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## Ethanol-Fueled Vehicles Make Their Way Around the World

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## **Ethanol-Fueled Vehicles Make Their Way Around the World**

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Outside of the North America, the range of progress toward the use of ethanol-fueled vehicles is quite broad, from countries that only use conventional petroleum-based gasoline-powered vehicles to countries attempting to convert to 100 percent ethanol (E100, or hydrated ethyl alcohol, which is 96 percent ethanol and 4 percent water). Many countries are in intermediate stages of conversion to ethanol-gasoline blends (anhydrous or water-free ethanol is used in those gasoline blends). Of course, all countries have some proportion of diesel-powered vehicles as well, as it is the traditional fuel for tractors, trucks, public transportation, and many automobiles. Any increase in the use of ethanol decreases the use of gasoline, providing the benefit of independence from a petroleum-based product and lowered environmental impact.

### **Brazil Leads the Way in Alternative Fuel Vehicles**

Brazil has maintained its lead in the world of flexible fuel vehicles (FFVs) and ethanol use. With the creation of the National Alcohol Program (ProAlcool) in 1975, Brazil required the use of E10 (10 percent ethanol, 90 percent gasoline). By 2006, Brazil was already the largest consumer of ethanol in the world. In fact, by 2006, all cars were made to run on a minimum of 22 percent ethanol (E22) and nearly 20 percent of cars ran on E100. By mid-2007, Brazilian law required that all gasoline have a minimum of 23 percent ethanol.

Many ethanol-only cars were sold in Brazil between 1980–95, reaching up to 90 percent of the cars sold between 1983–88. But when gas prices dropped, there was a total reversal. According to the Brazilian Automaker's Association, by 2002, interest in the biofuel had returned and sales of vehicles that run on ethanol once again increased. The government resolved to make a permanent change. At first, the government helped the auto industry change over to alternate fuels by granting subsidies and other incentives to automakers. Brazil also helped to influence consumer decision-making by levying a 14 percent tax on FFVs versus a 16 percent tax on gasoline-powered vehicle purchases. Legislation also was enacted that helped ethanol producers get loans and guarantee sales. Prices were fixed at 59 percent of government-mandated gasoline prices. Today, thanks to FFV ownership, Brazilian consumers choose their fuel at the pump, depending on the price. In fact, the number of cars in Brazil that ran on ethanol had reached a milestone of 2 million by August 2006, accounting for three quarters of the cars on the road. By March 2007, 2.6 million vehicles were running on ethanol. In early 2008, approximately 82 percent of the vehicles on the roads of Brazil were FFVs.

Although the FFVs that run on gasoline or gas/ethanol mixtures have only been on the market in Brazil since 2003, the number of companies producing and/or selling FFVs in Brazil is impressive. The market is still growing, with many new models added since 2006. As of March 2008, more than 80 percent of the new cars sold in Brazil were FFVs that can even run on E100.

In 2007, about 40 percent of all auto fuel used in Brazil was bioethanol. In the rest of the world, alternative fuels account for only about 1 percent of the fuel market.

The Brazilian government hopes to declare itself free of oil imports, with the help of extensive sugarcane crop harvesting. Brazil was the largest producer of ethanol until 2006 (17.5 billion liters per year), when it was passed by U.S. ethanol production. By December 2007, Brazil was producing 20 billion liters of ethanol a year and the U.S., 24 billion liters a year. As the second largest sugar producer after Brazil in 2006, India is following Brazil's progress with interest.

### **European and Global Status of Ethanol Cars**

In Europe, the push for alternative fuel use is accelerating. However, there is a much greater concentration on biodiesel use. In 2004, the European Union mandated that by 2010, petroleum-based fuels must be blended with at least 5.75 percent biofuels, whether biodiesel or ethanol. Even though to-date only 2 percent of transport fuel is biofuel, the European Commission just changed the target to 10 percent biofuel use by all members, by 2020. Also, new vehicles sold in Europe are expected to average the equivalent of 43 miles per gallon (mpg).

Automakers are providing the EU with vehicles that use ethanol, but most competition in the EU is from diesel-based technology. New diesel car registrations in Western Europe are increasing: While only 30 percent in 2000, the share of new diesel sales increased to around 53 percent for 2007.

In 2006, the total production of bioethanol in the EU was almost 1.6 billion liters, or 412 million gallons. At 250 million liters in 2006, France accounted for 16 percent of EU bioethanol production. Alain Jeanroy, France's ethanol industry coordinator, stated that France planned increases in ethanol production early on, so it could incorporate 10 percent biofuels into its petroleum-based products by 2010. By the end of 2006, Germany had surpassed Spain as Europe's largest ethanol manufacturer, with a dramatic increase in production since 2004. Combined, Germany and Spain accounted for 53 percent of the EU bioethanol production in 2006.

According to the European Bioethanol Fuel Association (EBFA), presently only 1.6 percent of the total EU cereal production goes toward bioethanol, and a third of that still goes back into animal feed, post-processing. Meanwhile, 62 percent of EU cereal production goes directly toward animal feed. Currently, 11 countries in the EU produce bioethanol; more are likely to join in soon. Belgium, Bulgaria, Greece and the UK have bioethanol production sites under construction. The Netherlands has by far the largest of the new planned facilities. It will derive bioethanol from wheat.

In Sweden, E5 has been available since 2003 and today it is widely used. Sweden began the conversion to E85 in 2004. The country now imports bioethanol from Brazil and Spain. The EBFA is concerned with the amount of bioethanol being imported into the EU from Brazil and the fact that U.S. bioethanol producers are trying to undercut EBFA members' prices to obtain sales. It wants controls to be set on imports.

### **Other Parts of Globe Also Converting to Ethanol**

Since 1980, Zimbabwe initiated use of E15 in its vehicles. At present, this is the only fuel available. The country has no petroleum resources, but produces its own fuel ethanol.

In Australia, the government developed a support system for promoting bioethanol use through tax incentives and subsidies (since 2000). A production goal of 92 million gallons of biofuel by 2010 has been set. Sources would include grain, sweet sorghum and sugar cane. This would replace only about 1 percent of the country's fuel supply.

In New Zealand, fuel alcohol is derived from lactose that is produced from dairy waste whey.

In 2003, India began using E5. The government hopes to increase ethanol use from 5 percent to 20 percent, and is subsidizing the production of ethanol from sugar cane. The number of plants producing ethanol has increased substantially.

In Thailand, E10 was already being dispensed at hundreds of Bangkok fuel stations in 2006. As of 2007, Thailand mandated that all gasoline-based fuel be E10.

Since 2001, China has had a few pilot cities where vehicles operated on ethanol-based fuels. In 2004, the largest ethanol distillery in the world was Chinese. According to the American Council for an Energy-Efficient Economy (ACEEE), China requires a fuel economy of 35 mpg for new cars sold in 2008. For 2007, Honda had record production and sales of autos outside of Japan, with the highest sales in China. Dong Feng Honda began Civic Hybrid sales in 2007. In the April 2007 Auto Shanghai motor show, Honda featured the Fit FFV made in Brazil and the FCX Concept, its new fuel cell vehicle, plus its Home Energy Station. Also showcased was the Green Boat 2 (developed by a Tongji University team) that won the first Chinese Honda Econopower race in 2006, which tests how far a vehicle can be made to drive on 1 liter of gasoline. Dreams of automobile ownership are increasing in China, but the country will have to plan any mass transition from bicycle to automotive power with some care: Pollution is already a major issue in some places, due to industrialization.

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