

## Documentation for zFacts.com

zFacts on ethanol

See yellow **highlights** on the [following page\(s\)](#).

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**Fact:** The energy in a gallon of gasoline = 116,090 Btu (LHV).

A GGE is a unit of energy, the gasoline gallon equivalent, with 116,090 Btu.

This correspond to actual US gasoline and the value was updated in Oct. 2006.

**Source:** DOE's Alternative Fuels Data Center. (Google search this title if you want the complete document.)

**Notes:** See p. 159 (pdf p.3) below. LHV means "Low Heating Value." Ethanol's LHV should be compared with the LHV of gasoline. Low heading values are based on the assumption that the energy in the exhaust water vapor cannot be used. This is true for cars. (For home heating the heat in the water vapor can be captured and used, so HHV is appropriate.)



## Alternative Fuels Data Center

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## Frequently Asked Questions

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### What is the U.S. Department of Energy's (DOE) definition of an alternative fuel?

[Alternative fuels](#) are substantially nonpetroleum and yield energy security and environmental benefits. As defined by the Energy Policy Act of 1993 (EPAct) DOE currently recognizes the following as alternative fuels:

- Mixtures containing 85% or more by volume of alcohol fuel, including methanol and denatured ethanol
- Natural gas (compressed or liquefied)
- Liquefied petroleum gas (propane)
- Hydrogen
- Coal-derived liquid fuels
- Fuels derived from biological materials
- Electricity (including electricity from solar energy)
- 100% Biodiesel (B100) \*

Through the Alternative Fuel Petition Program, third parties can petition DOE to add alternative fuels to this list. For more information about EPAct and its programs, download "EPAct: Alternative Fuels for Energy Security, Cleaner Air" ([PDF 258 KB](#)). [Download Acrobat Reader](#)

\* Pure biodiesel (B100) is considered an alternative fuel under EPAct. Lower-level biodiesel blends are not considered alternative fuels, but covered fleets can earn one EPAct credit for every 450 gallons of B100 purchased for use in blends of 20% Biodiesel or higher. To learn more, visit the [EPAct Alternative Fuels Web page](#).

### What are the characteristics of alternative fuels?

	Biodiesel	Compressed Natural Gas (CNG)	Ethanol (E85)	Liquefied Natural Gas (LNG)	Liquefied Petroleum Gas (LPG)	Methanol (M85)
<b>Chemical Structure</b>	Methyl esters of C16-C18 fatty acids	CH <sub>4</sub>	CH <sub>3</sub> CH <sub>2</sub> OH	CH <sub>4</sub>	C <sub>3</sub> H <sub>8</sub>	CH <sub>3</sub> OH
<b>Primary Components</b>	Vegetable oil, animal fats, or recycled restaurant grease	Methane	Denatured ethanol and gasoline	Methane that is cooled cryogenically	Propane	Methanol and gasoline
<b>Main Fuel Source</b>	Soybean oil	Underground reserves	Corn, grains, or agricultural waste	Underground reserves	A by-product of petroleum refining or natural gas processing	Natural gas, coal, or woody biomass

<b>Energy Content per Gallon</b>	117,000 to 120,000 Btu	33,000 to 38,000 Btu @3000 psi	80,460 Btu	73,500 Btu	84,000 Btu	65,350 Btu
<b>Energy Ratio Compared to Gasoline</b>	1.1 to 1 or 90%	3.94 to 1 or 25% @3000 psi	1.42 to 1 or 70%	1.55 to 1 or 66%	1.36 to 1 or 74%	1.75 to 1 or 57%
<b>Liquid or Gas</b>	Liquid	Gas	Liquid	Liquid	Liquid	Liquid

**What are the current battery technologies for electric vehicles, and how do they differ?**

**Lead Acid**

This is the most commonly used and least expensive battery technology. Generally, they have a range of fewer than 100 miles per charge and a lifetime of about three years. DaimlerChrysler, Ford, General Motors, and Toyota use this technology.

**Nickel Metal Hydride (NiMH)**

NiMH batteries offer a range of about 100 miles per charge but are more expensive than lead acid batteries. Their life expectancy is about 100,000 miles. DaimlerChrysler, Ford (California only), General Motors, Honda, and Toyota have offered vehicles with NiMH technology.

**Hybrid Electric**

Hybrid electric technology combines an internal combustion engine with an electric battery and a motor. Vehicles that have this technology are called hybrid electric vehicles (HEVs). HEVs currently on the market include the Toyota Prius and the Honda Insight and Civic. These vehicles all use NiMH batteries to power the electric motor. For more information on HEVs, visit the [Hybrid Electric Vehicle Program](#) Web site.

**Do alternative fuels offer any emission benefits?**

Yes. All available alternative fuels reduce some emissions. However, each fuel has its own characteristics, as does each vehicle type. For example, biodiesel reduces particulate matter and global warming gas emissions compared to conventional diesel but may increase NOx emissions. Some types of CNG vehicles may reduce CO and NOx compared to some conventional fuels but may increase HC emissions. Electric vehicles have zero tailpipe emissions but power generation can contribute emissions.

You can compare the emissions of each alternative fuel using the AFDC's [Custom Fuels Comparison Chart](#). For more information, check out the AFDC's page on [Emissions Tools](#), which offers links to helpful sites, such as the [AirCRED Online Tool](#) and the [GREET Model](#).

**What is a GGE?**

A gasoline gallon equivalent (GGE) is the amount of fuel required to equal the energy content of one liquid gallon of gasoline. A GGE is a way of comparing equivalent volumes of fuel based on the energy content in British thermal units (Btu). For example, because compressed natural gas (CNG) is not a liquid, its volume is measured in kilograms (kg), rather than gallons. The GGE of CNG is 2.60 kg and its volume has the same energy content as one gallon of gasoline (based on 44,682 Btu/kg of CNG and 116,090 Btu/gallon of gasoline).

**GGE Conversion Factors**

Fuel Type	Unit of Measure	BTUs per Unit	GGEs per Unit	Units to comprise 1 GGE	Source
Gasoline (typical)	gal	116,090	1.00	1.00	GREET
Diesel (U.S. typical)	gal	128,450	1.11	0.90	GREET

Ethanol (E100)	gal	76,330	0.66	1.52	GREET
Ethanol (E85)	gal	82,294	0.71	1.41	Calculated
Gasoline, RFG (10% Ethanol)	gal	112,114	0.97	1.04	Calculated
Gasoline, CaRFG (5.7% Ethanol)	gal	113,824	0.98	1.02	Calculated
Gasoline, RFG (10% MTBE)	gal	113,835	0.98	1.02	Calculated
Biodiesel (B100)	gal	119,550	1.03	0.97	GREET
Biodiesel (B20)	gal	126,670	1.09	0.92	Calculated
Liquefied natural gas (LNG)	gal	74,720	0.64	1.55	GREET
Liquefied petroleum gas (LPG)	gal	84,950	0.73	1.37	GREET
Liquid hydrogen	gal	30,500	0.26	3.81	GREET
Methyl tertiary butyl ether (MTBE)	gal	93,540	0.81	1.24	GREET
Crude oil	gal	129,670	1.12	0.90	GREET
Methanol	gal	57,250	0.49	2.03	GREET
Electricity	kWh	3,412	0.029	34.02	DOE's EIA
Compressed Natural Gas	kg	44,682	0.38	2.60	GREET
Gaseous Hydrogen	kg	115,139	0.99	1.01	GREET

### What is the average price of an alternative fuel at the pump?

Like gasoline and diesel, the prices of alternative fuels fluctuate due to factors such as the cost of processing the fuels, feedstock costs, marketing, distribution costs, retail station costs and taxes. The accessibility of alternative fuels varies by region, and geographic location can greatly affect the price at the pump. For example, propane (also known as liquefied petroleum gas or LPG) is generally less expensive in Texas and Oklahoma, as well as other states close to the major supply sources in the Gulf Coast and the Midwest; and the majority of ethanol is sold in the Midwest, where it is produced, which reduces the cost of transportation. Because LPG and compressed natural gas (CNG) are used primarily outside that have easy access to the Dixie pipeline; natural gas is more economical in urban areas; and ethanol producers tend to sell their fuel in the Midwest to cut down on fuel transportation costs. Since LPG and compressed natural gas (CNG) are also used outside the transportation sector, factors such as imports, inventories and oil prices make it difficult to isolate their price at the pump. Historical price information is available in the [Alternative Fuel Price Report](#). DOE does not currently track the price of alternative fuels at the pump. To find fuel prices for your location search the AFDC Refueling [Station Locator](#) and contact the refueling stations listed.

### Are there incentives for purchasing alternative fuel vehicles (AFVs)?

Yes the federal government has passed legislation that allows income tax deductions for AFV owners. Additionally, many states offer incentives, and some original equipment manufacturers (OEMs) and private companies provide rebates or discounts. Most incentives offset a percentage of the incremental cost of the vehicle (the additional dollars OEMs charge for the AFV versus a conventional model). Federal and state laws also help keep the cost of alternative fuels competitive with gasoline or diesel.

For more information, visit the [financial incentives](#) section in the [Vehicle Buyer's Guide for Fleets](#). There you can look up incentives by state.

### How safe are alternative fuels?

Most people are familiar with gasoline, so they rarely question its safety. However, people who are unaccustomed to alternative fuels may have misconceptions or doubts about their safety in vehicle applications. Some safety issues associated with the use of alternative fuels are outlined here.

#### Biodiesel

Biodiesel is biodegradable, meaning it dissipates quickly after a spill. It has a high flashpoint and low volatility, so it does not ignite as easily as conventional diesel, increasing the margin of safety in its handling. Biodiesel degrades four times faster than conventional diesel and is

**National Propane Gas Association**

[www.propanegas.com](http://www.propanegas.com)

(708) 515-0600

**Propane Vehicle Council**

[www.propanegas.com/vehicle](http://www.propanegas.com/vehicle)

(202) 371-6262

**Renewable Fuels Association**

[www.ethanolRFA.org](http://www.ethanolRFA.org)

(202) 289-3835

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