United States Environmental Protection Agency

Transportation and Air Quality
Transportation and Regional Programs Division

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Clean Alternative Fuels: Ethanol

One in a series of fact sheets

SUCCESS STORY

In January 2000, the U.S. Postal Service (USPS) made the largest purchase of flexible fuel vehicles (FFVs) by a federal government agency, agreeing to buy nearly 23,750 vehicles powered with up to 85 percent ethanol. Roughly 21,000 FFVs will serve as postal carrier vehicles, with the remainder used for administrative duties.

Because its fleet is concentrated in 11 areas of the country, USPS believes this purchase will promote ethanol use and availability and support development of a commercial ethanol infrastructure. In fact, state and local governments, in conjunction with the ethanol industry, the U.S. Department of Energy, and potential additional fleets, are creating master plans based largely on the USPS commitment.

While USPS will depend in large part on commercial fueling stations, the agency also is converting many on-site tanks to ethanol for supplemental supplies. For more information, contact Marguerite Downey at (202) 268-5073.

Ethanol-fueled vehicles date back to the 1880s when Henry Ford designed a car that ran solely on ethanol. Subsequently, the popular Model T was designed to operate on either ethanol or gasoline. Four generations later, ethanol-blended gasoline accounts for more than 10 percent of total gasoline sales in the United States.

Essentially 100 percent pure grain alcohol made unfit to drink, ethanol is produced by fermenting plant sugars. It can be made from corn, potatoes, wood, waste paper, wheat, brewery waste, and many other agricultural products and food wastes. Anything containing sugar, starch, or cellulose can be fermented and distilled into ethanol. More than 90 percent of U.S. ethanol production comes from corn.

Pure ethanol is rarely used for transportation; usually it is mixed with gasoline. The most popular blend for light-duty vehicles is known as E85, which is 85 percent ethanol and 15 percent gasoline. Heavy-duty trucks typically use E95 (ethanol blended with five percent unleaded gasoline) and E93 (ethanol blended with five percent methanol and two percent kerosene). For many years, ethanol has also been used as a 10 percent mixture with gasoline in a blend called "gasohol" or E10 to reduce carbon monoxide emissions during winter. Finally, ethanol is often blended in gasoline as an oxygenate to meet clean fuel requirements.

The technology to produce ethanol is well established, and all the resources needed to produce it can be supplied domestically.

AVAILABILITY

The use of E10 ethanol is covered under warranty by every automaker selling cars in the United States. American automakers also produce a variety of automobiles, light-duty pickup trucks, and minivans known as flexible fuel vehicles (FFVs). These vehicles can operate on any combination of ethanol and gasoline by automatically sensing the percentage of alcohol in the fuel tank and adjusting the engine's parameters accordingly.

EMISSIONS CHARACTERISTICS *

Actual emissions will vary with engine design; these numbers reflect the potential reductions offered by ethanol (E85), relative to conventional gasoline.

- Fewer total toxics are produced.
- Reductions in ozone-forming volatile organic compounds of 15 percent.
- Reductions in carbon monoxide of 40 percent.
- Reductions in particulate emissions of 20 percent.
- Reductions in nitrogen oxide emissions of 10 percent.
- Reductions in sulfate emissions of 80 percent.
- Lower reactivity of hydrocarbon emissions
- Higher ethanol and acetaldehyde emissions.

* Estimates based on ethanol's inherently "cleaner" chemical properties with an engine that takes full advantage of these fuel properties.

Ethanol is primarily used in the Midwest, where excess corn is distilled into fuel. Nearly 60 fueling stations offering E85 are located in 16 states. In states such as South Dakota and Iowa, ethanol-blended fuel (E10) is available at virtually every gas station. E95 is available only through bulk suppliers.

AFFORDABILITY

With mass production, manufacturers can offer FFVs at the same price as comparable gasoline vehicles. Generally, purchasing ethanol-blended gasoline is more expensive than traditional fuels. In the Midwest, however, E85 and other ethanol blends are sold at prices equivalent to or less than those for midgrade unleaded gasoline; prices vary due to a number of factors. Because ethanol contains approximately 60 percent of the energy content of gasoline, it takes more ethanol to get the same mileage as a similar gasoline vehicle. For heavy-duty vehicle applications, diesel prices tend to be lower than E95.

PERFORMANCE

Ethanol vehicles exhibit the same power, acceleration, payload, and cruise speed as conventionally fueled vehicles. In addition, ethanol use has several benefits. It has a higher octane rating than gasoline, which reduces engine "knock" and can result in higher energy efficiency. Ethanol also absorbs moisture and helps prevent gas-line freeze-up in cold weather, preventing the need to add expensive and possibly harmful fuel additives. In addition, ethanol has some detergent properties that reduce buildup, which keeps engines running smoothly and fuel injection systems clean for better performance.

On the other hand, ethanol vehicles have about 75 to 90 percent of the range of comparable gasoline vehicles and might require more frequent fueling. Some auto manufacturers are installing larger fuel tanks in E85 vehicles to prevent this inconvenience. Another potential concern is that ethanol is a more volatile fuel than gasoline, with a low volatility in winter and a high volatility in summer.

In addition, ethanol does not mix well with diesel fuel. Consumers with diesel vehicles who wish to use ethanol should completely replace diesel fuel with pure ethanol or use a special injection method.

SAFETY

Ethanol is not considered a toxic pollutant at levels likely to be inhaled when used as a motor fuel. It is much less flammable than gasoline, thus fires are less frequent and less severe when spills or releases of vapor occur. It is safer than gasoline to store, transport, and refuel. Because ethanol is water soluble and biodegradable, land and water spills are usually harmless, dispersing and decomposing quickly; the gasoline portion of a spill is still a problem in these situations. Adequate training is required to operate and maintain ethanol vehicles, however.

MAINTENANCE

Maintenance practices for ethanol-fueled vehicles are very similar to those for conventionally fueled vehicles. Special lubricants for ethanol-fueled vehicles are sometimes needed at a slightly higher cost than standard motor oils, but not all vehicles require these lubricants. In addition, oil changes are required less frequently, defraying some or all incremental costs. FFVs are designed specifically for ethanol's slightly more corrosive properties. But consumers who want existing vehicles to accommodate ethanol-blended gasoline beyond E10 might have to modify engines and fuel delivery systems to protect parts. Vehicle owners or maintenance shops should also identify the car as an ethanol vehicle when ordering replacement parts.

For More Information

EPA Alternative Fuels Web Site
www.epa.gov/otaq/consumer/fuels/altfuels/altfuels.htm

American Coalition for Ethanol
Web site: www.ethanol.org

Renewable Fuels Association
Web site: www.ethanolrfa.org

National Corn Growers Association
Web site: www.ncga.com

Governor's Ethanol Coalition
Web site: www.ethanol-gec.org

Alternative Fuel Refueling Station Locator
Web site: afdcmap.nrel.gov/nrel
(E85 only)

Alternative Fuels Data Center
Web site: www.afdc.nrel.gov

National Alternative Fuels Hotline
Phone: 800 423-1DOE

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