

ALTERNATIVE FUELS AND ALTERNATIVE FUEL VEHICLES

Compressed Natural Gas (CNG)

CNG consists of mostly methane and is a clean burning alternative fuel. Natural gas can be formulated into CNG or liquefied natural gas (LNG) to fuel vehicles.

Natural Gas Vehicle (NGV)

NGVs are bi-fuel vehicles with multi-fuel engines capable of running on two fuels. On internal combustion engines (ICEs), one fuel is gasoline or diesel and the other is an alternate fuel such as CNG, Liquefied Propane Gasoline (LPG), or hydrogen. The two fuels are stored in separate tanks and the engine runs on one fuel at a time.

Advantages	Disadvantages
<ul style="list-style-type: none">• Approximately 87% of natural gas used in America is produced domestically• Less smog-producing pollutants• Less greenhouse gas emissions• Less expensive than gasoline	<ul style="list-style-type: none">• Limited availability• Natural gas is less readily available than gasoline & diesel• Limited driving range as compared to gasoline vehicles

Ethanol

Ethanol is an alcohol-based fuel made by fermenting and distilling starch crops, such as corn. It can also be made from "cellulosic biomass" such as trees and grasses. The use of ethanol can reduce U.S. dependence upon foreign oil and reduce greenhouse gas emissions.

Ethanol 85 Flex Fuel Vehicle (E85)

An E85 flexible-fuel vehicle (FFV) or dual-fuel vehicle (colloquially called a flex-fuel vehicle) is an alternative fuel vehicle with a internal combustion engine designed to run on more than one fuel, usually gasoline blended with either ethanol or methanol; both fuels are stored in the same common tank.

Advantages	Disadvantages
<ul style="list-style-type: none">• Reduces the use of imported petroleum because it is domestically produced• Lowers air pollutant emissions• Increases resistance to engine knock• Similar to slightly-higher costs compared to gasoline vehicles• Same cost as gasoline	<ul style="list-style-type: none">• Only compatible with flex-fuel vehicles• Lower mileage per gallon compared to gasoline vehicles

Propane or Liquefied Petroleum Gas (LPG)

LPG is a clean-burning fossil fuel that can be used to power internal combustion engines. LPG-fueled vehicles produce fewer toxic and smog-forming air pollutants. LPG is usually less expensive than gasoline, and most LPG used in U.S. comes from domestic sources.

Liquefied Petroleum Gas Vehicle (LPGV)

LPGVs are bi-fuel vehicles with multi-fuel engines capable of running on two fuels. On ICEs, one fuel is gasoline or diesel and the other is an alternate fuel such as natural gas CNG, LPG, or hydrogen. The two fuels are stored in separate tanks and the engine runs on one fuel at a time.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Fewer toxic and smog-forming air pollutants • 85% of LPG used in U.S. comes from domestic sources • Costs less than gasoline 	<ul style="list-style-type: none"> • No new passenger cars or trucks commercially available (vehicles can be retrofitted for LPG) • Less readily available than gasoline & diesel • Fewer miles on a tank of fuel

Electric Vehicle (EV)

EVs are propelled by an electric motor(s) powered by rechargeable battery packs. EVs have several advantages over internal combustion engines ICEs. In EVs the battery must be recharged regularly, and there are limited battery recharging stations available when going long distance.

Advantages	Disadvantages
<ul style="list-style-type: none"> • Not readily available • Runs silently because there is no ICE • Environmentally friendly; no emissions • Easy manufacturing; you have to merely assemble various components of the vehicle. This is especially true for small motorcycles or mopeds • Requires less maintenance 	<ul style="list-style-type: none"> • Limited battery operating range; approximately 50-130 miles and roughly 6-8 hours to recharge completely • Scarcity of battery charging stations, especially across long distances. • Increased air pollution from power plants production

Biodiesel

Biodiesel is a form of diesel fuel manufactured from vegetable oils, animal fats, or recycled restaurant greases. Common blends include B2 (2% biodiesel), B5, and B20. B2 and B5 can be used safely in most diesel engines. **However, you can only receive an AFV credit by using the B20 blend.**

Advantages	Disadvantages
<ul style="list-style-type: none"> • Produced domestically from non-petroleum, renewable resources • Ability to be used in most diesel engines, especially newer ones • Produces Less air pollutants (other than nitrogen oxides) and greenhouse gases • Biodegradable, non-toxic, and safe to handle 	<ul style="list-style-type: none"> • B100 has lower fuel economy and power (10% lower for B100, 2% for B20) • Currently more expensive • B100 generally not suitable for use in low temperatures • B100's impact on engine durability is a concern

Hydrogen (H2)

H2 is being aggressively explored as a fuel for passenger vehicles. It can be used in fuel cells to power electric motors or burned in internal combustion engines (ICEs). It has the potential to dramatically reduce our dependence on foreign oil.

Benefits

- Hydrogen can be produced domestically from several sources, reducing our dependence on petroleum imports.
- Hydrogen produces no air pollutants or greenhouse gases when used in fuel cells, and as a result is environmentally friendly.

Challenges

- Hydrogen is currently expensive to produce and is only available at minimal locations, mostly in California.
- Fuel cell vehicles are currently far too expensive for most consumers to afford, and they are only available to a few demonstration fleets.
- Hydrogen contains much less energy than gasoline or diesel on a per-volume basis, so it is difficult to store enough hydrogen onboard a vehicle to travel more than 200 miles.
- Fuel cell performance, customer acceptance, and hydrogen transport and bulk storage are other challenges

Fuel Cell Vehicle (FCV)

Although they are not expected to reach the mass market before 2010, fuel cell vehicles FCVs may someday revolutionize on-road transportation. This emerging technology has the potential to significantly reduce energy use and harmful emissions, as well as our dependence on foreign oil. FCVs will have other benefits as well.

Benefits

- FCVs represent a radical departure from vehicles with conventional internal combustion engines. Like battery-electric vehicles, FCVs are propelled by electric motors. But while battery electric vehicles use electricity from an external source (and store it in a battery), FCVs create their own electricity from an onboard the vehicle creates electricity through a chemical process using hydrogen fuel and oxygen from the air.
- FCVs can be fueled with pure hydrogen gas stored onboard in high-pressure tanks. They also can be fueled with hydrogen-rich fuels; such as methanol, natural gas, or even gasoline; but these fuels must first be converted into hydrogen gas by an onboard device called a "reformer."
- FCVs are fueled with pure hydrogen emit no pollutants; only water and heat; while those using hydrogen-rich fuels and a reformer produce only small amounts of air pollutants. In addition, FCVs can be twice as efficient as similarly sized conventional vehicles and may also incorporate other advanced technologies to increase efficiency.

Hybrid Electric Vehicle (HEV)

HEVs combine the benefits of gasoline engines and electric motors and can be configured to obtain different objectives, such as improved fuel economy, increased power, or additional auxiliary power for electronic devices and power tools.

Benefits

- HEVs are primarily propelled by an internal combustion engine, just like conventional vehicles. However, they also convert energy normally wasted during coasting and braking into electricity, which is stored in a battery until needed by the electric motor.
- The electric motor is used to assist the engine when accelerating or hill climbing and in low-speed driving conditions where internal combustion engines are least efficient. Some HEVs also automatically

shut off the engine when the vehicle comes to a stop and restart it when the accelerator is pressed.
This prevents wasted energy from idling.