Alternative Fuels

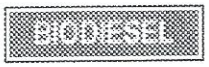
Alternative fuels are derived from resources other than petroleum. Some are produced domestically, reducing our dependence on imported oil, and some are derived from renewable sources. Often, they produce less pollution than gasoline or diesel.

To promote alternative fuels, the Federal government offers tax incentives to consumers purchasing qualifying alternative fuel vehicles.

Ethanol is produced domestically from corn and other crops and produces less greenhouse gas emissions than conventional fuels.

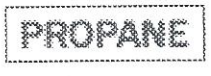
Biodiesel is derived from vegetable oils and animal fats. It usually produces less air pollutants than petroleum-based diesel.

Low-Level Biodiesel Blends

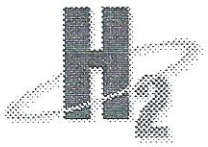


When biodiesel is blended with petroleum diesel, it produces a fuel that is compatible with diesel engines, displaces imported petroleum, and reduces harmful emissions. Blends like B2 (2% biodiesel, 98% diesel) and B5 (5% biodiesel, 95% diesel) are becoming increasingly common as drivers become aware of the benefits. Conventional diesel fuel ASTM D975 specifications allow for biodiesel concentrations of up to 5%. Higher-level biodiesel blends, such as B20, are also becoming more widely available and can qualify for credits under the Energy Policy Act of 1992.

Natural gas is a fossil fuel that generates less air pollutants and greenhouse gases. (Compressed Natural gas)



Propane, also called liquefied petroleum gas (LPG), is a domestically abundant fossil fuel that generates less harmful air pollutants and greenhouse gases.



Hydrogen can be produced domestically from fossil fuels (such as coal), nuclear power, or renewable resources, such as hydropower. Fuel cell vehicles powered by pure hydrogen emit no harmful air pollutants.

Fuel Blends

Blending amounts of alternative fuel with conventional fuel is an important option for reducing petroleum consumption. Examples of low-level fuel blends include E10 (10% ethanol/90% gasoline), B5 (5% biodiesel/95% diesel), and B2 (2% biodiesel/98% diesel). Blends can also consist of two types of alternative fuels, such as hydrogen and compressed natural gas (HCNG), which can be a combination of 20% hydrogen/80% CNG. B20 (20% biodiesel/80% diesel) and E85 (85% ethanol/15% gasoline) are not considered low level blends.

E85 (85% ethanol, 15% gasoline) qualifies as an alternative fuel under EPAct. E85 can be used in flexible fuel vehicles, which are designed to tolerate the fuel's high ethanol content. E85 cannot be used legally in standard gasoline-powered vehicles.

Electricity

Electricity can be used to power all-electric vehicles and plug-in hybrid electric vehicles directly from the power grid. Vehicles that run on electricity produce no tailpipe emissions. The only emissions that can be attributed to electricity are those generated in the production process at the power plant.

Hydrogen/Natural Gas (HCNG) Fuel Blends

Natural gas can be blended with hydrogen to make HCNG. Vehicles fueled with hydrogen/natural gas blends (HCNG) are an initial step toward the hydrogen-based transportation of the future.

Flex-Fuel Vehicles

Flexible fuel vehicles (FFVs) are designed to run on gasoline or a blend of up to 85% ethanol (E85). Except for a few engine and fuel system modifications, they are identical to gasoline-only models. FFVs experience no loss in performance when operating on E85. However, since ethanol contains less energy per volume than gasoline, FFVs typically get about 25-30% fewer miles per gallon when fueled with E85.[1]

FFVs have been produced since the 1980s, and dozens of models are currently available. Since FFVs look just like gasoline-only models, you may be driving an FFV and not even know it.

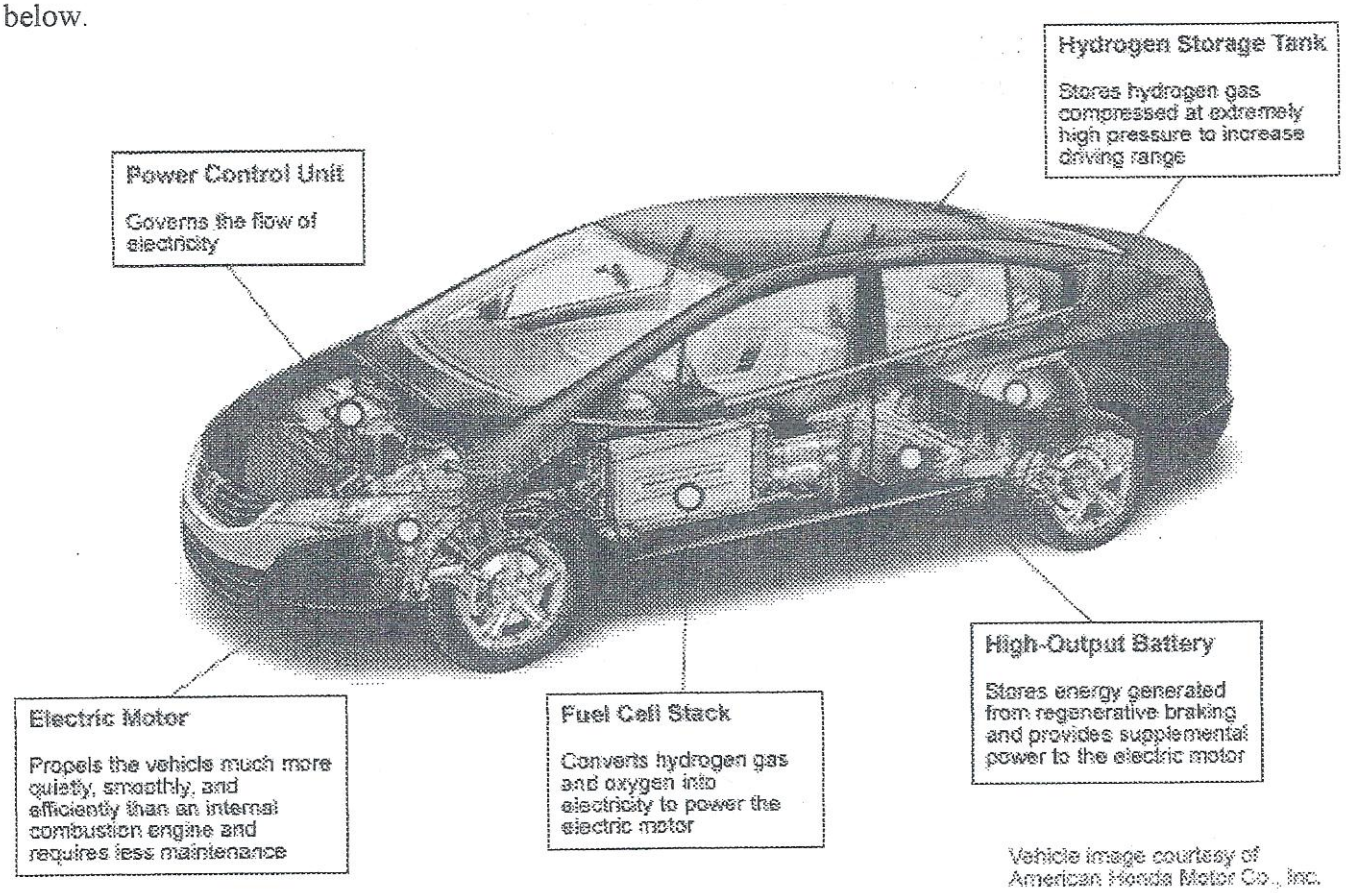
Fuel Cell Vehicles

Fuel cell vehicles (FCVs) have the potential to significantly reduce our dependence on foreign oil and lower harmful emissions that cause climate change. FCVs run on hydrogen gas rather

than gasoline and emit no harmful tailpipe emissions. These vehicles are in the early stages of development, and several challenges must be overcome before these vehicles will be competitive with conventional vehicles. However, the potential benefits of this technology are substantial.

A Look Inside

FCVs look like conventional vehicles from the outside, but inside they contain technologically advanced components not found on today's vehicles. The most obvious difference is the fuel cell stack that converts hydrogen gas stored onboard with oxygen from the air into electricity to drive the electric motor that propels the vehicle. The major components of a typical FCV are illustrated below.



Both dual-fuel and bi-fuel systems make use of two fuels in some way.

A dual-fuel system maintains two paths for fuel injection. Two types of fuel are stored in the car, but only one is delivered to the engine at any given time. For example, a hybrid car might make use of both natural gas and regular gasoline. Either a manual switch or some type of automatic sensor will tell the fuel injection system which fuel should be used. This patent is an example of such a system (http://www.freepatentsonline. com/5379740.html).

A bi-fuel system, on the other hand, makes use of two fuels simultaneously. The most common form of this is an E85 compatible vehicle. A mixture of fuels, made up of 85% ethanol and 15%

gasoline, is stored in a single tank. When fuel is injected into the engine, both the ethanol and gasoline arrive. They are mixed at a ratio that makes for optimal performance and efficiency.

Although it may seem like a minor distinction, there is a definite difference between the two types of systems. In a dual-fuel system, the engineer is attempting to make the car more efficient by adjusting to different situations. One fuel source may be more efficient for accelerating, for example, while another is more efficient for maintaining speed. With a bi-fuel system, the engineer is simply trying to deliver the best fuel possible to the vehicle. In this case, it happens to be a mixture of two simple fuels.

- **Ethanol:** Ethanol is an alcohol fuel that's derived mainly from grain.
- **Methanol:** Methanol is an alcohol fuel that's derived primarily from coal.
- **Blends:** A transitional fuel, blends are mixtures of traditional and alternative fuels, such as E85 and B20.
- **Natural Gas:** A by-product of oil drilling and coal mining, natural gas can also be harvested from natural gas fields.
- **Propane:** Also known as liquefied petroleum gas, propane is a by-product of natural gas and crude oil refining.
- **Hydrogen:** Most commercial hydrogen is refined from petroleum, but can also be made by passing electricity through water (electrolysis).
- **Electricity:** Electricity is considered an alternative since it is used to power the motors in electric vehicles.
- **Biodiesel:** A diesel fuel replacement or additive, biodiesel is made from vegetable oil or animal fat.
- **Biomass:** Derived from biological material, predominantly vegetation, biomass includes biofuels such as biodiesel and ethanol.
- **P-series:** Colorless, clear liquid fuels between 89-93 octane, P-series fuels are designed to be used in flex-fuel vehicles.