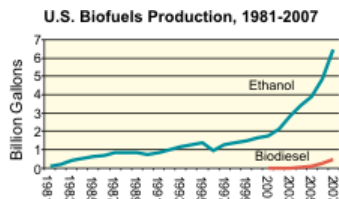
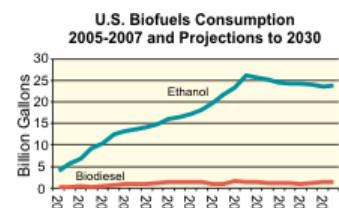


What are biofuels and how much do we use?

Biofuels are liquid fuels produced from biomass materials and are used primarily for transportation¹. The term biofuels most commonly refers to ethanol and biodiesel. In 2007, the United States consumed 6.8 billion gallons of ethanol and 491 million gallons of biodiesel. By comparison, 2007 consumption of motor gasoline and diesel (not inclusive of biofuels) was 139 billion gallons and 39 billion gallons, respectively.



Source: Energy Information Administration, Renewable Energy Consumption and Electricity Preliminary 2007 Statistics (May 2008).



Source: Energy Information Administration, Annual Energy Outlook 2008 (March 2008).

Targets for Renewable Fuels Usage as Established by the Energy Independence and Security Act of 2007

Year	Total Renewable Fuels Standard (billion credit gallons)
2008	9.00
2009	11.10
2010	12.95
2011	13.95
2012	15.20
2013	16.55
2014	18.15
2015	20.50
2016	22.25
2017	24.00
2018	26.00
2019	28.00
2020	30.00
2021	33.00
2022	36.00

Source: Energy Independence and Security Act of 2007 (P.L. 110-140).

Note: A gallon of biofuel with greater energy content per gallon than ethanol would count as more than one ethanol gallon equivalent. For example, each gallon of biodiesel counts as 1.5 gallons toward the advanced and total biofuels requirements.

Biofuels are made by converting various forms of biomass such as corn or animal fat into liquid fuels and can be used as replacements or additives for gasoline or diesel. Biofuels generally have lower life-cycle carbon dioxide emissions than do their fossil fuel counterparts. In recent years, several new Federal laws designed to increase the production and consumption of domestic biofuels have been enacted. The Energy Policy Act of 2005 established the Renewable Fuel Standard, which mandated that transportation fuels sold in the United States contain a minimum volume of renewable fuels², the level of which increases yearly until 2022. In December 2007, the Energy Independence and Security Act of 2007 increased the mandatory levels of renewable fuel blending credits to a total of 36 billion gallons by 2022, including 16 billion gallons of cellulosic biofuels³.

Did You Know?

Henry Ford's original automobile, the Model T, had an engine capable of running on either gasoline or ethanol.

What Is Ethanol?

Ethanol is a clear, colorless alcohol—the same as is found in alcoholic beverages. In fact, ethanol is produced when yeast ferments sugar in a process similar to that used to produce beer. Ethanol can be made from the starches or sugars found in various agricultural crops, such as corn, barley, and sugar cane, or from cellulosic residues from woody biomass, such as bark or switchgrass. Cellulosic ethanol is considered an "advanced" biofuel and involves a more complicated production process than conventional ethanol made from starches or sugars; however, its commercial viability has yet to be demonstrated⁴.

How Is Ethanol Used?

Prior to the passage of the Energy Policy Act of 2005, gasoline sold in certain geographic areas was required to contain oxygen, which helps the fuel mixture combust more completely. Originally, a chemical called methyl tertiary butyl ether (MTBE) was the preferred oxygenate, but it was phased out due to concerns about seepage into groundwater and ethanol was mandated as a replacement. The usage of ethanol also gained market share due to the Renewable Fuel Standard requirements of the Energy Policy Act of 2005. Today, a little more than half of the gasoline in the United States has some amount of ethanol blended into it, and these blends are named by their ethanol content: for example, a blend of 90% gasoline and 10% ethanol (by volume) is known as E10. However, because ethanol contains approximately 67% the energy content of gasoline per gallon, usage of ethanol blends results in decreased gas mileage. Despite this reduced gas mileage, high crude oil prices and government incentives have resulted in the consumption of increasing amounts of ethanol.

While almost any regular gasoline car can run on blends of ethanol up to E10, special cars known as "flex-fuel" vehicles are required for use of blends above E10. Flex-fueled vehicles are currently available from every major American automobile manufacturer and are almost identical to regular gasoline vehicles, except for a few modifications to the fuel system and minor engine components. On a mass production basis, it costs less than \$200 extra per car to make a flex-fuel automobile compared with a conventional gasoline vehicle. As of August 2008, more than 1,400 of a total of 170,000 gas stations in the United States are offering E85 to the public⁵. Ethanol is expected to play a major role in helping to reach the annual minimum renewable fuel consumption required by the Renewable Fuel Standard.

What Is Biodiesel?

Biodiesel consists of chemicals known as fatty acid methyl esters (FAME) that can be used as a diesel fuel substitute or diesel fuel additive. Biodiesel is typically made from oils produced from agricultural crops such as soybeans or canola but can also be made from various other feedstocks such as animal fats.

Currently, most biodiesel in the United States is produced from soybean oil, but recent increases in soybean crop prices have caused producers to switch to other feedstocks such as waste animal fats from processing plants or recycled grease from restaurants. Biodiesel can be made from virtually any feedstock that contains an adequate amount of free fatty acids, which are the raw materials that are converted to biodiesel through a chemical process. Research is underway to harvest algae for biodiesel production because they contain fat pockets that help them float, and this fat can be collected and processed into biodiesel. Continued biodiesel production and usage will help the United States meet levels of biofuels consumption mandated by the Renewable Fuel Standard.

In addition to biodiesel derived from FAME, it is also possible to make a diesel fuel substitute from cellulosic material. This fuel, sometimes called renewable diesel, would also count towards meeting the Renewable Fuel Standard mandate. Like cellulosic ethanol, however, its commercial viability has yet to be demonstrated.

How Is Biodiesel Used?

Biodiesel has chemical characteristics much like petroleum-based diesel and, therefore, can be used as a direct

substitute for diesel fuel or blended with petroleum diesel in any percentage without suffering any significant loss of fuel economy⁶. Blends are named in the same manner as ethanol-gasoline blends, for example, a blend of 20% biodiesel with 80% petroleum diesel is known as B20. Low level, i.e., B2-B5, biodiesel blends are a popular fuel in the trucking industry because biodiesel has excellent lubricating properties, and therefore usage of the blends can be beneficial for engine performance. Biodiesel also has virtually no sulfur content, making it a popular additive for low- and ultra-low-sulfur diesel fuels required by the Environmental Protection Agency⁷.

How Much Do We Consume?

In 2007, the United States consumed 6.8 billion gallons of ethanol and 491 million gallons of biodiesel. According to EIA's *Annual Energy Outlook 2008*, ethanol usage is predicted to increase to nearly 24 billion gallons in 2030, which would represent approximately 16% of total gasoline consumption by volume in 2030. Thirty-one percent of corn production in 2008 is projected to be used for ethanol, and this percentage is expected to rise to 36 percent by 2030⁸. Biodiesel consumption is predicted to increase to 1.2 billion gallons by 2030, or approximately 1.5% of total diesel consumption. Consumption of renewable diesel, made from cellulosic materials, is expected to substantially exceed biodiesel consumption by 2030.

Learn More

- [Ethanol and Biodiesel Data Overview](#)
- [Biofuels in the Transportation Sector](#)
- [Biofuels Basics \(National Renewable Energy Lab\)](#)
- [Alternative Fuels \(Department of Energy's Office of Energy Efficiency and Renewable Energy\)](#)



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¹Biomass is defined as organic nonfossil material of biological origin constituting a renewable energy source.

²Eligible renewable fuels include ethanol, biodiesel, renewable diesel, and biomass-to-liquids.

³Note: A gallon of biofuel with greater energy content per gallon than ethanol would count as more than one ethanol gallon equivalent. For example, each gallon of biodiesel counts as 1.5 gallons toward the advanced and total biofuels requirements.

⁴According to the Energy Independence and Security Act of 2007, an advanced biofuel is a renewable fuel (other than ethanol from corn starch) that is derived from renewable biomass and achieves greenhouse gas emissions reductions of 50 percent.

⁵Department of Energy Office of Energy Efficiency and Renewable Energy's Alternative Fuel Data Center, <http://eere.energy.gov/afdc/ethanol/index.html> (accessed August 21, 2008).

⁶Some alterations may need to be made to older engines in order to run on blends with high percentages of biodiesel. Also, higher blends of biodiesel do have temperature-related issues such as the tendency to coagulate at higher temperatures than petroleum diesel.

⁷Regulations limiting the sulfur content of on-road diesel fuel to 15 parts per million became effective in 2006. Diesel fuel meeting the 15-parts-per-million requirement is known as "ultra-low-sulfur diesel." Diesel fuel meeting the previous highway standard of 500 parts per million is known as "low-sulfur diesel." The lubricity of diesel fuel has generally been reduced due to the processes used to reduce sulfur and aromatic compounds in the fuel (<http://www.cleanairfleets.org/altfuels.html>).

⁸Energy Information Administration, *Annual Energy Outlook 2008* (March 2008).