

# Biofuels

Biofuels, including ethanol, are clean-burning, biodegradable and made from renewable resources. In addition to being used as fuel for transportation, biofuel can be converted to other useful forms of energy, including methane gas and heat. Ethanol is probably added to the gasoline you use in your car, so you may be more familiar with biofuel than you thought!



## How Biofuels are Produced

Most biofuels are made through a chemical process called transesterification (trans-uh-ster-uh-fi-KAY-shun). This process separates the glycerin from animal fats or vegetable oil, leaving behind methyl esters (the chemical name for biodiesel) and glycerin (a valuable byproduct used in soaps and other products).

Ethanol is made by fermenting starch or sugar crops such as sugarcane, barley, rice, maize, potatoes, sorghum, sunflower, sugar beets, wheat and other grains, or even cornstalks, fruit and vegetable waste. The process is similar to the way beer is brewed!

Biodiesel is made by mixing cooking grease, vegetable oil or animal fat with alcohol. Like ethanol, it's usually used as an additive to cut down on vehicle emissions. But biodiesel can also be used in its pure form as a fuel in diesel engines.

## Fuel from... Algae?

Emerging research suggests that algae may prove to be a valuable component in the solution to the planet's growing energy demand. According to scientists from ExxonMobil, photosynthetic algae have many advantages that make it a compelling alternative fuel source.

- Algae produce fatty, lipid cells containing oil that can be used as fuel.
- Growing algae consume carbon dioxide, offsetting greenhouse gases.
- Algae can be grown in areas that are deemed unsuitable for growing plants or crops. This is a benefit over other biofuels, which are produced on farmland that could be used for food crops or forest land that has been cleared of trees (causing environmental concerns).
- Algae may yield greater volumes of biofuel per acre than other sources. Algae could produce more than 2,000 gallons of fuel per acre per year as opposed to corn's 250 gallons per acre per year.

California-based company Sapphire Energy aims to produce 1 million gallons of algae-based diesel and jet fuel by 2011 and 100 million gallons a year by 2018. Even NASA is interested in the algae-based fuel business with its proposed "Sustainable Energy for Spaceship Earth" project. The project would use semi-permeable bags floating on the ocean's surface to grow

algae. The bags would collect ocean sewage, which would give the algae inside nutrients. When the process is completed, the algae will be rich with biofuel.

### Brazil: Sweet on Ethanol

Brazil is second only to the United States in ethanol fuel production: In 2008, Brazil produced more than 37% of the ethanol used around the world. The country's thriving ethanol industry relies on its agricultural technology, large amount of cultivatable land and abundance of inexpensive sugarcane that can be used in ethanol production and gasoline is used to plant, harvest, transport and manufacture the corn based ethanol.

Brazil's use of biofuels took off in the mid-1970s after the first global oil crisis. The Brazilian government put a plan into motion in 1975 to phase out fossil fuel-based fuels in favor of ethanol made from sugarcane.

The sugarcane-based ethanol industry in Brazil is more cost effective than the US' corn-based industry. The process costs more in the US because corn starch must be converted to sugar before it can be distilled into alcohol.

According to a report by the United Nations Environment Program, Brazil's sugarcane-based ethanol production can significantly reduce greenhouse gas emissions and can even lead to "negative emission," which means that carbon dioxide is actually pulled out of the atmosphere.

### Uses for Biofuels

Biofuels are most commonly used to power vehicles, heat homes, and for cooking. Biofuels can be used, in either pure form or blended with fossil fuels, in diesel-powered vehicles and boats. In Brazil, farmers grow a special kind of sugar cane called "energy-cane," which is used to fuel some of their cars. Renewable energy represents 46% of Brazil's total annual energy supply, one-third of which is the biofuel ethanol.

Biofuels are commonly used:

- As solvents in perfumes or varnish
- As disinfectants
- To increase octane and improve the emissions quality of gasoline

### Demand for Biofuels

The demand for biofuels, especially ethanol, is expected to increase globally in the coming years, although rising food prices, trade tensions and social unrest are prompting a debate on running more cars and trucks on biofuel.

In the transportation sector, ethanol is the most widely used liquid biofuel in the world. The United States and Brazil are the world's top ethanol fuel producers, accounting for 89% of the world's production in 2008. Research indicates that worldwide ethanol production will exceed 20 billion gallons in 2012, with production capabilities emerging in India, Latin America and other spots around the globe.