

## Low-Level Ethanol Fuel Blends

The U.S. Department of Energy's (DOE) Clean Cities initiative supports the use of blends of ethanol with gasoline as one of a range of technologies and strategies that can reduce our nation's reliance on imported petroleum for transportation. Ethanol is made from renewable resources grown on our nation's farms. Using ethanol blends in gasoline reduces our consumption of petroleum and supports local and regional economies.

Ethanol is being used today in blends ranging from 5% to 85%. Blends of up to 10% ethanol with gasoline (E10) are approved for use in all gasoline vehicles, and have been used for many years across the nation to improve air quality.

Blends above 10% require use of flexible-fuel vehicles (FFVs), which are sold as standard models by several automakers. These vehicles have special controls and materials to accommodate higher levels of ethanol. More than 4 million FFVs are on the road today, and these vehicles can use any proportion up to 85% ethanol with gasoline. The most popular higher blend is E85, currently available at more than 200 stations. Retail fueling stations for this U.S.-produced fuel are growing at a steady pace, especially in the Midwest. To find station locations, see the Alternative Fuels Data Center's Station Locator at [www.eere.energy.gov/afdc/infrastructure/locator.html](http://www.eere.energy.gov/afdc/infrastructure/locator.html). If you're not sure if your vehicle can accept E85, look inside your gas cap or in your owner's manual.

Both E85 and lower-level blends can have a place in local, state, or regional transportation systems. The large number of FFVs in fleets and those owned by consumers are ready markets for new E85 infrastructure, while users of E10 or below can take advantage of the broader vehicle stock and the existing fueling infrastructure. This fact sheet focuses on the performance, emissions, and opportunities of E10 or lower; see the Clean Cities publication *Do You Own a Flexible Fuel Vehicle?* for more information on FFVs and E85.

### Vehicle Emissions

Ethanol has been used in vehicles since the early 1990s to promote more complete combustion of the fuel, thereby reducing emissions of carbon monoxide (CO), a regulated pollutant that is dangerous to human health. Particularly in cold weather with older or poorly maintained vehicles,

the reduction of CO can be significant (20% to 30%). Emissions of NO<sub>x</sub> are not increased through the use of low-level blends because the 3-way catalytic converter ensures that tailpipe emissions comply with NO<sub>x</sub> standards. In addition, by displacing gasoline, ethanol reduces exposure to toxic pollutants found in gasoline.

E10 has a higher vapor pressure than does gasoline, which gives the fuel a higher volatility. This increased volatility can cause higher evaporative emissions of light hydrocarbon from the fuel. However, state and federal regulations control the volatility of the blended fuel. Higher vapor pressure can also cause permeation through fuel system components, although this is expected to decrease as fuel systems continue to meet new standards for evaporative emissions.

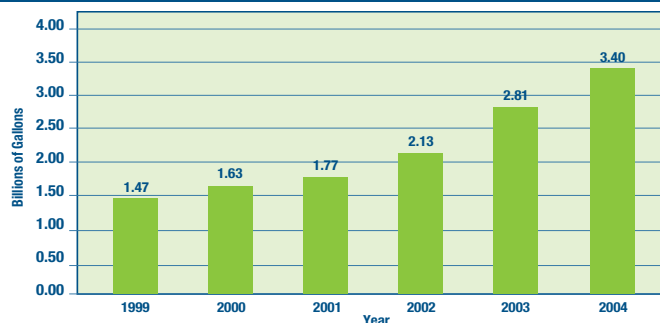
The use of ethanol blends significantly reduces the emission of greenhouse gases. In the United States, ethanol is made from agricultural crops, predominantly corn. As it grows, the corn plant captures carbon dioxide from the atmosphere, converting it to sugars and starches through photosynthesis. These sugars and starches are then fermented to produce ethanol, transforming the building blocks of a potent greenhouse gas to a renewable fuel.

### Fuel Performance and Availability

There have been many successful years of vehicle operating experience with low-level ethanol blends. All auto manufacturers warranty their vehicles to operate on E10 or less. Ethanol has higher octane than gasoline, leading to excellent drivability and performance. Ethanol has less energy content per gallon than does gasoline, but at blends of E10 and below, there is typically not a perceptible difference in fuel economy or range.

Ethanol Production 1999-2004

Source: Renewable Fuels Association



The supply of ethanol is steadily growing. According to the Renewable Fuels Association, the ethanol industry produced about 3.4 billion gallons in 2004, up from 2.81 billion gallons in 2003, a 21% increase. In February 2005, DOE/EERE's Biomass Energy Program estimated that U.S. agricultural and forest resources could potentially meet 30% of our current transportation fuel needs. Currently, 98 ethanol plants nationwide have the capacity to produce nearly 3.7 billion gallons annually. There are 17 ethanol plants under construction with a combined annual capacity of more than 689 million gallons.<sup>1</sup> Local economic development is often a driver for these new plants, along with increased expected demand.

Infrastructure for production and distribution of ethanol blends varies regionally around the country. Areas that have been using ethanol as an oxygenate have well-established infrastructure. As methyl tertiary butyl ether (MTBE) is phased out as an oxygenate because of groundwater concerns, ethanol infrastructure will likely expand to other regions of the country.

In the coming years, ethanol will be produced from other materials besides corn. DOE and industry are developing technologies to produce ethanol from farm and forestry materials such as cornhusks and stalks, grasses, and fast-growing trees. The first ethanol production plants to use this technology are expected to be built starting in 2008.

## Cost, Incentives, and Regulations

Prices at the pump for E10 are competitive with gasoline prices. Production costs for ethanol, currently more expensive than for gasoline, are subsidized by about \$0.50 per gallon of ethanol, taken as a tax credit by blenders. Legislation passed by Congress in 2004 modified the ethanol tax incentive, making it easier for blenders to use this credit, although the Internal Revenue Service is still developing rules to implement the changes. The most current status of this rulemaking can be found at the Renewable Fuels Association Web site: [www.ethanolrfa.org/VEETC.htm](http://www.ethanolrfa.org/VEETC.htm).

Technical and financial assistance is available for developing ethanol production facilities through the U.S. Department of Agriculture. (See [www.ethanolrfa.org/leg\\_position\\_usda.shtml](http://www.ethanolrfa.org/leg_position_usda.shtml).) Several states also have programs

to support ethanol development from state resources. (See [www.ncsl.org/programs/energy/ethinc.htm](http://www.ncsl.org/programs/energy/ethinc.htm).)

## What Clean Cities Coalitions Can Do

Some states are aggressively pursuing more widespread use of ethanol in their public fleets, or in the retail fuel supply. For example, Minnesota requires almost all gasoline sold within the state to contain 10% ethanol. Other states are considering similar initiatives.

Clean Cities coalitions can work with state regulators and legislators to encourage policies that require use of E10 or less. Partnerships can often be formed with the agricultural community to help build support for these policies. Through Clean Cities, coordinators can access comparative information about other states' programs and technical information about ethanol issues to help ensure new state programs are successful.

Coordinators can also work with nearby federal, state, and utility fleets to encourage use of ethanol blends. Many of these fleets have extra motivation to use regionally produced fuels, and in some cases, are required to do so by federal regulations.

Public education can also help build support for these homegrown fuels, which can contribute to local and regional economies.

### Resources for Additional Information

Clean Cities Resources:

- Clean Cities Fuel Blends Web site: [www.eere.energy.gov/cleancities/blends](http://www.eere.energy.gov/cleancities/blends)
- Alternative Fuels Data Center [www.eere.energy.gov/afdc](http://www.eere.energy.gov/afdc)
- National Alternative Fuels Hotline 800-423-1363

National Ethanol Vehicle Coalition (NEVC) [www.e85fuel.com](http://www.e85fuel.com)

Renewable Fuels Association (RFA) [www.ethanolrfa.org](http://www.ethanolrfa.org)

Governors' Ethanol Coalition [www.ethanol-gec.org](http://www.ethanol-gec.org)

<sup>1</sup> Renewable Fuels Association press release, "U.S. Ethanol Industry Sets Annual Production Record of 3.4 Billion Gallons in 2004", February 23, 2005

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