.S. Consumption of Biofuels, 2016



Environmental Impacts

Ethanol is both water soluble and biodegradable. If a fuel spill occurs, the effects are less environmentally severe than with gasoline. Because ethanol contains oxygen, using it as a fuel additive results in lower carbon monoxide emissions. The E10 blend results in 12 to 25 percent less carbon monoxide emissions than conventional gasoline. E10 is widely used in areas that fail to meet the EPA's air quality standards for carbon monoxide. However, some research indicates that under common driving conditions E10 can increase **ozone** concentrations. Breathing ozone in unhealthy concentrations can result in damage to the lungs and cause coughing and shortness of breath. In contrast to E10, E85 reduces ozone-forming volatile organic compounds and carbon monoxide.

Compared to gasoline, the production and use of corn ethanol could result in little to no carbon dioxide (CO₂) reductions in the near future. This is because an increased demand for ethanol may lead to converting forests and grasslands to crop land for fuel and food. This conversion releases carbon dioxide into the atmosphere. When these factors are taken into account, switching to corn ethanol from gasoline would provide little or no climate change benefit in the next 50 years. However, the production and use of cellulosic ethanol could reduce CO₂ emissions by 18 to 25 percent compared to gasoline, even when the impacts from clearing land for crops are considered.

Land Use and Ethanol

One concern with the use of corn ethanol is that the land required to grow the corn might compete with land needed to grow food. If this is true, the increased demand for corn could cause food prices to rise. Poultry farmers and ranchers are concerned that the cost of feed for their animals would rise. A global spike in food prices in 2008 was partially caused by increased demand for ethanol. Though it was only a small component of the price spike, it has caused concern that greatly increasing the use of corn ethanol could affect food prices more significantly.

A study by the Department of Energy and the Department of Agriculture concluded that by 2030 it would be possible to replace 30 percent of our gasoline use with ethanol without increasing demands on crop land. While we can't sustainably meet all of our transportation fuel needs with ethanol, in the future it could significantly decrease our dependence on petroleum.