UNIT V

ALTERNATIVE ENERGY SOURCES

5.1. Natural Gas as a Fuel in Automobile;

A natural gas vehicle (NGV) is an alternative fuel vehicle that uses compressed natural gas (CNG) or liquefied natural gas (LNG) as a cleaner alternative to other fossil fuels. Natural gas vehicles should not be confused with vehicles powered by propane(LPG), which is a fuel with a fundamentally different composition. Worldwide, there were 14.8 million natural gas vehicles by 2011, led by Iran with 2.86 million, Pakistan (2.85 million), Argentina (2.07 million), Brazil (1.70 million), and India (1.10 million).

TheAsia-Pacific region leads the world with 6.8 million NGVs, followed by Latin America with 4.2 million vehicles. In the Latin American region almost 90% of NGVs have bi-fuel engines, allowing these vehicles to run on either gasoline or CNG. In Pakistan, almost every vehicle converted to (or manufactured for) alternative fuel use typically retains the capability to run on ordinary gasoline.

As of 2009, the U.S. had a fleet of 114,270 compressed natural gas (CNG) vehicles, mostly buses; 147,030 vehicles running on liquefied petroleum gas (LPG); and 3,176 vehicles liquefied natural gas (LNG). Other countries where natural gas-powered buses are popular include India, Australia, Argentina, and Germany. In OECD countries there are around 500,000 CNG vehicles. Pakistan's market share of NGVs was 61.1% in 2010, follow by Armenia with 32%, and Bolivia with 20%.The number of NGV refueling stations has also increased, to 18,202 worldwide as of 2010, up 10.2% from the previous year.

Existing gasoline-powered vehicles may be converted to run on CNG or LNG, and can be dedicated (running only on natural gas) or bi-fuel (running on either gasoline or natural gas. Diesel engines for heavy trucks and busses can also be converted and can be dedicated with the addition of new heads containing spark ignition systems, or can be run on a blend of diesel and natural gas, with the primary fuel being natural gas and a small amount of diesel fuel being used as an ignition source.

An increasing number of vehicles worldwide are being manufactured to run on CNG. Until recently, theHonda Civic GX was the only NGV commercially available in the US market., however now Ford, GM and Ram have bi-fuel offerings in their vehicle lineup. Fords approach is to offer a bi-fuel prep kit as a factory option, and then have the customer choose an authorized partner to install the natural gas equipment.

In 2006 the Brazilian subsidiary of FIAT introduced the Fiat Siena Tetra fuel, a four-fuel car developed under Magneti Marelli of Fiat Brazil. This automobile can run on natural gas (CNG); 100% ethanol (E100); E20 to E25 gasoline blend, Brazil's mandatory gasoline; and pure gasoline, though no longer available in Brazil it is used in neighboring countries.

NGV filling stations can be located anywhere that natural gas lines exist. Compressors (CNG) or liquifaction plants (LNG) are usually built on large scale but with CNG small home refueling stations are possible. A company called FuelMaker pioneered such a system called Phill

Home Refueling Appliance (known as "Phill"), which they developed in partnership with Honda for the American GX model. Phill is now manufactured and sold by BRC FuelMaker, a division of Fuel Systems Solutions, Inc.

CNG may also be mixed with biogas, produced from landfills or wastewater, which doesn't increase the concentration of carbon in the atmosphere. Despite its advantages, the use of natural gas vehicles faces several limitations, including fuel storage and infrastructure available for delivery and distribution at fueling stations. CNG must be stored in high pressure cylinders (3000psi to 3600psi operation pressure), and LNG must be stored in cryogenic cylinders (-260F to -200F).

These cylinders take up more space than gasoline or diesel tanks that can be molded in intricate shapes to store more fuel and use less on-vehicle space. CNG tanks are usually located in the vehicle's trunk or pickup bed, reducing the space available for other cargo. This problem can be solved by installing the tanks under the body of the vehicle, or on the roof (typical for busses), leaving cargo areas free.

As with other alternative fuels, other barriers for widespread use of NGVs are natural gas distribution to and at fueling stations as well as the low number of CNG and LNG stations. CNG-powered vehicles are considered to be safer than gasoline-powered vehicles

5.2.Liquefied petroleum gas as a Fuel in Automobile;

Liquefied petroleum gas or liquid petroleum gas (LPG or LP gas), also referred to as simply propane or butane, is a flammable mixture of hydrocarbon gases used as a fuel in heating appliances, cooking equipment, and vehicles. It is increasingly used as an aerosol propellant and a refrigerant, replacing chlorofluorocarbons in an effort to reduce damage to the ozone layer. When specifically used as a vehicle fuel it is often referred to as auto gas.

Varieties of LPG bought and sold include mixes that are primarily propane (C 3H8),primarily butane (C4H10) and, most commonly, mixes including both propane andbutane. In winter, the mixes contain more propane, while in summer, they contain more butane. In the United States, primarily two grades of LPG are sold: commercial propane and HD-5. These specifications are published by the Gas Processors Association (GPA) and the American Society of Testing and Materials (ASTM). Propane/butane blends are also listed in these specifications.

Propylene, butylenes and various other hydrocarbons are usually also present in small concentrations. HD-5 limits the amount of propylene that can be placed in LPG to 5%, and is utilized as an autogas specification. A powerful odorant, ethanethiol, is added so that leaks can be detected easily. The international standard is EN 589. In the United States, tetrahydrothiophene (thiophane) or amyl mercaptan are also approved odorants,[5] although neither is currently being utilized.

LPG is prepared by refining petroleum or "wet" natural gas, and is almost entirely derived from fossil fuel sources, being manufactured during the refining of petroleum (crude oil), or extracted from petroleum or natural gas streams as they emerge from the ground. It was first produced in 1910 by Dr. Walter Snelling, and the first commercial products appeared in 1912. It currently provides about 3% of all energy consumed, and burns relatively cleanly with no soot and very few sulfur emissions.

As it is a gas, it does not pose ground or water pollution hazards, but it can cause air pollution. LPG has a typical specific calorific value of 46.1 MJ/kg compared with 42.5 MJ/kg for fuel oil and 43.5 MJ/kg for premium grade petrol (gasoline).[6] However, its energy density per volume unit of 26 MJ/L is lower than either that of petrol or fuel oil, as its relative density is lower (about 0.5–0.58, compared to 0.71–0.77 for gasoline).

As its boiling point is below room temperature, LPG will evaporate quickly at normal temperatures and pressures and is usually supplied in pressurised steel vessels. They are typically filled to 80–85% of their capacity to allow for thermal expansion of the contained liquid. The ratio between the volumes of the vaporized gas and the liquefied gas varies depending on composition, pressure, and temperature, but is typically around 250:1.

The pressure at which LPG becomes liquid, called its vapour pressure, likewise varies depending on composition and temperature; for example, it is approximately 220 kilopascals (32 psi) for pure butane at 20 °C (68 °F), and approximately 2,200 kilopascals (320 psi) for pure propane at 55 °C (131 °F). LPG is heavier than air, unlike natural gas, and thus will flow along floors and tend to settle in low spots, such as basements. There are two main dangers from this. The first is a possible explosion if the mixture of LPG and air is within the explosive limits and there is an ignition source. The second is suffocation due to LPG displacing air, causing a decrease in oxygen concentration.

Large amounts of LPG can be stored in bulk cylinders and can be buried underground.

5.3. Bio diesel as a Fuel in Automobile;

Biodiesel and conventional diesel vehicles are one in the same. Although light-, medium-, and heavy-duty diesel vehicles are not technically "alternative fuel" vehicles, many are capable of running on biodiesel. Biodiesel, which is most often used as a blend with regular diesel fuel, can be used in many diesel vehicles without any engine modification. The most common biodiesel blend is B20, which is 20% biodiesel and 80% conventional diesel. B5 (5% biodiesel, 95% diesel) is also commonly used in fleets.

Before using biodiesel, be sure to check your engine warranty to ensure that higher-level blends (all OEMs accept the use of B5 and many accept the use of B20) of this alternative fuel don't void or affect it. High-level biodiesel blends (blends over B20) can have a solvency effect in engines and fuel systems that previously used petroleum diesel which may result in degraded seals and clogged fuel filters.

Biodiesel improves fuel lubricity and raises the cetane number of the fuel. Diesel engines depend on the lubricity of the fuel to keep moving parts from wearing prematurely. Federal regulations have gradually reduced allowable fuel sulfur to only 15 parts per million, which has often resulted in lowered aromatics content in diesel fuel. One advantage of biodiesel is that it can impart adequate lubricity to diesel fuels at blend levels as low as 1%.

5.4. Hybrid electric vehicle;

A hybrid electric vehicle (HEV) is a type of hybrid vehicle and electric vehiclewhich combines a conventional internal combustion engine (ICE) propulsion system with an electric propulsion system. The presence of the electric powertrain is intended to achieve either better fuel economy than a conventional vehicle or better performance. There are a variety of HEV types, and the degree to which they function as EVs varies as well. The most common form of HEV is the hybrid electric car, although hybrid electric trucks (pickups and tractors) and buses also exist.

Modern HEVs make use of efficiency-improving technologies such as regenerative braking, which converts the vehicle's kinetic energy into electric energy to charge the battery, rather than wasting it as heat energy as conventional brakes do. Some varieties of HEVs use their internal combustion engine to generate electricity by spinning an electrical generator (this combination is known as a motor-generator), to either recharge their batteries or to directly power the electric drive motors.

Many HEVs reduce idle emissions by shutting down the ICE at idle and restarting it when needed; this is known as a start-stop system. A hybrid-electric produces less emissions from its ICE than a comparably sized gasoline car, since an HEV's gasoline engine is usually smaller than a comparably sized pure gasoline-burning vehicle (natural gas and propane fuels produce lower emissions) and if not used to directly drive the car, can be geared to run at maximum efficiency, further improving fuel economy.

In 1901 Ferdinand Porsche developed the Lohner-Porsche Mixte Hybrid, the first gasoline-electric hybrid automobile in the world. The hybrid-electric vehicle did not become widely available until the release of the Toyota Prius in Japan in 1997, followed by the Honda Insight in 1999. While initially perceived as unnecessary due to the low cost of gasoline, worldwide increases in the price of petroleum caused many automakers to release hybrids in the late 2000s; they are now perceived as a core segment of the automotive market of the future.

About 9 million hybrid electric vehicles have been sold worldwide by October 2014, led by Toyota Motor Company (TMC) with more than 7 million Lexus and Toyota hybrids sold as of September 2014, followed by Honda Motor Co., Ltd. with cumulative global sales of more than 1.35 million hybrids as of June 2014, Ford Motor Corporation with over 375 thousand hybrids sold in the United States through September 2014, and the Hyundai Group with cumulative global sales of 200 thousand hybrids as of March 2014, including both Hyundai Motors and Kia Motors hybrid models.

Worldwide sales of hybrid vehicles produced by TMC reached 1 million units in May 2007; 2 million in August 2009; and passed the 5 million mark in March 2013. As of December 2013, worldwide hybrid sales are led by the Toyota Prius lift back, with cumulative sales of 3.17 million units, and available in almost 80 countries and regions.

The Prius nameplate has sold 4.2 million hybrids and plug-in hybrids up to December 2013. The United States is the world's largest hybrid market with over 3 million hybrid automobiles and SUVs sold through October 2013, followed by Japan with more than 2.6 million hybrids sold through September 2013. The Prius is the top selling hybrid car in the U.S. market, passing the 1 million milestones in April 2011. Cumulative sales of the Prius in Japan reached the 1 million mark in August 2011.

5.5. Fuel Cell;

A Fuel Cell is an electrochemical device that combines hydrogen and oxygen to produce electricity, with water and heat as its by-product. Since conversion of the fuel to energy takes place via an electrochemical process, not combustion. It is a clean, quiet and highly efficient process- two to three times more efficient than fuel burning.

It operates similarly to a battery, but it does not run down nor does it require recharging As long as fuel is supplied, a Fuel Cell will produce both energy and heat A Fuel Cell consists of two catalyst coated electrodes surrounding an electrolyte. One electrode is an anode and the other is a cathode The process begins when Hydrogen molecules enter the anode The catalyst coating separates hydrogen's negatively charged electrons from the positively charged protons The Electrolyte allows the protons to pass through to the cathode, but not the electrons.

Instead the electrons are directed through an external circuit which creates electrical current. While the electrons pass through the external circuit, oxygen molecules pass through the cathode. There the oxygen and the protons combine with the electrons after they have passed through the external circuit. When the oxygen and the protons combine with the electrons it produces water and heat. Individual fuel cells can then be placed in a series to form a fuel cell stack. The stack can be used in a system to power a vehicle or to provide stationary power to a building