

Biofuels UPDATE

Report on U.S. Department of Energy Biofuels Technology

Ethanol Vehicles Benefit Everyone

Today there are more than 2.5 million ethanol fueled vehicles in use worldwide. Several countries, including the United States, are increasing the use of renewable fuels to mitigate global warming, and to achieve energy independence and economic security.

Most U.S. ethanol vehicles are in federal and state government fleets located in the Midwest. This year the General Services Administration anticipates acquiring more than 1,350 E85 vehicles. Several states have also pledged to buy more than 100 vehicles each, and state associations are promoting the fuel to fleet operators.

All Americans will benefit from the growing E85 market. Ethanol is biodegradable, which greatly reduces the long-term environmental effects of fuel spills. Researchers at the National Renewable Energy Laboratory (NREL) have concluded that E85 can significantly reduce hydrocarbon, benzene, carbon monoxide and nitrogen oxide emissions.

The nation's economy benefits from increased E85 use because ethanol is a renewable and domestically produced fuel.

Benefits to fleet managers include (1) no incremental increase in vehicle or insurance costs, (2) fueling flexibility, (3) full warranty availability, and (4) easy fleet implementation. □



Ford's 1996 flexible-fuel ethanol Taurus

When buying a new car, consumers can now choose a vehicle that can run on up to 85% ethanol (E85).

The U.S. Department of Energy's National Renewable Energy Laboratory (NREL) is working to improve production of ethanol from agricultural and forestry residues and dedicated energy crops. NREL has already increased production efficiency and greatly reduced the cost. Now there is an opportunity to continue that progress in an expanding marketplace. This issue of Biofuels Update is therefore dedicated to providing information on becoming an ethanol consumer. For more information on several groups mentioned in this newsletter, see the Summer 1995 Biofuels Update.

Detroit Brings Ethanol Vehicles to the Showroom

This year Ford Motor Company announced that all its dealerships will offer an ethanol version of the redesigned 1996 Taurus for the same price as a gasoline Taurus.

Ford Motor Company began its alcohol vehicle program in 1993, when the company began selling cars that ran on up to 85% methanol. Midwest support for ethanol led Ford to add ethanol to its program.

This year Ford's production plant in Chicago is prepared to produce several thousand flexible-fuel models. "We'll increase the volume of flexible-fuel vehicles to respond to demand, and we expect consumers to increase their demand for ethanol," said Tom Artushin, Ford's specialty fleet manager.

So far, state and federal government fleets are leading the push. The Taurus now comes with

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What's Next for Ethanol Vehicles?

Flexible-fuel vehicles can help build the ethanol market and bring a variety of benefits in the near-term, but many engineers believe a dedicated vehicle will deliver even better emissions and performance.

Working with the National Renewable Energy Laboratory, Southwest Research Institute (SwRI) is developing a dedicated ethanol vehicle that will meet California's ultra-low emission standards.

"Instead of starting with a gasoline engine and compromising it to run on ethanol, we're designing it for ethanol and taking full advantage of the fuel," said Lee Dodge, program manager at SwRI. A dedicated vehicle will also simplify the certification

procedure, making it more cost-effective by reducing the multiple emissions tests required for the different fuel blends.

As part of the project, a Ford engine has been modified with air-assist injectors, high-compression pistons and a computer-based engine control system. SwRI increased the compression ratio to take advantage of ethanol's high octane rating, and developed an engine controller to improve the control of fuel to air ratio and spark timing. The engine will be tested in a Ford Taurus during 1996.

In other NREL projects, researchers are addressing improved cold-start performance by developing new ethanol fuel processing systems. □

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no added cost, but it is larger and more costly than the vehicles government fleets normally purchase. "We're investigating other light-duty applications in response to customers' requests and desires," Artushin said.

The Taurus offers several unique features, including a special engine computer and fuel sensor, that enable it to run on either gasoline or ethanol. The sensor constantly detects the percentage of ethanol in the fuel and signals an on-board computer to adjust the fuel flow and engine timing accordingly. This allows the vehicle to take advantage of the performance characteristics of alcohol fuels.

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Owning an Ethanol Vehicle

Because ethanol vehicles fuel and operate the same as their gasoline counterparts, little training is required to incorporate E85 vehicles into a fleet. However, some points should be clarified:

- Ethanol is the same alcohol used for beverages, but it is denatured for the fuel market to prevent ingestion. That is a point not often made when the fuel is marketed, according to a recent Federal Transit Administration assessment of alternative fuel safety issues. "While ethanol is not especially toxic via dermal exposure, excessive skin contact with any fuel should be avoided," the report stated.

- The report also noted that fire dangers from ethanol are similar to those from gasoline, but the fire rate should be somewhat lower because of ethanol's lower vapor pressure. Normal precautions,

such as prohibiting smoking near refueling sites, should be taken.

- Alcohol vehicles sometimes have difficulty starting at cold temperatures, so Ford has equipped its Taurus with an engine block heater. The company also recommends that fuel providers offer lower ethanol blends (such as 70% ethanol and 30% gasoline) during the winter.

- Ethanol's higher octane provides several performance advantages, including increased horsepower, good fuel economy, and decreased emissions.

- Ethanol has few disadvantages, and advancements in engine design have addressed many issues. Ethanol has a lower energy content than gasoline, but a larger fuel tank and increased engine efficiency mean the driver should not notice a difference in range.

- Because ethanol is soluble in water, E85 is susceptible to water contamination, which can lead to reduced fuel economy or fuel system corrosion, depending on the water quantity and quality. This has been more of a problem in theory than in practice, according to General Motors engineer Norman Brinkman.

- Repair and maintenance practices are generally equivalent to gasoline-fueled vehicles, but the E85 model requires a special alcohol-tolerant oil with enhanced acid-neutralizing capabilities. This is available through any Ford and Ford Lincoln-Mercury dealer and can now be purchased at auto parts stores.

For a copy of the Federal Transit Administration's Clean Air Program: Summary Assessment of the Safety, Health, Environmental and System Risks of Alternative Fuel, call the National Alternative Fuels Hotline at 1-800-423-1DOE. □

Bringing Ethanol to the Corner Fueling Station

Thanks to the joint efforts of the U.S. Department of Energy, the Governor's Ethanol Coalition, the National Corn Growers Association, and the National Ethanol Vehicle Coalition (NEVC), the Midwest is being linked by an E85 refueling infrastructure that enables many drivers to keep E85 in their tanks (*see Fall 1995 Biofuels Update*).

Bringing E85 into the marketplace requires support from fuel producers and suppliers. At E85 fuel stations supported by the National Corn Growers Association, the fuel price to the public is equivalent to that of mid-grade gasoline.

Industry is also working to build the infrastructure. Ethanol storage and dispensing is similar to gasoline service stations. However, use of the wrong materials could lead to leakage, fuel contamination, and equipment failure. A gasoline fuel site can be made ethanol compatible for less than \$1,000, according to Phillip Lampert, NEVC project coordinator. A new E85 fueling site can be constructed for about \$40,000.

"It's to the auto manufacturers' benefit to help standardize the infrastructure," said Lampert, "and both Ford and General Motors have been active in that regard."

This Fall the American Automobile Manufacturers Association proposed standards as part of an industry cooperative effort for above- and underground dispensers that will make it easier to install reliable ethanol fueling sites.

As part of this endeavor, the Society of Automotive Engineers is developing a standard labeling



An E85 pump at a Sunoco station in Washington, D.C.

system for designated "E85 Compatible" systems. Fueling sites that have been operating reliably for more than a year but have not undergone rigorous testing can be designated "E85 Temporary Use." Tanks and dispensers that have been upgraded to be E85 compatible can also be used for gasoline, which gives station owners flexibility as the E85 market develops.

The auto manufacturers' involvement stems from their experiences with methanol. "A lot of the refueling station equipment designed for gasoline had problems with alcohol fuel," said General Motors engineer Norman Brinkman. "There was concern about leaking, but the real issue was whether components would impact the fuel and cause vehicle problems." According to Brinkman, methanol corroded the aluminum nozzles and the corrosion products entered the fuel. Just

a small amount was enough to clog vehicle filters. Likewise, methanol affected the rubber hoses, and ions leached into the fuel.

"We are taking what we learned with methanol and applying it to ethanol. Today ethanol stations are put in with this knowledge," Brinkman said.

For updated information on ethanol fueling locations, visit the Alternative Fuels Data Center on the Internet's world wide web at <http://www.afdc.doe.gov>, or call the National Alternative Fuels Hotline at 1-800-423-1DOE.

For information on pending sites or fuel specifications, call the National Ethanol Vehicle Coalition's hotline at 1-800-E85-8895.

For equipment dispensing standards, contact James Steiger at the American Automobile Manufacturers Association, 7430 Second Avenue, Suite 300, Detroit, MI 48202, 313-872-4311. □

Biofuels News Bites

- Volvo GM Heavy Truck Corporation announced its new hybrid Environmental Concept Truck that uses an ethanol-powered turbine connected to a generator to charge a battery-powered electric motor. The truck was built in Sweden and designed to reduce emissions.
- Illinois recently established a \$20 million program to offer rebates for the incremental cost of purchasing an alternative fuel vehicle as well as the fuel cost differential. The law also authorizes the Illinois Environmental Protection Agency to establish an ethanol fuel research program.

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The alcohol models are equipped with a larger fuel tank to ensure that the overall driving range is closer to gasoline vehicles despite ethanol's lower energy content. They also have upgraded internal components, such as piston rings, engine block and valve seals.

Ford will prepare a videotape to educate its dealers on the new vehicles, but the company does not expect many problems.

"There's really not any major change," said Al Updegrove of Ford's customer service division.

"Just a few components are different and there are two calibrations for the ethanol and methanol." He also notes that the diagnostic routine is the same, and even a repair technician unfamiliar with the model will find the part numbers and know what to order.

The flexible-fuel ethanol Taurus is certified to meet federal emissions standards, but has demonstrated it can further reduce smog-forming hydrocarbon

Photo not available for distribution on the Internet

General Motors' GMC Sonoma flexible-fuel ethanol vehicle for the 1998 model year.

emissions by as much as 30 percent, according to Ford engineer Richard Bell. "When customers are comfortable with the ethanol infrastructure, a dedicated ethanol vehicle could be produced to optimize emissions," he said.

Ford and the National Ethanol Vehicle Coalition will join forces next spring to introduce the vehicle to several key Midwest markets, but the announcement General Motors made earlier this

year may be the thing that has ethanol advocates most excited.

Starting with the 1998 model year, all S-Series and Sonoma pickup trucks will be E85. The plan gives GM the advantages of credits in the U.S. Environmental Protection Agency's Corporate Average Fuel Economy program, and truck purchasers benefit because they will be able to decide about alternative fuels at the fuel pump instead of on the showroom floor. □

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