

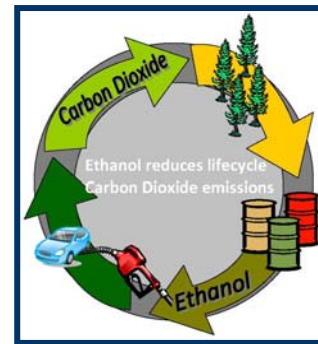
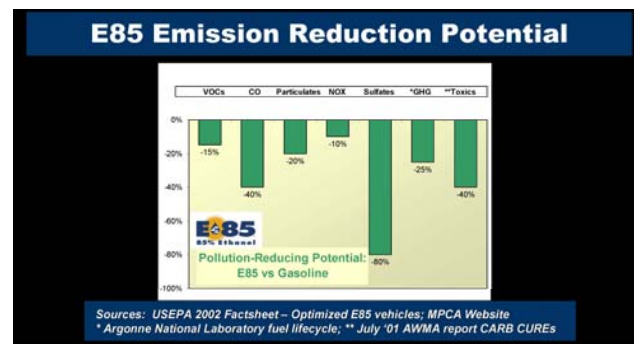
Lesson Four: The Environment

What are effects of ethanol on local water resources?

Like many industries (paper-making, gasoline refining and electricity utilities) ethanol production uses water. Typically, 2.5 to 4 gallons of water are used in producing one 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 US EPA's Office of Water reports that it takes on average, 2-7 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 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 our environment. On a fuel lifecycle basis, today's E85 produced from corn can reduce carbon dioxide (CO₂) emissions, our "carbon footprint," by 20% to 30%. CO₂ is a primary contributor to global climate change.



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 security risk of accidental release or malicious attack.

Sinking of the 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 or Alternative Fuels, please contact:

The American Lung Association of the Upper Midwest
800.LUNG.USA • CleanAirChoice.org

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Clean Air Choice Lesson on E85 Ethanol



Misconceptions and misunderstandings about ethanol have long been debated. To help set the record straight, the American Lung Association of the Upper Midwest provides this *Lesson on E85 Ethanol*.

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. In the future other feedstocks will be used—such as agricultural, forestry, and municipal wastes or specially grown energy crops.

What is E85?

E85 is a name given to motor fuel blends of up to 85 percent ethanol and 15 percent 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).

Where can E85 be purchased?

E85 is now available at about 1,500 fueling locations in the United States. More than 700 sites are found in the Upper Midwest region. Our online directory at CleanAirChoice.org will point you to the latest list of E85 sites in the region. For E85 stations across the United States, visit E85Fuel.com.

What are benefits of using E85?

E85 is clean. A typical FFV driver can prevent 4 tons of lifecycle carbon dioxide (CO₂) emissions and other harmful pollutants from entering our air every year by fueling with E85 instead of gasoline. Using E85 can reduce tailpipe emissions such as ozone-forming pollutants by about 20%. E85 will also reduce evaporative emissions of air toxics and ozone-formers.

E85 is renewable. Starch from corn is most commonly used to produce U.S. ethanol. Cellulose-to-ethanol technologies are under development and expected to be commercialized within 5 years.

E85 is made here. Whatever the source, more can be "grown closer to home" today. In 2007, ~ 6 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 Indy Racing. E85 burns cooler and keeps your engine and fuel system clean.

By the numbers...

E85 is available at ~ **1,500** fueling stations in the United States today

About **50%** of all E85 stations are located in the Upper Midwest today

6 Million flex-fuel vehicles are traveling American roadways today

By **2012**, American automakers plan to produce **50%** or more of their vehicles as E85-capable

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 E85 compatible?

To determine if your vehicle is E85 compatible look inside the fuel door for a decal indicating “E85” or “Ethanol Fuel” may be used. The vehicle identification number (VIN) will also indicate an FFV system (please speak to our staff if you need the VIN code listing). GM and other automakers now use yellow fuel caps and external badging to educate customers and dealership salespeople about E85 and FFVs.

Can a vehicle be converted to use E85?

FFVs produced by original equipment manufacturers carry the same warranties as gasoline-only vehicles. They are specifically built to use E85 in accordance with all safety and environmental laws. Several conversion kits are available on the Internet. By early 2008, only one E85 kit was nearing certification by the US Environmental Protection Agency (EPA). Technically, 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% to 20% fuel economy difference. Fuel economy can vary considerably with road and vehicle conditions, driving habits and several other factors. Today, FFVs are not “dedicated” to E85 and optimization for E85 operation is limited due to the fuel system flexibility. A tankful of E85 will provide a 300- to 400-mile range. Typically, E85 is priced 10% to 25% less than 87-octane gasoline.

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%.



What a deal!

When manufacturers offer a flex-fuel engine as an option, there is rarely an 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.

For a complete FFV vehicle listing visit: CleanAirChoice.org

Lesson Three: How Much...?

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 beverages, 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 6 billion gallons each year. Production is expected to increase to 15 billion gallons within the next several years and 36 billion by 2020. U.S. Department of Energy research indicates upwards of 30% of our motor fuel needs may be met with ethanol fuels by 2030.

How much energy does it take to produce ethanol?

The energy balance of production for both ethanol and biodiesel compare well to those of gasoline and diesel. The U.S. departments of Energy and Agriculture report a net energy balance for ethanol production of 1.67. In other words, for every unit of energy used to produce ethanol and its co-products, 1.67 units of energy result. 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 0.79 energy units in the form of gasoline. Of the 17 studies published since the early 1990s, 13 contend that biofuels have a positive energy balance of production.

Energy Balance of Production

(Sources: USDOE/USDA (2004), University of Idaho (2008), USDA ERS Report #721)

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

Fuel	*Energy Yield	*Balance
Gasoline	0.74	-26%
Diesel	0.83	-17%
Ethanol	1.67	+67%
Biodiesel	3.50	+250%

How much corn is being used for ethanol versus food products?

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. 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 is fed directly to livestock and is never intended for human consumption.

When will we have cellulosic ethanol?

Most experts believe full-scale cellulose-to-ethanol production will begin by 2012. 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.