

Biofuels

Petroleum reserves are not infinite, and they are not spread evenly throughout the world. For these reasons, the ability to produce hydrocarbon fuel from crops has long been a dream. Today, this dream has become a reality; gasoline with various proportions of ethanol (derived from crops) and biodiesel (made from used vegetable oil) is currently available. The realization of this dream has presented a few problems. Biofuels are not so "green," and they can also have unanticipated negative social and environmental consequences.

Before Filling Up the Tank

Conventional gasoline differs from biofuels in its origin, but also in its effects on society.

CONVENTIONAL GASOLINE

It is produced through the distillation of petroleum, which is extracted from underground deposits.



When it is burned, it releases considerable amounts of greenhouse gases and other pollutants into the atmosphere.

It is a nonrenewable resource—that is, it will run out some day.

BIOETHANOL

It is made from starches or sugars, such as those found in corn and sugar cane, respectively.



It is generally used in mixtures with conventional gasoline. The most common are E10 (10% ethanol) and E85 (85% ethanol).

It is not less polluting than conventional gasoline, however. When the processes used to manufacture biofuels are considered, biofuels release more volatile organic compounds (VOCs) into the air.

In addition, crops diverted toward the production of biofuels contribute to rising food costs, which can aggravate social unrest.

BIODIESEL

It is diesel fuel that can be produced from any source of animal or vegetable fat, including frying oil.



Even though the carbon that is released through combustion is reabsorbed by the plants used in biofuel production, carbon is also released by the biofuel production process, through the use of agricultural machinery and the fuel used to power industrial processes.

It can be used in various concentrations. Biodiesel can be mixed with conventional diesel up to 100%; however, the combustion of 100% biodiesel requires modifications to the engine.

As with bioethanol, the mass production of biodiesel has significant social and environmental implications.

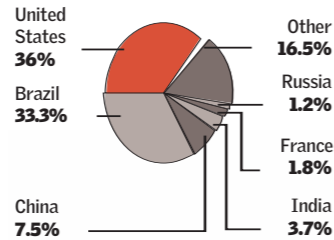
THE ANSWER

Most authorities agree that the large-scale transition to biofuels will be realized when industry manages to produce them efficiently and inexpensively from cellulose, a material found in all plants.

The Ins and Outs of Bioethanol

Sugar cane, sugar beets, corn, yucca, potatoes, and even wood can be used to produce ethanol, but some raw materials can be used more efficiently than others. The production of ethanol from cellulose would be ideal.

Ethanol production (2006)



1 PRODUCTION
Once the planted corn has matured, it is harvested.

2 MILLING
The grains are milled. The resulting flour is mixed with water. It is then treated with an enzyme that helps convert the starch into fermentable sugars. (This treatment is not needed when producing ethanol from sugar cane, however.)

KERNEL OF CORN

Germ

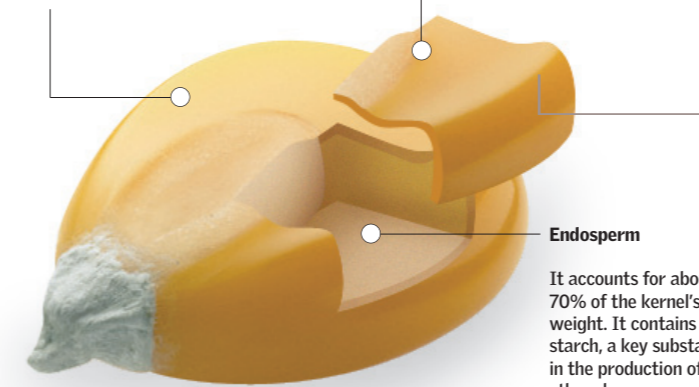
This is the most valuable part of the kernel and the only living part. It contains vitamins and minerals, and it is 25% oil.

Hull

It protects the seed from water, insects, and microorganisms.

Endosperm

It accounts for about 70% of the kernel's dry weight. It contains starch, a key substance in the production of ethanol.



3 COOKER
The mixture is cooked at about 300° F (150° C) for sterilization, followed by a cold rinse of water.

4 FERMENTATION
Yeast is added to convert the sugar to ethanol. This process, which yields heat and carbon dioxide, lasts about 48 hours. The resulting mixture, called "beer," is about 15% ethanol.

5 DISTILLATION
The mixture is distilled to obtain 96% pure ethanol. A molecular sieve is then used to obtain close to 100% ethanol. Before shipping, it is mixed with about 5% denaturant (such as gasoline), which makes it undrinkable.

6 CONSUMPTION
Ethanol is added to gasoline in several different proportions for use in motor vehicles. Gasoline that contains between 10% and 25% ethanol does not require any special modification to the engine.

Byproducts

The production of ethanol has several byproducts. Some of the carbon dioxide that is produced is used in carbonated beverages. The residue, called "sillage," is very nutritious and can be used in cattle feed.

