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Alternate Fuels and Energy System

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Abstract: This paper is basically based on the estimation of petroleum reserves i.e. world strategy of petroleum, need for alternative fuels, availability, concepts of conventional fuels, potential alternative fuels like alcohols (Ethanol, Methanol) hydrogen, LPG (liquefied petroleum gas), CNG (compressed natural gas), producer gas bio gas and various vegetable oils along with merits and demerits of various fuels and their effect on the environment is mentioned in the paper.

Key words: Estimation of petroleum reserves · Producer gas bio gas · Environment is mentioned in the paper

INTRODUCTION

In this world it is mentioned that crude oil and petroleum products are left in very less amount which results in increased in its price. Day to day, fuel economy of engine is getting improved and will continue for further improvement. However, increases in number of vehicles are demanding for fuel. Because of this reason Gasoline and diesel will become scare and costly in near future. With increased use and the depletion of fossil fuels, alternative fuel technology will become more common in the coming decades [1].

Transportation is one of the important infrastructures of the particular country. Without transportation country even can't move one step. But main source for transportation is fuel i.e. gasoline and diesel. And clearly we know that the availability of fossils fuel is not for more than upcoming 60-70 years. So it has become important to search fuels which can be the alternative source of fuel for automobile.

Global Strategic Petroleum Reserves: It is the crude oil inventories or stockpiles held by the government of particular country, as well as private industry, for the purpose of providing economic and national security during an energy crisis. According to the United States Energy Information, approximately 4.1 billion barrels (650,000,000 m3) of oil are held in strategic reserves, of which 1.4 billion is government controlled. The remainder is with much of the remainder held by the other 26 members of the International Energy Agency.

Emergency Oil Sharing Agreements: In addition to maintaining a domestic stockpile of petroleum, several countries also have agreements to share their stockpiles in the event of an emergency.

The Japan, New Zealand and South Korea Agreement: In mid-2007 Japan announced a program to share its strategic reserve with other countries in its region. Negotiations are currently underway with New Zealand on an emergency oil-sharing program whereby Japan will make available for purchase its strategic reserves. In an emergency New Zealand would pay the market price plus negotiated option fees for the amount of oil previously held for them by Japan [2]. South Korea and Japan have also agreed to share their oil reserves in an emergency.

The United States and Israel Agreement: According to 1975 Second Sinai withdrawal document signed by the USA and Israel, in an emergency the USA is obligated to make oil available for sale to Israel for up to 5 years.

China: In 2007 China announced an expansion of their crude reserves into a two part system. The government-controlled consist of 101.9 million and 170 million barrels in first and second phase.

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Oil	Iodine value	Cetane number	Heating value (kJ/kg)	Viscosity	Cloud point	Pour point	Flash point
Castor	82-88		39500	297		-31.7	260
Corn	103-140	37.6	39500	34.9	-1.1	-40.0	277
Cottonseed	90-199	41.8	39468	33.5	1.7	-15	234
Crambe		44.6	40500	53.6	10	-12.2	274
Jatropha	94	45	39774	49.9			240
Karanji		40	35800	56			250
Linseed	168-204	34.6	39307	27.2	1.7	-15	241
Palm	35-61	42	36553	63.6	27		267
Peanut	80-106	41.8	39782	39.6	12.8	-6.7	271
Rapeseed	94-120	37.6	39709	37	-3.9	-31.7	246
Safflower	126-152	41.3	39519	31.3	18.3	-6.7	260
Sesame	104-120	40.2	39349	35.5	-3.9	-9.4	260
Soybean	117-143	37.9	39623	32.6	-3.9	-12.2	284
Sunflower	110-143	37.1	39575	37.1	7.2	-15.0	274
Diesel	8.6	45-55	44500	2.7	-15	-33	52

India: India has begun the development of strategic crude oil reserve sized at 37.4 million barrels, enough for two weeks of consumption. Petroleum stocks have been transferred from the Indian Oil Corporation to the Oil Industry Development Board(OIDB) [2]. The OIDB then created the Indian Strategic Petroleum Reserve Ltd (ISPRL) to serve as the controlling government agency for the strategic reserve.

The Facilities Are:

- Mangalore, State of Karnataka. Capacity of 11.22 barrels barrels.
- Padur village, Karnataka. Capacity of 18.7 million barrels.
- Visakhapatnam andhra Pradesh. Capacity of 7.48 million barrels.

Besides these Japan, South Korea, Europe, Middle East countries like Iran, Kuwait, Oceania etc. countries are also having strategic crude oil reserve.

Need of Alternative Fuels:

- Environmental Damage
- Global Warming
- Oil Spills
- Acid Rain
- Air Pollution
- Health Threat of Fossil Fuel Use

Various Alternate Sources of Fuel:

- Vegetable oil
- Hydrogen
- Ethanol
- Methanol
- Bio Gas
- Liquid petroleum gas (LPG)
- Compressed Natural Gas (CNG)
- Methanol
- Ethanol
- Solar power
- Electric power

Vegetable Oils: Vegetable oils are extracted from seeds through a series process involving drying, grinding, steaming, air cooling and oil extraction by pressing and screening. There are varieties of vegetable oils, there properties lie within close range. Vegetable oils have cetane number of about 35-50 depending upon their composition. Heating values are favorable when compared to diesel. However, vegetable oils and diesel differ greatly in other properties[3-5]. The viscosity is higher, which is nearly 10 times greater than the diesel. Most of the vegetable oils are triglycerides generally with no branched chains of different length and degree of saturation.

Some Physical Properties of Vegetable Oil: The main problems associated with the use of vegetable oils are due to their viscosity and poor volatility. Therefore some effort has been diverted towards the development of the derivatives of the oil. Different methods can be adopted to use vegetable oils efficiently in engines. They are

- Blending with diesel / alcohols
- Transesterification with alcohols
- Pyrolysis or cracking

- Preheating
- Dual fuelling with liquid and gaseous fuels
- Use of additives
- Microemulsification
- Use of semi adiabatic engine components.

Ethanol (E85): Ethanol, or grain alcohol, is produced by fermenting biomass, commonly corn (though other, lower-value feedstocks have been tested in an effort to reduce costs, like brewery waste and cheese-factory effluent--blecch!). It is thus inherently a renewable resource and contributes nothing in itself to greenhouse-gas loading of the atmosphere (and with efficient modern farming techniques, there's still an improvement even when you add in the petroleum-based fuel burned to plow the fields, make the fertilizer, etc.). As an alternative motor vehicle fuel, it is usually blended in a mixture of 85% ethanol, 15% unleaded gasoline, whence E85.

(It is also used in up to 10% blends with gasoline(gasohol) to oxygenate the gasoline and this mixture can be used by most modern gasoline vehicles).

Advantages: Ethanol is a renewable resource that contributes nothing in itself to global warming concerns. Like methanol, it can be blended with any amount of gasoline in the tank of a flex-fuel vehicle, which is what automakers are selling these days. In fact, starting with the 1999 model year, some automakers are making every one of certain vehicle models capable of using E85 in any mixture with gasoline, at no extra charge. Thus buyers will not have to do anything extra at all to have a vehicle capable of using an alternative fuel, though they will still have to find an E85 fueling station to take advantage of that capability.

Disadvantages: The main disadvantage of E85 is the price of the fuel. However, research is under way to enable the fermentation of lower-grade feedstocks (think of using not only the corn squeezin's but also the cob to make alcohol!), which should help a lot. Ethanol is somewhat corrosive, though less so than methanol and concerns about vapor lock, cold starts and flame visibility like those for methanol have led to the same standard blend of 85% alcohol with 15% gasoline.

Methanol: Methanol is typically made from natural gas; though it is possible to produce it by fermenting biomass (this is why it is sometimes called "wood alcohol"), this is not economically competitive yet. Because it is easier to transport natural gas to a distant market by converting it to methanol, which is a liquid at ordinary temperatures and pressures, than by chilling and liquefying it or by building a long pipeline, some petroleum-exporting countries are looking at exporting their "waste" natural gas (which they currently "flare off" in huge flames visible from the Space Shuttle!) by converting it to methanol; however, most of the natural gas that goes into methanol in the United States is still domestically produced. For reasons to be explained below, most fuel methanol in this country is sold as a blend of 85% methanol with 15% unleaded premium gasoline, whence "M85". In the not-too-distant future, "neat" (100%) methanol may be the preferred means of storing hydrogen for fuel-cell electric vehicles, but this technology is still in the R&D stage.

Advantages: Alcohol fuels like methanol are perhaps the most "transparent" alternative fuels to the user, i.e. they are the least distinguishable from gasoline in how you buy and use them, which should ease the acceptance. The fuel system of a car or truck only needs to be slightly changed (somewhat different materials, bigger fuel injectors and a fuel composition sensor) in order for it to run on it. Recently automakers have been offering M85 vehicles at no extra cost over their gasoline counterparts (or even for slightly less money), though at present automakers seem to be more interested in ethanol (E85).

At least in California, the fuel costs about the same per mile as mid-grade gasoline (that is, you need about 1.7 gallons of it to get the same driving range as one gallon of gasoline, but price of a gallon of gasoline is about 1.7 times the price of a gallon of M85, so it balances out). And perhaps best of all, modern methanol vehicles are flex-fuel vehicles, which means that any mixture of M85 and gasoline in the fuel tank can be used by the engine; a fuel-composition sensor tells the engine computer what percentage of methanol is in the fuel and it adjusts the injectors and ignition accordingly. Thus an methanol vehicle is a gasoline vehicle if M85 is not available, but you can top it off with methanol whenever you get back into an area where it can be found and you don't have to carry (and pay for!) two separate fuel systems to do this.

Disadvantages: Methanol is more corrosive than gasoline (though it is less toxic and not carcinogenic); this is why an automaker needs to change some of the materials in the fuel-handling systems of both the vehicle and the refueling station to materials that can withstand attack by the fuel. Special oil additives are necessary in order to protect the engine. Also, because the mixture of air to fuel is much richer than gasoline (about 8 to 1 by weight,

compared to about 14 to 1 for gasoline), there is more liquid fuel available to wash oil off of cylinder walls during a cold start. Some early methanol users experienced durability problems, but development work has been making steady progress.

The richer fuel/air mixture needed by methanol also means that a given volume of gasoline will take you about 70% farther than the same tank full of M85; most automakers have at least partially compensated for this by putting a larger fuel tank in their M85 vehicles. Very cold weather.

Biodiesel: Biodiesel is to petroleum diesel fuel what ethanol is to gasoline: a substitute fuel made from biomass, which means that it is inherently renewable and, in itself, it contributes nothing to carbon-dioxide loading of the atmosphere. Biodiesel commonly uses soybean or canola oil as its base, but animal fat or recycled cooking oil can also be used. To speed its market introduction and dilute its additional cost over petroleum diesel fuel, the initial commercial product being studied is a blend of 20% biodiesel and 80% petroleum diesel fuel, whence B20.Biodiesel is not currently widely available, though production-scale plants (as opposed to laboratory-scale experimental setups) do exist, for example NOPEC.

Advantages: It can be stored and dispensed in exactly the same manner as petroleum diesel or fuel; in addition, diesel-powered vehicles require no modification at all to run on B20 or even higher blends.Thus any diesel-powered truck or bus is, potentially, already analternative-fueled vehicle! For example, an ordinary used Winnebago was "converted" into the Veggie Van simply by pouring homemade biodiesel into its tank. Since biodiesel is not a fossil fuel, as noted above, it can cut greenhouse-gas emissions as well as ordinary pollutants (particularly soot) by displacing petroleum diesel fuel.

Disadvantages: The main disadvantage of B20, like that of E85, is fuel cost. However, since it requires no changes in hardware (vehicle or refueling) or retraining of mechanics and users, studies have shown that it could be the most cost-effective way for some fleets to meet clean-air requirements (compressed natural gas cuts fuel and maintenance costs, but vehicles must be replaced or converted to use it and mechanics must be retrained, which may tip the balance).

Liquefied Natural Gas (LNG): Liquefied natural gas for vehicles comes from the same sources as compressed natural gas (CNG), or for that matter as the gas that cooks your dinner. Unlikeliquefied petroleum gas (LPG), which is changed from a vapor to a liquid at room temperature by application of pressure, LNG has to be cooled to very low temperatures in order to cause it to liquefy; this makes it hard (though not impossible) to transport via tanker and it is usually liquefied at the dispensing station. As with CNG, LNG benefits from decades of infrastructure development because of heavy domestic, industrial and utility use of natural gas.

Advantages: LNG has all the emissions advantages. In addition, the liquefaction process amounts to a distillation, so the fuel is essentially pure methane (CNG can contain up to 12% of heavier molecules in California, like ethane and propane and even more elsewhere), which prevents variations in fuel quality that I'm told can occur for CNG (or gasoline, for that matter). Also, LNG is a somewhat less bulky and heavy way to store natural gas than as CNG in high-pressure tanks.

Disadvantages: Though LNG tanks are less bulky and heavy than CNG tanks, they are still more so than tanks for liquid fuels like gasoline, diesel, or alcohols. They are also more complex and expensive because they have to insulate the fuel very well in order to prevent it from warming up and boiling off too fast. Even with modern, rocket-science (literally!) insulation materials and techniques, a LNG tank will begin venting fuel if left to sit for several days, so the fuel is best used in high-duty-cycle applications like delivery trucks.

Electricity: Electricity can be made by many means, from the burning of high-sulfur coal to pollution-free photovoltaic cells (or solar cells).

Electric vehicles are generally divided intobattery and hybrid classes, depending on whether the electricity is generated off-board and stored in a battery or generated by a small on-board power plant. Hybrid electric vehicles can be designed to run on any fuel, including gasoline or diesel as well as alternative fuels and can best be thought of as highly-efficient gasoline, diesel, or alternative-fueled vehicles. This page discusses battery-electric vehicles, whose power comes from an off-board generator somewhere [6-8].

Electricity is the most readily available form of energy in the India. The network of power plants and transmission lines reaches even where natural-gas pipelines don't.

Advantages:

- Electricity is renewable source of energy.
- Electric vehicles are smooth in operation.
- Vehicles running by electricity are pollution free.
- An electric vehicle does not produce any unwanted sounds and vibrations.

Disadvantages: The main disadvantage of the electric vehicles is their price and there range.

Hydrogen: Hydrogen does not occur free in nature; it can be made by "re-forming" natural gas or another fossil fuel, or by using electricity to split ("electrolyze") water into its components of oxygen and hydrogen. In this sense, hydrogen is like electricity: the energy to generate it can be obtained from sources ranging from the burning of high-sulfur coal to pollution-free photovoltaic cells (solar cells).

Advantages:

- Clean combustion HC/CO is absent. Exhaust product is only water.
- Produced from renewable sources.
- No soot, so2, lead, sulphur, particulates.
- Higher thermal efficiency, higher self-ignition temperature, high resistance to knock.
- Higher compression can be used.
- Fuel performance can be used by applying dual concept with vegetable oil.
- Slow burning fuel such as natural gas engine performance can be improved by hydrogen induction.

Disadvantages:

- High cost of production and storage.
- Not safe fuel, very low minimum ign energy compared to petroland very high flame velocity. Lots of precautions is required.
- Develop less power. Hydrogen has very low density being in gaseous form. Its induction along with air quantity for combustion hence about 10% less power is developed compared to the petrol engine.
- Because of high combustion temperature, no emission is more.0

Liquefied Petroleum Gas (LPG): Propane and Butane are obtained from oil and gas wells. They are also the products of the petroleum refining process. For automobile engines, two types LPG are used. One is propane and the other is butane. Sometimes, a mixture of propane and butane is used as liquid petroleum gas in automobile engines. Liquid petroleum gases serve as fuel in place of petrol. They are widely used in buses, car and trucks. It is compressed and cooled to from liquid. This liquid is kept in pre4ssure tanks which are sealed.

Advantages:

- LPG contains less carbon than petrol.
- It mixes with air at all temperatures.
- In multi cylinder engine a uniform mixture can be supplied to all cylinders
- There is no crank case dilution, because the fuel is in the form of vapor.
- Automobile engines can use propane, if they have high compression ratio of 10:1.
- LPG has high anti knock characteristics.
- The engine may have 50% longer life.

Disadvantages: LPG is, again, in some ways the least "alternative" of alternative fuels; because its source is partly petroleum, it does less to help relieve the petroleum dependency problem than some other alternative fuels and given the dominance of the petroleum source in California it is not even considered an alternative fuel for some state incentive programs.

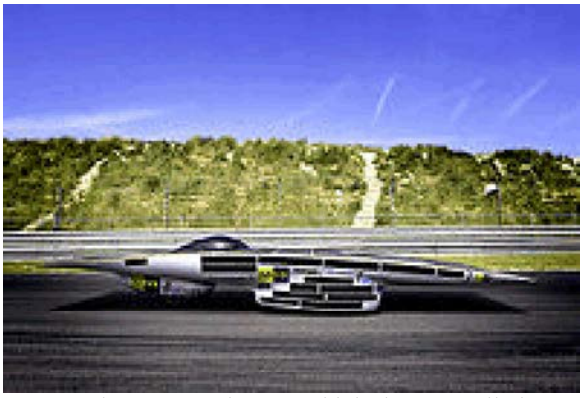
Similarly other types of important and major alternative energy sources are solar power, natural gas, bio gas etc.

CNG Compressed Natural GAS:

The Brazilian Fiat Siena Tetra fuel 1.4

High pressure compressed natural gas, mainly composed of methane that is used to fuel normal combustion engines instead of gasoline. Combustion of methane produces the least amount of CO_2 of all fossil fuels. Gasoline cars can be retrofitted to CNG and become biofuelNatural gas vehicles (NGVs) as the gasoline tank is kept. The driver can switch between CNG and gasoline during operation. Natural gas vehicles (NGVs) are popular in regions or countries where natural gas is abundant. Buses powered with CNG are common in the Delhi.

Solar Energy:



Nuna solar powered car, which has travelled up to 140km/h (84mph).

A solar car is an electric vehicle powered by solar energy obtained from solar panels on the car. Solar panels cannot currently be used to directly supply a car with a suitable amount of power at this time, but they can be used to extend the range of electric vehicles.

CONCLUSION

Hence the several types of alternate fuels and energy system found in the world are discussed above. From above description it is clear about the importance and need of alternate fuel and their several advantages and disadvantages. Since we are going to face the scarcity of fossil fuel we should reduce its uses. Instead of moving in private vehicle we can travel through the public buses and train. This not only help us to reduce the uses of fossil fuels but also save our money and environment from getting polluted.

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