Lesson on FlexFuel Blends

Lesson One: The Basics

What is Ethanol?

Ethanol is ethyl alcohol used as a transportation fuel and historically produced by fermentation of sugars. In the United States today, ethanol is primarily produced from the starch component of corn and other grain products; however, other feedstocks can also be used such as agricultural, forestry, and municipal wastes or specially grown energy crops.

What are FlexFuel blends?

- E85 is the name given to motor fuel blends of up to 85% ethanol and 15% gasoline. E85 is an alternative fuel as defined by the U.S. Department of Energy and is designed for use in flex fuel vehicles (FFVs).
- Many retailers now offering additional mid-level blends such as 50% ethanol (E50), E30 and E20, also only for FFVs.
- In 2011, the U.S. Environmental Protection Agency approved the use of a 15% ethanol blend (E15) in all gasoline vehicles model year 2001 and newer. It is not for use in motorcycles, boats or small engines. E15 is typically sold as an 88 octane gasoline and is available at a growing number of retail locations nationally.

Where can E85 be purchased?

E85 is now available at more than 3,300 public and private fueling locations in the U.S. More than 1,700 sites are found in the Midwest. Our online directory at **CleanAirChoice.org** will point you to the latest list of E85 sites in the region. For E85 stations across the U.S., visit **afdc.energy.gov.**

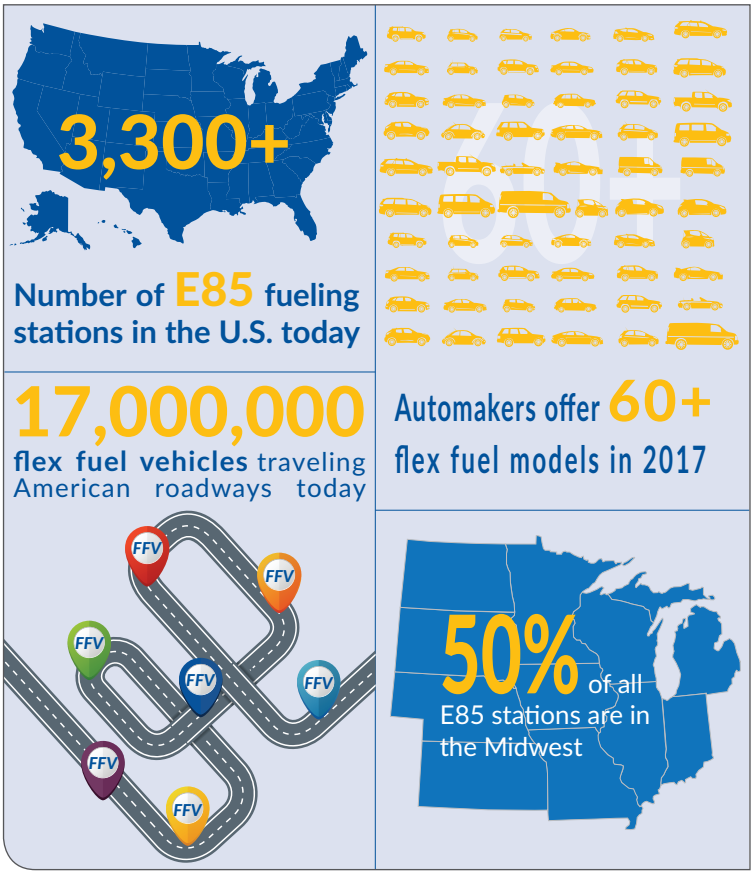
What are benefits of using E85?

Clean. Using E85 produces significantly fewer lifecycle greenhouse gas emissions than gasoline from oil, especially compared to tar sands crude. Using E85 also reduces tailpipe emissions of ozone formers and air toxics.

Renewable. Starch from corn is the most common feedstock used to produce U.S. ethanol. Cellulose-to-ethanol technologies became commercially available in 2014 and are expected to keep growing.

Close to home. Whatever the source, more can be "grown closer to home" today. In 2016, more than 15 billion gallons of ethanol were produced from locally grown materials providing jobs and support to local economies and a shorter, more secure supply line to your community.

E85 is high performance. E85's octane rating is 100+. Characteristics of this high-alcohol fuel make it ideal for boosting horsepower. E100 is used in IndyCar racing. E85 burns cooler and keeps your engine and fuel system clean.



Lesson Two: Vehicle Technologies

What is a flex fuel vehicle?

A flex fuel vehicle, or FFV, is specifically designed to operate on any ethanol blend up to 85% ethanol, gasoline, or any mix of the two. Special onboard diagnostics "read" the fuel blend, enabling the driver to fuel with E85 or gasoline in any combination from a single tank. The computer system adjusts fuel injection and ignition timing to compensate for different fuels.

Is my vehicle FlexFuel compatible?

To determine if your vehicle is capable of using blends above 15%, look inside the fuel door for a decal indicating "E85" or "Ethanol Fuel" may be used. Automakers often use yellow fuel caps and external badging to educate customers and dealership salespeople about E85 and FFVs.

Can a vehicle be converted to use FlexFuel blends?

FFVs produced by original equipment manufacturers carry the same warranties as gasoline-only vehicles. They are specifically built to use E85 and mid-level ethanol blends in accordance with all safety and environmental laws. Numerous conversion kits are available on the internet; however, the U.S. Environmental Protection Agency (EPA) has certified conversion kits for only eight vehicle models. Improperly converting a gasoline-only vehicle is a violation of federal law. The rules are intended to protect consumers, the environment, and public safety.

What is the range of an FFV?

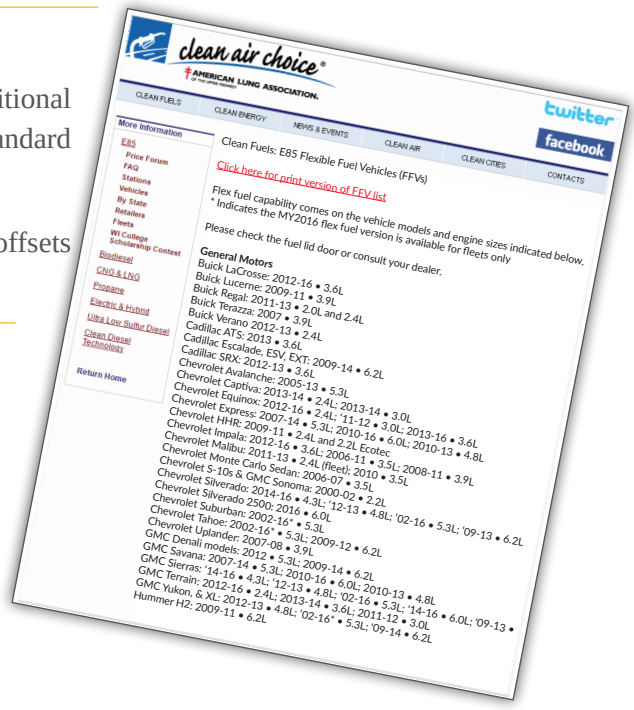
Ethanol has lower energy density than typical gasoline. However, E85 also has a higher octane rating (100+) and unique combustion characteristics. When using E85, FFV drivers may experience a 10-20% fuel economy difference. Typically, E85 is priced 10-25% less than 87-octane gasoline. With all fuels, fuel economy can vary considerably with road and vehicle conditions, driving habits, and several other factors. A tankful of E85 will often provide a 300-400 mile range depending on the vehicle tank size.

Keep in mind. Aggressive driving habits can reduce your fuel economy by 20%, while even low tire pressure can cause a loss of more than 5%. Fuel economy tests show that in short trip city driving a conventional gas vehicle's mileage is about 12% lower at 20°F than it would be for 77°F.

What a Deal!

When manufacturers offer a flex fuel engine as an option, there is no additional cost to the consumer. In 1998, automakers began making the FFV system standard equipment on certain models.

PLUS: E85 is usually priced lower at the pump than gasoline. This typically offsets much, if not all, of the MPG difference FFV drivers may experience.


clean air choice
AMERICAN LUNG ASSOCIATION.
CLEAN FUELS | CLEAN ENERGY | NEWS & EVENTS | CLEAN AIR | CLEAN CITIES | CONTACTS
twitter facebook
More Information
E85
Price Forum
FAQ
Stations
Vehicles
By State
Retailers
Fleets
WI College Scholarship Contest
Biodiesel
CNG & LNG
Propane
Electric & Hybrid
Ultra Low Sulfur Diesel
Clean Diesel Technology
Return Home
Clean Fuels: E85 Flexible Fuel Vehicles (FFVs)
Click here for print version of FFV list
Flex fuel capability comes on the vehicle models and engine sizes indicated below.
* Indicates the MY2016 flex fuel version is available for fleets only
Please check the fuel lid door or consult your dealer.
General Motors
Buick LaCrosse: 2012-16 • 3.6L
Buick Lucerne: 2009-11 • 3.9L
Buick Regal: 2011-13 • 2.0L and 2.4L
Buick Terazza: 2007 • 3.9L
Buick Verano 2012-13 • 2.4L
Cadillac ATS: 2013 • 3.6L
Cadillac Escalade, ESV, EXT: 2009-14 • 6.2L
Cadillac SRX: 2012-13 • 3.6L
Chevrolet Avalanche: 2005-13 • 5.3L
Chevrolet Captiva: 2013-14 • 2.4L; 2013-14 • 3.0L
Chevrolet Equinox: 2012-16 • 2.4L; 2013-16 • 3.6L
Chevrolet Express: 2007-14 • 5.3L; 2010-16 • 6.0L; 2010-13 • 4.8L
Chevrolet HHR: 2009-11 • 2.4L and 2.2L Ecotec
Chevrolet Impala: 2012-16 • 3.6L; 2006-11 • 3.5L; 2008-11 • 3.9L
Chevrolet Malibu: 2011-13 • 2.4L (fleet); 2010 • 3.5L
Chevrolet Monte Carlo Sedan: 2006-07 • 3.5L
Chevrolet S-10s & GMC Sonoma: 2000-02 • 2.2L
Chevrolet Silverado: 2014-16 • 4.3L; '12-13 • 4.8L; '02-16 • 5.3L; '09-13 • 6.2L
Chevrolet Silverado 2500: 2016 • 6.0L
Chevrolet Suburban: 2002-16* • 5.3L; 2009-12 • 6.2L
Chevrolet Tahoe: 2002-16* • 5.3L
Chevrolet Uplander: 2007-08 • 3.9L
GMC Denali models: 2012 • 5.3L; 2009-14 • 6.2L
GMC Savana: 2007-14 • 5.3L; '12-13 • 4.8L; '02-16 • 5.3L; '14-16 • 6.0L; '09-13 • 6.2L
GMC Sierras: '14-16 • 5.3L; 2010-16 • 6.0L; 2010-13 • 4.8L
GMC Terrain: 2012-16 • 2.4L; 2013-14 • 3.6L; 2011-12 • 3.0L
GMC Yukon, & XL: 2012-13 • 4.8L; '02-16* • 5.3L; '09-14 • 6.2L
Hummer H2: 2009-11 • 6.2L

Ethanol Basics

More than 97% of gasoline sold in the U.S. contains ethanol. Ethanol's primary market drivers are its ability to raise octane levels at lower costs than alternatives and the Federal Renewable Fuel Standard advocating its use. Gasoline and gasoline blendstocks shipped via pipelines need ethanol or another source to bring octane levels up and meet consumer demand for a higher-octane fuel (this improves vehicle performance). For the whole story, visit **CleanAirChoice.org.**

For a complete flex fuel vehicle listing visit: CleanAirChoice.org

How much corn does it take to make ethanol?

A 56-pound bushel of field corn will typically yield 1.6 pounds of corn oil, 10.9 pounds of high-protein livestock feed, 2.6 pounds of corn meal, and 31.5 pounds of starch. That starch may be converted to sweeteners or about 2.8 gallons of fuel ethanol (some producers are achieving yields of 3 gallons). Ethanol production continues to improve and new technologies hold promise for dramatically increasing yield.

How much ethanol can we make?

Today, U.S. ethanol producers have the capacity to produce more than 15 billion gallons each year. U.S. Department of Energy research indicates upwards of 30% of our motor fuel needs may be met with biofuels by 2030.

How much energy does it take to produce ethanol?

The energy balance of production for both ethanol and biodiesel far exceed those of gasoline and diesel. The U.S. Departments of Energy and Agriculture report that for every unit of fossil fuel energy used to produce ethanol and its co-products 1.87 units of energy result. The increase comes from the sun's energy stored in the corn. The U.S. Department of Energy reports that gasoline refining has a negative energy balance, and every unit of energy expended in its production results in just 0.81 energy units in the form of gasoline. Of 17 studies published since the early 1990s, 13 concluded that biofuels have a positive energy balance of production.

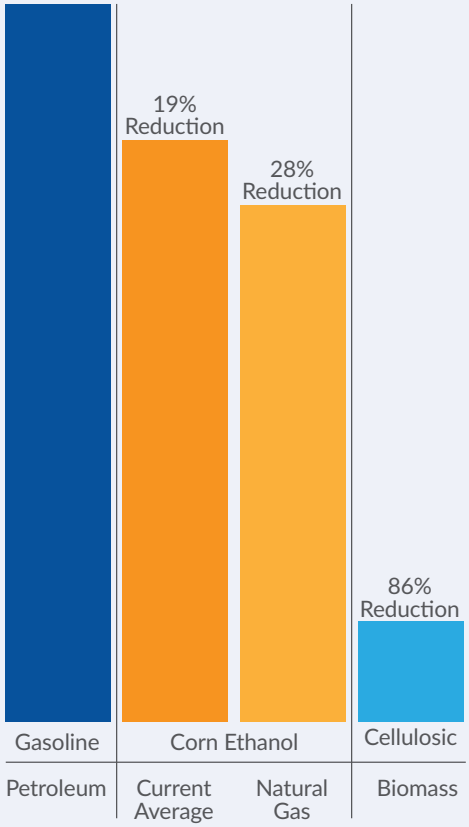
Energy Balance of Production

**Yield in liquid fuel BTUs per BTU of fossil energy inputs*

Fuel	*Energy Yield	*Balance
Gasoline	0.81	-19%
Diesel	0.83	-17%
Ethanol	**1.87**	**+87%**
Biodiesel	5.50	+450%

Sources: USDOE, USDA, University of Idaho, ASABE

Lifecycle Greenhouse Gas Emissions As a Function of Each Fuel's Thermal Energy Source



Source: *Life-Cycle Energy and Greenhouse Gas Emission Impacts of Different Corn Ethanol Plant Types* (ANL)

Does ethanol affect food prices?

Corn is a commodity and commodity prices are influenced by market speculation. Corn prices rose in 2007 as investors speculated on its demand. There was no corn shortage and studies show that ethanol production actually has little effect on the price of food. Remember, ethanol is produced from only the starch component of corn; 100% of the protein is retained and returned to the "food chain" as co-products such as high-value livestock feed. Most field corn grown in the U.S. is fed directly to livestock and is never intended for human consumption.

When will we have cellulosic ethanol?

Many experts believe full-scale cellulose-to-ethanol production will expand soon. If not for experience and opportunities gained by starch-to-ethanol development, advances in cellulosic technologies would not be near. Corn is likely to play a role in ethanol production well into the future. However, other feedstocks and cellulose-to-ethanol technologies will definitely gain importance.

Lesson Four: The Environment

What effect does ethanol have on air quality?

Using E85 instead of petroleum-based fuels can reduce ozone-forming tailpipe and evaporative emissions, as well as lifecycle emissions of air toxics and greenhouse gases. Gasoline contains compounds such as benzene, toluene, and xylene. Using E85 instead of gasoline can prevent release of these toxic chemicals into the air we breathe. On a fuel lifecycle basis, today's E85 produced from corn can reduce carbon dioxide (CO_2) emissions, our "carbon footprint," by 20-30%. CO_2 is a primary contributor to global climate change.

What effect can ethanol have on local water resources?

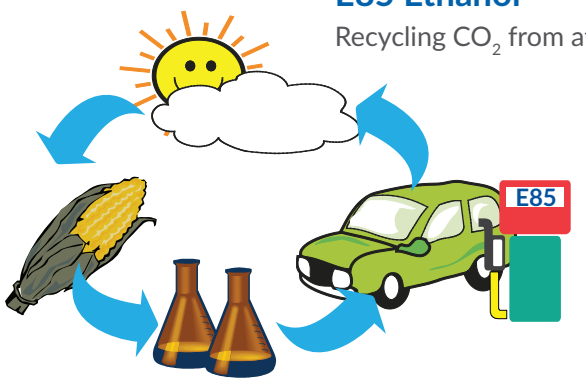
Like many industries (papermaking, gasoline refining, and electricity utilities) ethanol production uses water. Typically, 2.5-4 gallons of water are used in producing one gallon of ethanol. The Guardian Ethanol plant in Janesville, MN uses only 2 gallons of water per gallon of ethanol. In comparison, gasoline production typically uses 2.5 gallons of water for every gallon of gasoline produced. To put this in perspective, the U.S. EPA's Office of Water reports that it takes on average, 1.7-7 gallons of water to flush a toilet. Regardless of the industry, local authorities must ensure sustainable water resources exist before siting any manufacturing facility or business.

What if the Exxon Valdez had carried biodiesel or ethanol instead of crude oil?

The environmental damage caused by petroleum spills is obvious. While a spill of any fuel has negative effects, a release of ethanol or biodiesel is minor in comparison. Biofuels are biodegradable and can be much less of a threat to ground and surface waters. Although ethanol and biodiesel can be transported over long distances like other fuels and products, most biofuels are used closer to home than petroleum that is often transported across the globe. Using renewable-based fuels closer to the point of production means a shorter supply chain and reduced risk of accidental release or malicious attack.

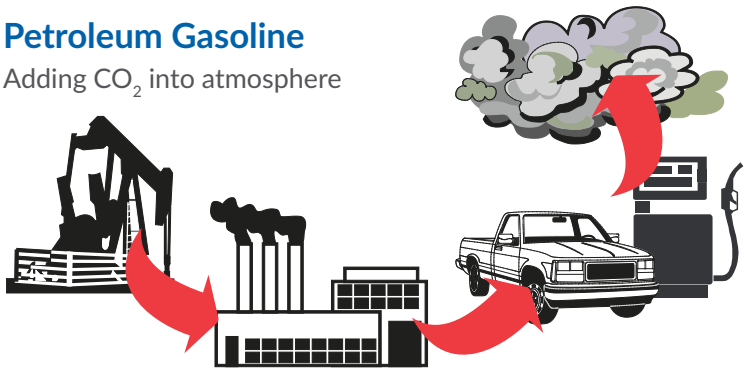
E85 Ethanol

Recycling CO_2 from atmosphere



Petroleum Gasoline

Adding CO_2 into atmosphere



Bow Mariner

After the tragic sinking of the Bow Mariner off the coast of Virginia in 2004, U.S. Coast Guard officials noted the ship's cargo of 3.2 million gallons of ethanol had "dissipated quickly and did not pose a danger to humans or marine life."

For more information on E85 & Alternative Fuels contact us at CleanAirChoice.org

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