Biofuel Basics

What You Need to Know

High in Carbs

What are Biofuels?

Biofuels are fuels made from biomass – or recently living biological matter. There are two types of biofuels that have the potential to significantly change our dependency on petroleum: ethanol (or grain alcohol) and biodiesel. These fuels can substitute for petroleum at the pump.

Ethanol is made by fermenting grains and sugarcane into alcohol, while biodiesel is usually distilled from oilseed crops. Soy is the most common feedstock for biodiesel in the United States, and canola is the most common base oil used in Europe. Cooking grease, like the oil used to make french fries, can also be recycled into biodiesel.

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Image courtesy of Reware www.rewarestore.com

DRIVE THRU... AND THRU, AND THRU, AND THRU...

Fuel of the Future

An American Legacy

Nearly a century ago, Henry Ford designed the Model-T, the first mass-produced automobile, to run on either ethanol or gasoline. Even before that in 1897, Rudolf Diesel demonstrated that the combustion engine that bears his name could run on peanut oil. Today, this "fuel of the future," as Henry Ford once called it, is finally catching on.

"There's enough alcohol in one year's yield of an acre of potatoes to drive the machinery necessary to cultivate the fields for a hundred years." – Henry Ford, 1925

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Ford with a Model-T in 1921

Production

Ethanol in the United States on the Rise

The production of ethanol in the United States has increased dramatically since 2000, largely because ethanol is used as an octane-enhancer to reduce the pollution of gasoline. Ethanol is used in regular cars at up to a 10% blend with gasoline, known as E10, with no loss of performance. Diesel engines can easily run on 20% blends, known as B20.

The U.S. ethanol industry produced more than 3.4 billion gallons in 2004, up 22% from the previous year. If the United States makes the right investments to continue at this rate, the country could meet the renewable fuel standard of the 2005 Energy Bill (7.5 billion gallons by 2012) in half the time.

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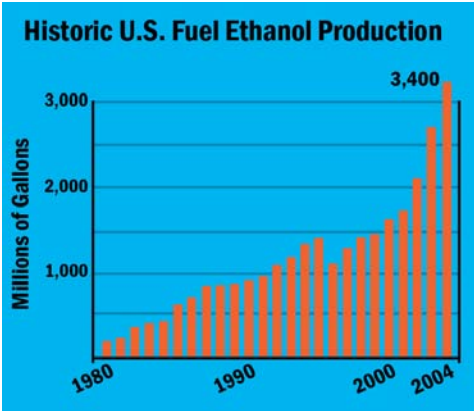

Source: U.S. Energy Information Administration/ Renewable Fuels Association

"Whale oil was out-competed before it was depleted."
– Amory Lovins, Rocky Mountain Institute

Biodiesel

Biodiesel is the fastest growing alternative fuel in the United States. Production for 2005 is expected to triple 2004 levels.

Major fleets across the country already rely on it. These include: Yellowstone National Park; NASA; cities, such as Seattle; major public utility fleets, such as Florida Power & Light; and more than 100 school districts. The four branches of the U.S. military run their vehicles on B20 at installations around the country, and the Navy is even brewing its own biodiesel from used cooking oil straight out of the mess halls.

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THE SAUCE THAT SAVED THE NATION.

Image courtesy of Reware www.rewarestore.com

Flex-Fuel

Under the Hood... In the Tank... Behind the Wheel...

You may not know it, but the car you drive might be a flex-fuel car. Ford Taurus, Ford Explorer, Dodge Caravan, and Chevy Impala are just some of the familiar models that can run on blends of up to 85% ethanol, or E85. These cars are known as Flexible Fuel Vehicles (FFVs), and the simple alteration needed to turn a regular engine into a flexible fuel engine costs manufacturers less than $100. Little do Americans know that there are over 5 million FFVs on the road. So check your owner's manual, or visit www.E85.com, and check out what you're driving.

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Flex-Fuel

If every flex-fuel vehicle already on the road today were run on E85, the United States would immediately see a reduction of gasoline consumption of nearly 4.5 billion gallons per year. So, what's the hold-up? Distribution. Even though ethanol is generally cheaper than gas at the pump, 600 E85 fueling stations across 36 states are not enough to reach the consumer base. Fortunately, ethanol pumps do not require major changes in infrastructure, and the 2005 Energy Bill includes incentives to build more.

At the Pump

Filling up with Biofuels

Image courtesy of National Vehicle Coalition
www.e85fuel.com

Conventional ethanol is competitive with gasoline when oil costs $50 a barrel.

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"All economic downturns in the United States since 1973 have been preceded by sharp increases in the price of oil."

– Alan Greenspan,
Chairman of the U.S. Federal Reserve

Cellulosic Ethanol

Alchemy in the Transportation Age

Ethanol produced in the United States is mostly derived from corn. But advances in biotechnology allow us to make ethanol from almost any type of plant material. The cellulose in plant fiber, including the leaves, stems and stalks – the most common organic compound on earth – can be broken down by enzymes into sugars. The sugars can then be fermented to make ethanol.

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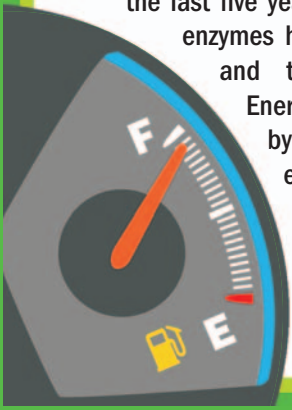
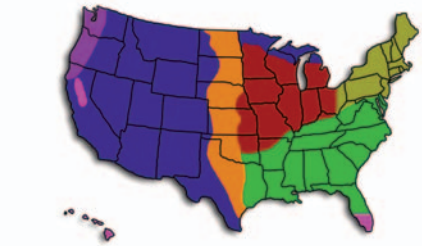
Cellulosic Ethanol

Agricultural waste materials like rice straw, as well as forestry residue like waste paper and sawdust, are abundant and much cheaper than crop feedstocks like corn and sugarcane. But they require additional processing. The enzymes needed to break down cellulose are genetically modified and unique depending on the type of feedstock, and therefore costly. However, in the last five years the cost of these enzymes has dropped 30 fold, and the Department of Energy estimates that by 2010 cellulosic ethanol could make its way into American gas stations at a production cost of $1.07 a gallon.



Feedstocks

Potential Feedstocks for Cellulosic Ethanol in the United States



- Switchgrass, Hybrid Poplars, Silver Maple, Reed Canary Grass, Black Locust, Sorghum
- Switchgrass, Reed Canary Grass
- Willows, Hybrid Poplars, Silver Maple, Black Locust
- Switchgrass, Poplars, Tropical Grasses, Sycamore, Sweetgum, Sorghum, Black Locust
- Available Crop Residue
- Hybrid Poplars
- Eucalyptus, Hybrid Poplars

Source: Oak Ridge National Laboratory

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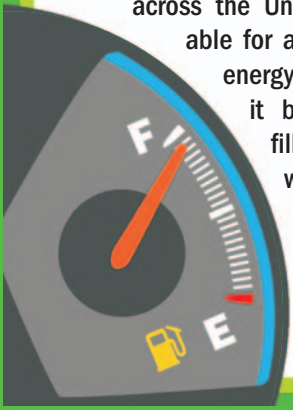
Cellulosic Ethanol: Homegrown Energy

Cellulosic ethanol can be made from agricultural waste, and it can also be derived from crops grown and harvested explicitly for their energy potential. American land could be put into production for fast-growing trees and grasses, like switchgrass, which have high cellulose yields. Agro-ecological zones across the United States are suitable for a variety of dedicated energy crops. What would it be like if Americans filled up their tanks, with fuel grown in their neighbor's fields?



Fuel vs. Food

The Myth of Food Price

Q: If the United States starts growing crops for fuel, will it raise the price of food?

A: An increase in crop prices is actually beneficial to farmers and would have little impact on consumers. Compared to other costs, such as processing and transportation, crop prices represent a small portion of food prices. Current corn supplies have the potential to produce 8-10 billion gallons of ethanol without any negative impact on food supply.

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The Myth of Land Availability

However, the real gains stand to come from cellulosic material. Using agricultural waste alone without putting any additional land under cultivation, the United States could produce 50 billion gallons of ethanol a year. That's about 25% of current gasoline use.

Inputs vs. Outputs

The Myth of Energy Balance

There's an argument that the amount of energy you put into producing ethanol exceeds the amount of energy you get from it. But that's no longer true. With free energy from the sun, improved corn yields, and efficient processing, ethanol gives us 30% more energy than it takes to produce. Cellulosic ethanol provides an impressive 60% more energy than it takes to produce. Furthermore, for every gallon of oil used to produce ethanol, we get 6-7 gallons of ethanol in return – so ethanol can help us reduce oil consumption too.

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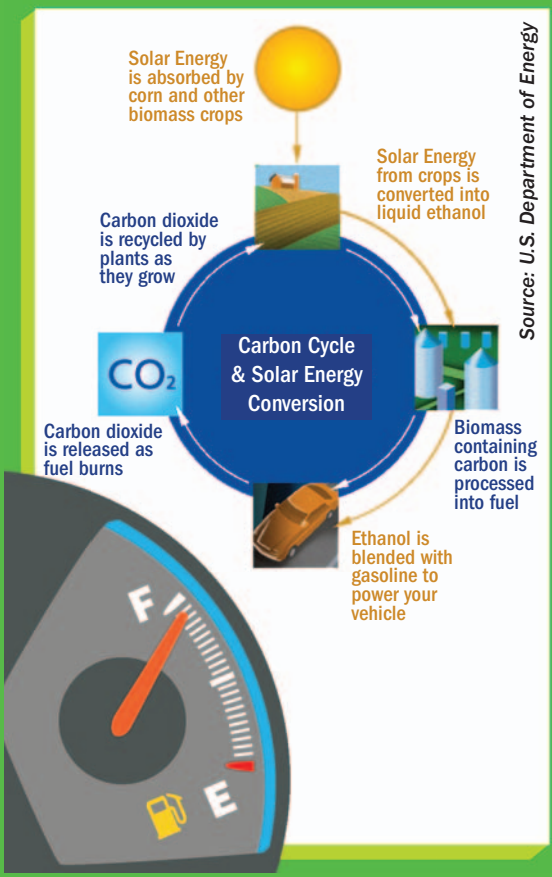

Clean Air

Biofuels help reduce air pollution.

Biofuels help reduce harmful emissions that regular gasoline and diesel emit. Burning biofuels instead of petroleum can produce fewer carbon monoxide, particulate, and toxic pollution emissions. These emissions contribute to tens of thousands of premature deaths in the United States each year from respiratory and heart diseases. And, unlike regular diesel, biodiesel contains no sulfur – a major component of acid rain.

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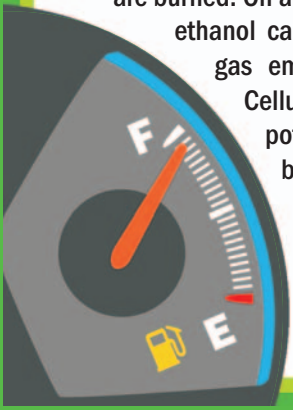
Greenhouse Gases

Biofuels help reduce carbon dioxide (CO_2), a greenhouse gas that contributes to climate change. When we burn fossil fuels, we burden the atmosphere with carbon that has been stored underground for millions of years. Plants, on the other hand, absorb CO_2 as they grow, balancing the CO_2 that is emitted when they are burned. On a per gallon basis, corn ethanol can reduce greenhouse gas emissions by 18-29%. Cellulosic ethanol has the potential to reduce CO_2 by more than 100%, actually lowering CO_2 concentrations in the atmosphere.



Today vs. Tomorrow

Comparative Advantages

Today's Ethanol (Conventional)	Tomorrow's Ethanol (Cellulosic)
Relies on conventional food crops, such as corn and sugarcane.	Uses a wider range of feedstocks, including agricultural waste (corn stalks, wheat straw, waste wood).
20% reduction in carbon emissions relative to gasoline.	Potential 100% reduction in carbon emissions relative to gasoline; may promote beneficial carbon storage in the soil with perennial energy crops, like switchgrass.

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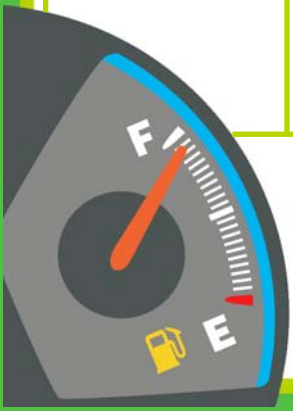
Comparative Advantages

Today's Ethanol (Conventional)	Tomorrow's Ethanol (Cellulosic)
Conventional crops require greater use of chemical and water inputs to grow.	Energy crops require fewer inputs and may be perennial crops, which help prevent soil erosion.
High-value byproducts include animal feed.	High-value byproducts include a wide variety of chemical products, such as lubricants and plastics, as well as electricity.



On the Farm

Rural Development

The ethanol industry can be an engine of growth for rural America. Biofuels rely on homegrown resources. To be cost-effective, the refineries that produce this high-value energy product have to be located near feedstock supplies. From farmer to fuel pump, a biobased industry will keep energy production dollars circulating in rural communities.

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Job Creation and Economic Benefits

In 2004, as a result of building new plants, the ethanol industry supported over 147,000 jobs in the United States and added billions of dollars to the gross domestic product. A growing demand for corn and soy raises the value of the crops and the prices paid to farmers. Cellulosic biomass, from otherwise discarded agricultural waste, would offer farmers an additional source of income. All of this homegrown effort also helps reduce the trade deficit by displacing imported oil. In 2004, the production of biofuels eliminated the need to import 143.3 million barrels of oil, saving $5 billion.

Next Steps

Picking up the Pace

Biofuels are part of the solution for reducing dependence on foreign oil, cleaning up the environment, and creating new markets for agricultural products. But to fully realize these benefits, we need to invest in our new energy future now. While the 2005 Energy Bill included provisions for the advancement of biofuels, the funding is needed now. Congress should appropriate funds for loan guarantees to promote the construction of biorefineries and provide greater incentives to make the existing distribution infrastructure compatible with biofuels. Automakers need to make flex-fuel vehicles standard and educate their customers about their capabilities.

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Hydrocarbons to Carbohydrates

Investments in biorefineries will steer the United States toward a clean and affordable energy future – moving from hydrocarbons from foreign countries to carbohydrates from our backyards.

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The Center for American Progress is a nonpartisan research and educational institute dedicated to promoting a strong, just and free America that ensures opportunity for all. We believe that Americans are bound together by a common commitment to these values and we aspire to ensure that our national policies reflect these values. We work to find progressive and pragmatic solutions to significant domestic and international problems and develop policy proposals that foster a government that is "of the people, by the people, and for the people." http://www.americanprogress.org

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The Energy Future Coalition is a broad-based, nonpartisan alliance that seeks to bridge the differences among business, labor, and environmental groups and identify energy policy options with broad political support. The Coalition aims to bring about changes in U.S. energy policy to address the economic, security and environmental challenges related to the production and use of fossil fuels with a compelling new vision of the economic opportunities that will be created by the transition to a new energy economy. http://www.energyfuturecoalition.org

The Resources for Global Growth program at the Center for American Progress is focused on strengthening the competitiveness of U.S. agriculture, promoting global economic growth, and developing safe, clean, and affordable energy.

http://www.americanprogress.org/RGG

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