ALTERNATIVE FUELS – A BOON FOR FUTURE GENERATIONS

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"The stocks of petroleum, coal, propane, and natural gas will be consumed in a few years."
"Most of the observed increase in globally averaged temperatures since the mid-20th century is due to the observed increase in anthropogenic greenhouse gas concentrations."
"The majority of the known petroleum reserves are located in the Middle East and thus worldwide fuel shortages would intensify the unrest that exists in the region, leading to further conflict and war."

This concern and words of apprehension regarding conventional petroleum products has been starting the people all over the world since a decade. There is a growing anxiety due to general environmental, economic, and geopolitical matters of sustainability of the petroleum products. Also the prices of the fossils fuels have been upsurging day-by-day. The only solution to these problems is the identification and usage of the alternative fuels in industry, transportation and in economy of the world.

What are Alternative Fuels?

Alternative fuels are also known as non-conventional fuels and are substances that can be used as fuels, other than conventional fuels. Conventional fuels include : fossil fuels (petroleum (oil), coal, propane, and natural gas), and nuclear materials such as uranium. An array of alternative fuels are there viz. biodiesel, bioalcohol (methanol, ethanol, butanol), chemically stored electricity (batteries and fuel cells), hydrogen, non-fossil methane, non-fossil natural gas, vegetable oil and other biomass sources.

Why is there an increasing demand for alternative fuels?

A variety of reasons contribute towards the increased demand for alternative fuels,

1. Environmental Concern - The major environmental concern, according to an IPCC report, is that "Most of the observed increase in globally averaged temperatures since the mid-20th century is due to the observed increase in anthropogenic greenhouse gas concentrations." Since burning fossil fuels is known to increase greenhouse gas concentrations in the atmosphere, they are a likely contributor to global warming.

2. Economic and Political Concern - The majority of the known petroleum reserves are located in the Middle East. There is general concern that worldwide fuel shortage could intensify the unrest that exists in the region, leading to further conflict and war.

3. Limited Reserves of the Alternative fuels - Other important concern which have fuelled demand revolve around the concept of peak oil, which predicts rising fuel costs as production rates of petroleum enter a terminal decline. According to the Hubbert peak theory, when the production levels peak, demand for oil will exceed supply and without proper mitigation this gap will continue to grow as production drops, which could cause a major energy crisis.

Biodiesel

Biodiesel refers to a vegetable oil - or animal fat-based diesel fuel consisting of long-chain alkyl (methyl, propyl or ethyl) esters. Biodiesel is typically made by chemically reacting lipids (e.g., vegetable oil, animal fat (tallow) with an alcohol. Biodiesel is meant to be used in standard diesel engines alone, or blended with petrodiesel.

Biodiesel can be produced from a great variety of feedstocks like vegetable oils (soyabean, cottonseed, peanut, sunflower, coconut, etc.) and animal fats (tallow) as well as waste oils (used frying oils).

The problem with the use of biodiesel includes the inherent higher price of the biodiesel, which in many countries is offset by legislative and regulatory incentives or subsidies in the form of reduced excise taxes, Slightly increased NOX exhaust emissions from biodiesel burning, oxidative stability, and Cold flow properties which are especially relevant in cold countries.

Bioalcohol (Methanol and ethanol)

Ethanol is generally made from corn, biomass (agricultural crops and waste like rice straw), plant material left from logging, and trash including cellulose. Methanol can be made from various biomass resources like wood, as well as from coal. However, today nearly all methanol is made from natural gas, because it is cheaper.

Methanol and ethanol are not primary sources of energy; however, they are convenient fuels for storing and transporting energy. These alcohol can be used in internal combustion engines such as flexible fuel vehicles with minor modifications.

The use of bioethanol in replacing fossil fuels in vehicles is a matter of concern as large amount of arable land is required for crops resulting in imbalance of environment and energy but recent developments with cellulosic ethanol production and commercialisation may assuage these concerns.

Chemically stored electricity

Chemically stored electricity is used to run electric cars, T.V. and electrical appliances etc. Electric vehicles receive their power from various sources, including fossil fuels, nuclear power, and renewable sources (tidal power, solar power, and wind power) or any combination of those. After generation, this energy is then transmitted to the vehicle through use of overhead lines, wireless energy transfer, or a direct connection through an electrical cable. The electricity may then be stored onboard the vehicle using a battery, flywheel, super capacitor, or fuel cell. A key advantage of electric or hybrid electric vehicles is their ability to recover braking energy as electricity to be restored to the on-board battery or sent back to the grid whereas when fossil fuel vehicles brake, they simply dump the energy into the environment as waste heat.

The problem with electric vehicles is of long recharge times compared to the relatively fast process of refuelling a tank which is further complicated by the current scarcity of public charging stations.

Hydrogen

Hydrogen is the lightest of all elements, easy to produce through electrolysis, burns nearly pollution-free and being a non-carbon fuel, the exhaust is free of carbon dioxide.

Hydrogen as a fuel can be an asset but there is no accessible natural reserve of uncombined hydrogen, since what little there is resides in Earth's outer atmosphere. Therefore, hydrogen for use as fuel must first be produced using another energy source, making it a means to transport energy, rather than an energy source.

One existing method of hydrogen production is steam methane reformation; however, this method requires methane, which raises sustainability concerns. Another method of hydrogen production is through electrolysis of water, in which electricity generated from any source can be used. Photoelectrolysis, biohydrogen, and biomass or coal gasification have also been proposed as means to produce hydrogen. Hydrogen has thus currently become impractical to be used as an alternative fuel.

Alternative fossil fuels

Compressed natural gas (CNG) is a common fuel which comes from underground. However, natural gas is a gas like air, rather a liquid like petroleum. It has been found to be one of the most environmentally friendly fuels and is used to power a car or truck. Natural gas is made up of methane (95 per cent) and the other 5 per cent is made up of various gases like butane, propane, ethane along with small amounts of water vapour. However, natural gas is a finite resource like all fossil fuels, and its production is expected to peak soon after oil does.

Liquefied natural gas (LNG) is made by refrigerating natural gas to –260° F to condense it into a liquid (liquefaction) which removes most of the water vapour, butane, propane, and other trace gases, that are usually included in ordinary natural gas. The resulting LNG is usually more than 98 per cent pure methane. The liquid form is much denser than natural gas or CNG and has much more energy. LNG is good for large trucks that need to go a long distance before they stop for more fuel.

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