NRCS
Natural Resources
Conservation Service

Fact Sheet-- Renewable Energy

Ethanol

Description

Ethanol is currently the primary biofuel used in passenger vehicles. It is made from crops such as corn, sugar beets, and sugar cane. Increased research and development efforts are being conducted on the use of cellulosic biomass such as corn stover, switchgrass, and other bio-feedstocks.

In June 2004, the USDA updated its 2002 analysis and determined that the net energy balance of corn starch ethanol production is 1.67 to 1. (For every 100 BTUs of energy used to make ethanol, 167 BTUs of ethanol are produced.) As a gasoline additive, methyl tertiary butyl ether (MTBE) has been phased out in many parts of the country because of its threat to groundwater quality. This is increasing the demand for ethanol as a substitute fuel.

Ethanol Fuel Mixes

E10 (10% ethanol and 90% unleaded gasoline) is approved for use in any make or model of vehicle sold in the US. Many automakers recommend its use because of its high performance and clean-burning characteristics.

Flexible Fuel Vehicles (FFVs)

E85 (85% ethanol and 15% unleaded gasoline) is an alternative fuel for use in flexible fuel vehicles (FFVs). All major American automakers offer models that can operate on E85. FFVs can run on E85, E-10, or pure unleaded gasoline. A fuel system computer automatically adjusts for the level of ethanol in the fuel.

Energy Content in Fuel Mixes

Fuel Mix	BTUs/gallon	% BTUs

Ethanol and Air Quality

Compared with gasoline-fueled vehicles, most ethanol-fueled vehicles produce lower carbon monoxide and carbon dioxide emissions as well as the same or lower levels of methane and non-methane hydrocarbon emissions (when consideration of the manufacturing process is included). In addition, crops used to make ethanol absorb CO_2 from the atmosphere into their plant tissue and ultimately, into the ground as soil organic matter, reducing the net impact of CO_2 on climate change.

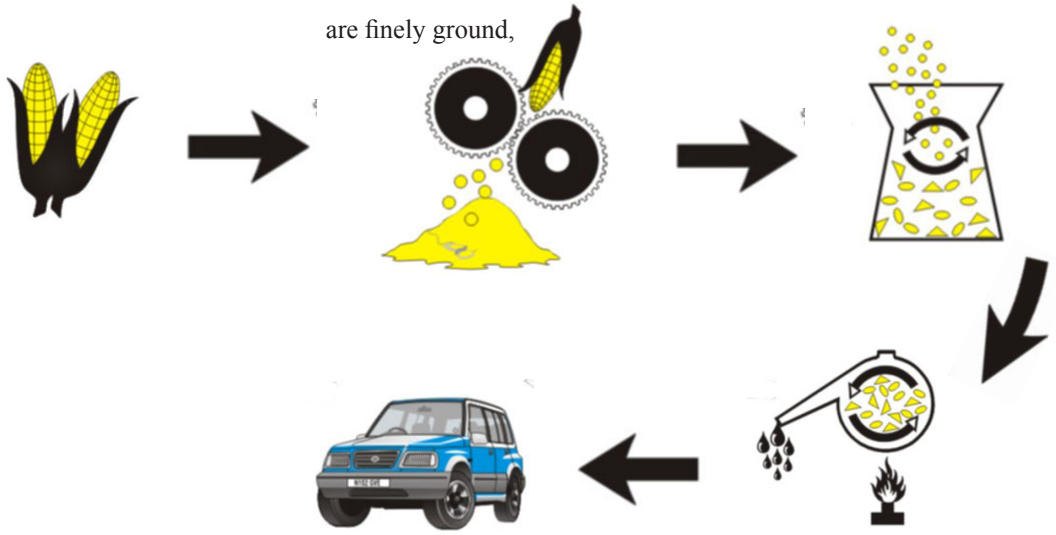
Oxides of nitrogen (NOx) emissions are about the same for ethanol and gasoline vehicles, although research continues on this subject.

Ethanol Production

To produce corn ethanol, the corn grain is typically ground and cooked into a liquid mash that separates out the component sugars. Specific microbes are added to the mash and convert the sugars into ethanol. The ethanol is distilled off, denatured, and can be used as an alternative fuel in cars.

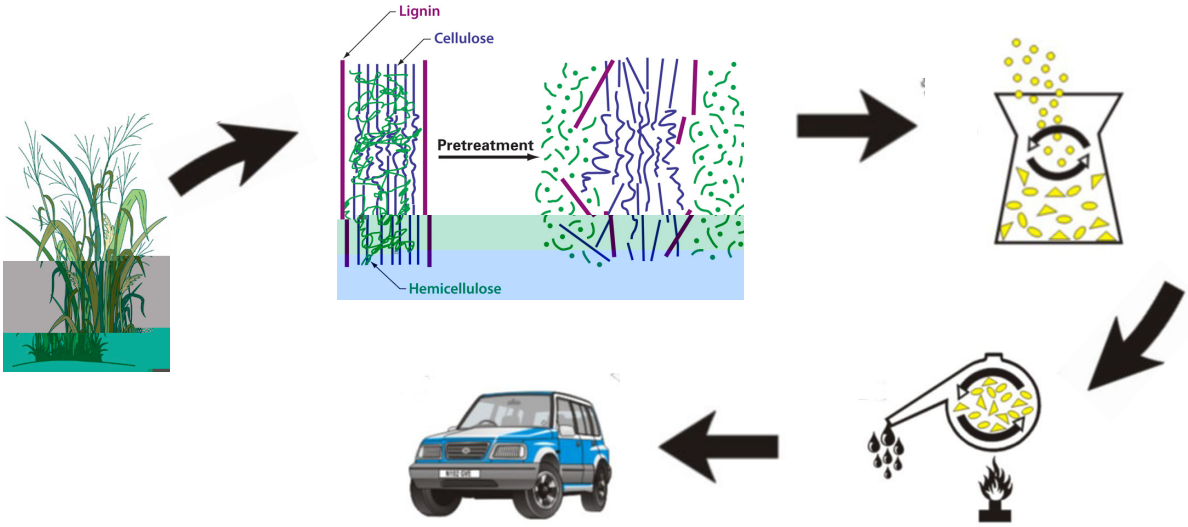
During cellulosic ethanol production, plant material is pretreated to separate lignin from cellulose. The cellulose is converted to sugars for fermenting.

Corn Ethanol Production



Adapted from a flow chart developed by the US Department of Energy

Cellulosic Ethanol Production



For More Information

For more information on ethanol or renewable energy, contact the Energy National Technology Development Team at the West National Technology Support Center in Portland, OR, Stefanie Aschmann, Team leader, 503-273-2408, stefanie.aschmann@por.usda.gov.