
Alternative Fuel for Transportation

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ABSTRACT

The world of century 2000 present many critical challenges. One of the most important challenges concerns the environment .As population increases and the standard of living improves, there is an increasing concern that there will a shortage of energy to heat our homes and power the vehicles we clean air, clean water and biodegradable, renewable materials. Advances in technology have allowed development of alternative energy sources. Ethanol is a good alternative energy sources. My present paper focuses attention towards not only the Types of energy resources to be used i.e. Non- conventional sources but the Alarming question is “How much and way of Producing and Managing Energy”? So we are giving more attention towards the better and better exploitation of Energy through Biological Approach i.e. Use of Bioenergy. Increased use of ethanol as fuel has developed since the late 1970’s. It was first used as product extender because of gasoline shortage. The OPEC action called attention to the fact that the United States was extremely dependent on foreign oil. The focus shifted once again to the alternative fuel such as ethanol. At that time gasoline containing ethanol was called gasoline. Later on unleaded plus or super unleaded are two examples of names used today. Ethanol, used as gasoline component, improves combustion and reduces emission of CO which contributes to the formation of smog. Using ethanol can slow global warming. During past two decades enormous efforts were made to harness Bioenergy sources in India to meet up the growing demand of energy for domestic use in particular, as such Department of Non-Conventional Energy Sources (DNES) under the Ministry of Power and Energy was setup in 1982. So the urgent need of the day is to implement the process and use of Biological energy in our day to day life to make our Environment Pollution free and our country self dependent and reliable in this field.

Keywords: Gasoline, Biological energy, ethanol, methanol, environment

1. Introduction

As much as the wheels of energy turns, more and more the country will prosper especially the case of India which is the seventh largest country in the world where the population is increasing drastically and that’s why is on the verge of extinction of disappearance of conventional fuels like coal, oil, and natural gas as these resources are very finite and if this will be on use in same manner as in current scenario then will be no more available in the near future. So the better, reliable, alternative of this is the more and more use of Non-conventional sources of energy

1.1 Energy Consumption – A World Scenario

Oil – 33%
Coal – 22.8%
Bio mass – 13.8%
Hydro – 5.9 %
Nuclear – 5.6 %

A world data shows USA which has only 5.5 % of world's population consumes 35 % of the global energy consumption while Asia and Africa; Latin America has 70% of world population, consumes 17.5 % of the global energy consumption.

It means energy consumption by

1 American = 40 Indian = 90 Nigerians.

1.2 Alternative Fuel - Need and Prospects in India

Ethanol is an alcohol made by fermenting corn for other similar products. The liquid ethanol or ethyl alcohol can be used as a fuel when blended with gasoline or when in its original states. Methanol is made by fermenting almost any material that contains starch and other farm plants and wastes are also suitable. Annual ethanol production in IOWA is approximately 440 million gallons.

There are three primary ways that ethanol can be used as a transportation fuel:

1. As a blend of 10% ethanol with 90% gasoline.
2. As a component of reformulated gasoline, directly and / or as ethyl tertiary butyl ether.
3. Use directly as a fuel with 15% gasoline known as E- 85.

Ethanol use production has increased considerably during the 1980's and 1990's.

Proponents of ethanol have identified addition reasons for increased production and use.

1. It is in our national interest to reduce dependence on oil imports.
2. The quality of the environment improves.Co emissions is reduced and lead and other carcinogens (cancer causing agents) have been removed from gasoline.
3. Car owners gain from increased octane in gasoline which reduces engine knock. It also absorbs moisture and cleans the fuel system.

Presently, Indian is the largest sugarcane producer in the world, followed closely by Brazil. As per indicative estimates, the country has a total installed production capacity of about 2835 million liters of ethanol per years as against the total requirement for potable, industrial and other uses of about 1200 million liters. This is one major reason to focus on the operation of ethanol fuel vehicles.

Significantly, emissions from vehicles include about 1/5th carbon dioxide regarded as major contributor to global warming .Besides, oxides of sulphur and nitrogen. Precipitate acid rains, in addition to suspended particulate matter etc. Posing grave health risks .So all the above

mentioned facts provoke a strong need for bringing ethanol outlook. Table -5 indicates the basic justification for bringing in an alternate fuel resources economy in a true sense.

1.3 Current Report for Showing World Scenario

Today, ethanol is widely used and available in most areas. Ethanol is contained in over 11% of all gasoline sold in the United States .American consumer have driven more than 2 trillion miles on ethanol blended gasoline. The 1990's experienced the introduction and operation of flexible fuel vehicle (FFV) is capable of operating on E-85. The Ford Taurus FFV car was introduced to IOWA in 1996.The key component in a FFV is a sensor which determines the % of ethanol in the fuel with the help of computer . Beginning with the 1998 model year, Chrysler offered FFV mini vans Ford continues to offer the Taurus and added Windstar and Ranger in 1999. Explorer and sport Trac were offered in2001. General motors' Chevorlet S10 and Sonoma, Isuzu homber, and Mazda B3000 were offered in an FFVversion beginning in 2000.Brazil and Sweden are using large quantities of ethanol as an automotive fuel.

Pure ethanol is used in approximately 40% of the cars in Brazil .The remaining vehicles use blends of 22% ethanol with 78% gasoline. Based on experiments by the Indian Institute of Petroleum, a 10% ethanol blend with gasoline and a 15% ethanol blend with diesel is being is being considered for use as road fuel in at least one state. Ethanol use will improve due to updated engine technology in mass transit city bused and over the road trucks. Some will convert diesel engine to burn 100% ethanol. Others will burn E-diesel, a blend of ethanol and diesel fuel

1.4 Justification for Ethanol as A Fuel Substitute

The escalating oil import bills, dwindling fossil fuel reserves, burg-eoning pollution levels, deteriorating health standards , and above all, a strong indicators to dictate a change from a purely fossil fuel mode to that based on a blend of both gasoline and ethanol. Today ethanol banks upon quite a few successful experience of use in transport mode across several countries like Brazil, USA and Canada. In India too, trial runs of gasohol in the public transport vehicles have, by and large, shown quite encouraging results. The clear advantage of trying this fuel on the large scale is also manifested in abundantly available local reserves of sugarcane production .If viewed realistically, the issue is not so much about the partial utilization of ethanol, but much more importantly the broad policy framework, within which, its large use can become possible .So, while examining the alternate fuel in their new found role, it is quite suitable to talk of optimum use of production capacities available in the market place today.

Table 1: Energy value and properties of various fuels

Parameter	Petrol	Diesel	Ethanol
Energy content(MJ/Kg	43.65	45.15	29.73
Liquid density (Kg/l)	0.735	0.843-0.848	0.77843
Energy density (MJ/l)	32.1	38.16	23.32
Normal b.p.(⁰ c)	37-205	140-360	79
Octane#	91-97	25	111
Cetane#	0-5	45-55	5

Table 2: Basic Characteristics of the Alternate Fuels

	CNG	E-85	LNG	LPG	M-85
Chemical structure	CH ₄	C ₂ H ₅ OH	CH ₄	C ₃ H ₈	CH ₃ OH
Primary components	Methanol	Denatured ethanol and gasoline	Methane that in cooled cryogenically	Propane	Methanol and gasoline
Main fuel source	Underground reserves	Corn grain of agricultural wastes	Underground reserves	A by product of petroleum refining or natural gas	Natural gas , coal or wooded biomass
Energy content per gallon	29,00 btu	80,460 btu	73,500 btu	84,500 btu	63,350 btu
Energy ratio	3.94 to 1	1.42 to 1	1.55 to 1	1.36 to 1	1.75 to 1
Compared to gasoline	25% at 300psi	70%	66%	74%	57%
Liquid or gas	Gas	Liquid	Liquid	Liquid	Liquid

2. Safety Consideration of Ethanol And Other Fuels

As against an intimate understanding of the conventional petroleum fuels, the new class of alternate fuels is relatively new in the public memory. For this purpose it seems quite necessary to list down their associated safety aspects at some length .Table -3 indicates the key features as well as the accompanying safety guidelines of the alternate fuels from a user perspective.

Table 3: Features/safety guideline of alternate fuels

CNG	Odorless	Add odorants to detect any leaks --Use only heavy storage tanks to avoid possible hazards.
E-85	Less volatile than gasoline due to denaturing of the ethanol component	Being corrosive to some metals, gaskets and seals, use of anticorrosive elements is required.
LNG	No addition of odorants possible	Use methane gas detectors for detection of any leakage.
LPG	Extremely volatile , more than gasoline	Odorizing required besides use of gas detectors for leaks.
Methanol	Low flame luminosity prevent inhalation	Avoid use of corrosion prone elements.

2.1 Process Flow for Ethanol Production

There are several methods available to produce fuel ethanol, but the prominent route to produce this important fuel is through the following steps. Each of these steps is based on one chemical process or the other, without any major complexity involve. Presently, dry milling and the wet milling methods are the most common techniques employed for the purpose, as highlighted with the individual processing steps in table-4

Table 4: Production steps in Ethan

Processing stage	Process Features	Remarks
Milling	-- Hammer Mills grind the passing feedstock into a powdery mall	--Grain size should be small
Liquefaction	-Inter – mixing of the mass with water and alpha – amylase -- Passage via the cookers maintained at a high temp.stage (120-150 C) followed by a low temp. holding period(at 95 C) -- Liquefaction of the heat applied	-- Presence of the high temperatures reduces the bacteria levels in the mash
Saccharification	-- Cooling of the mash available in the cookers followed by the addition by the addition of secondary enzyme i.e. gluco-amylase	-- the addition converts the liquefied starch into the useful fermentable sugars(Dextrose)
Fermentation	-- Addition of the yeasts to the mash so as to ferment the sugars to ethanol and carbon dioxide	--Within a batch fermentation process, the mash is retained one fermenter for nearly 48 hrs.prior to the engine of the distillation process.
Distillation	-- The fermented mash known as Beer constitutes of about 10% alcohol, along with the non-Fermentable solids from the corn and yeast cells	-- Removal of alcohol takes place from the solids and water
Dehydration	-- Moisture , if any , present in the alcohol obtained above is removed by passing it through a dehydration system	-- Pure alcohol finally obtained is in an anhydrous form and is about 200 proof
Denaturing	-- Alcohol is made unfit for human consumption by denaturing it with a small (2-5%) of gasoline	-- Pilferage for human consumption drastically reduced

By – products	-- CO2 (in large quantity) and Distillers grain are produced during ethanol production	-- Alcohol free CO2 is utilize by ethanol plants after proper compression for sale as carbonate beverages or for other purpose -- In comparison , the distillers grains have a high protein content along with other nutrients for high value use or percentage demonstration
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3. Principal Advantages Of Ethanol Blended Gasoline As An Automotive Fuel

1. Higher latent heat vaporization
2. Uniform composition.
3. Higher flash point.
4. Very high octane rating.
5. No hazardous component.
6. Higher compression operation of the engine.
7. Reduced particulate emissions.
8. Enhanced engine power output and efficiency.
9. Increased safety during use.

4. Conclusion and Recommendation

The renewed faith in ethanol as in effective gasoline blended fuel is certainly a welcome step. With the recent commissioning of the pilot plant facilities at a few locations, more and more such initiatives should be forthcoming .The initial run with gasohol (5% ethanol base) could be extended on a large scale, but only with the requisite infrastructure availability in place.

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