

# Indian Biofuel Scenario: An Assessment of Science, Policy and Economy

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## Abstract—

The expectancy from the bio-fuels is to reduce the carbon footprints from the transportation sector and also reduce the dependency of country's economics on the foreign fuel sources. Our study is centred on one of the very important stream of bio-fuel which is bioethanol. It is an alcohol produced by the biological fermentation of carbohydrates derived from plant material. Its importance is that it can be directly used in cars designed to run on pure ethanol. Otherwise it can also act as a blending material in gasoline functioning as a substitute product for gasoline. It usually yield reductions in greenhouse gas emissions by 70 to 90% excluding carbon releases related to land-use change.

We will be underlining the technologies and government policies intrigued in order to increase the bio-fuel production and the latest developments taking place in the field of bioethanol production. The economic factor involved with the increase in bio-fuel development and its impact on the oil and gas industry is also discussed.

## I. INTRODUCTION

Energy is globally recognized as the prevailing factor for the amelioration of humans and economies. In case of an economy, the GDP escalation rate relies on performance of the energy sector. The energy sector in India is typically fossil fuel dependent for accommodating its energy demands. But with an exponential upsurge in energy demands, the domestic supply could not endure it leading to a large amount of imports. Even though being the fifth largest energy consumer in the world India has very low per capita energy consumption (i.e. approximately 24.74 GJ per capita per annum as compared to other developing countries). Reasons for this could be higher tariff and non accessibility of energy sources. Indian having a population of 1.2 billion and out of this 72% of the population lives in rural areas and 56% of rural household does not have access to electricity because of poor reliability and supply deficiency. Apart from this economic predicament, there is an indispensable need to reduce our gas emissions so as to contain the global warming.

## II. BIOETHANOL

The principle fuel used as a petrol substitute for road transport vehicles is bioethanol. Bioethanol fuel is mainly produced by the sugar fermentation process, although it can also be manufactured by the chemical process of reacting ethylene with steam.

$C_2H_5OH$  - that is the chemical formula for the compound which, colloquially, is just called "alcohol".

To most people it is also known as ethyl alcohol or spirits of wine. It bears the suffix "bio" because it is produced by fermenting biomass that contains sugar and starch - bioethanol is therefore a natural product.

## III. ADVANTAGES OF BIOETHANOL

- **Climate protection through fewer greenhouse gas emissions:**

Renewable energy sources such as bioethanol mean that fewer greenhouse gases are produced. Apart from the energy needed to manufacture it, sustainably produced bioethanol, produced from regenerative raw materials, is CO<sub>2</sub>-neutral. The CO<sub>2</sub> released when bioethanol combusts was originally absorbed by photosynthesis by the plants from which it is manufactured as they grew. A typical production plant, for instance, reduces greenhouse gases by 70% compared to fossil fuels.

- **Greater security of supply and less dependence on imports:**

Not only international political tensions but also the developments of the oil markets are projecting this important advantage of bioethanol more and more into the fore: the reserves of many "reliable" oil-producing countries - e.g. EU member states - are dwindling and demand has to be met increasingly from politically less stable regions. It is also to be expected that crude oil exploitation will become still more difficult and costly in the future.

- **Conservation of fossil resources:**

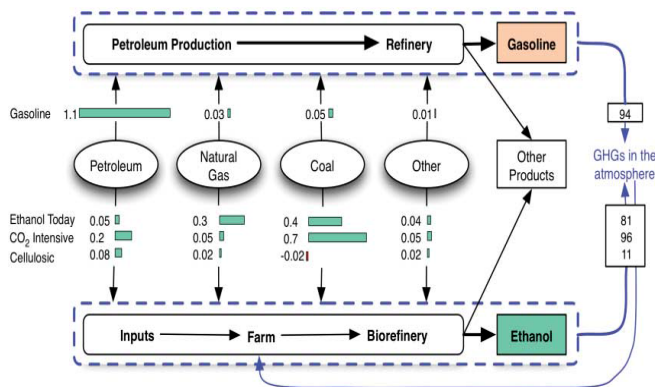
Each litre of bioethanol produced from regenerative raw materials means a similar saving in fossil fuels such as petrol and diesel produced from finite resources.

- **Innovative new industry offering important potential for rural areas:**

The country's economy and the public purse benefit from the emergence of a new domestic bioethanol industry through the value added, new jobs and tax revenues it creates. It also opens up new outlets for farmers.

- **More efficient than conventional fuels:**

Bioethanol scores here thanks to its beneficial chemical properties. It has a considerably higher octane rating than petrol, is virtually free of sulphur and is biologically degradable.



*Fraction of different petroleum fuel and bio fuel used in various industries.*

#### IV. SCIENTIFIC APPROACH BEHIND BIOETHANOL

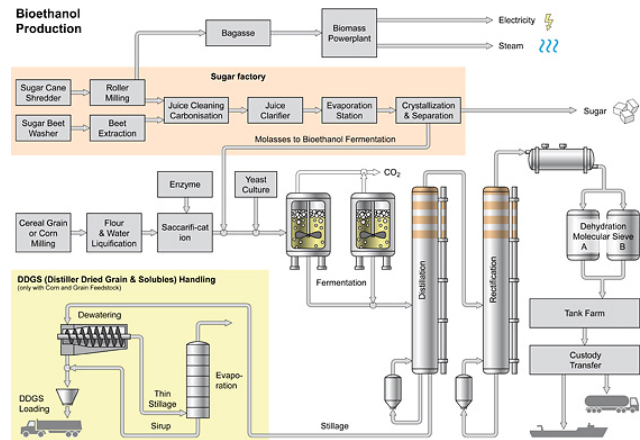
The key raw materials for bioethanol production are sugarcane in Brazil, corn in the USA, corn and wheat in China and molasses in India. In the case of biodiesel, the main feedstocks are vegetable oils from rapeseed, mustard, soybean, sunflower and palm oil. However, the biofuel industry is still at a nascent stage requiring government support in terms of lower taxes and other infant industry incentives.

Sweet sorghum stalk has been found to be a potential source of raw material for commercial ethanol production. Sweet sorghum does not compromise on food, feed or fodder production when used for energy production, thereby meeting the biofuel program's vision of not compromising on food security.

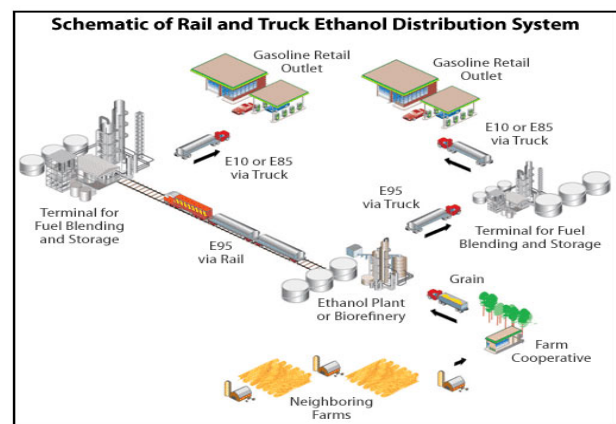
##### • The production of bioethanol from starch-containing cereals takes place in five steps:

1. Mechanical crushing of the cereal grains to release the starch components.
2. Heating and addition of water and enzymes for conversion into fermentable sugar.
3. Fermentation of the mash using yeast, whereby the sugar is converted into bioethanol and CO<sub>2</sub>.
4. Concentration and cleaning the ethanol produced by distillation.
5. Drying (dehydration) of the bioethanol.

Bioethanol can also be produced directly from sugar syrups. This dispenses with steps 1 and 2, which serve to prepare the grain for fermentation.



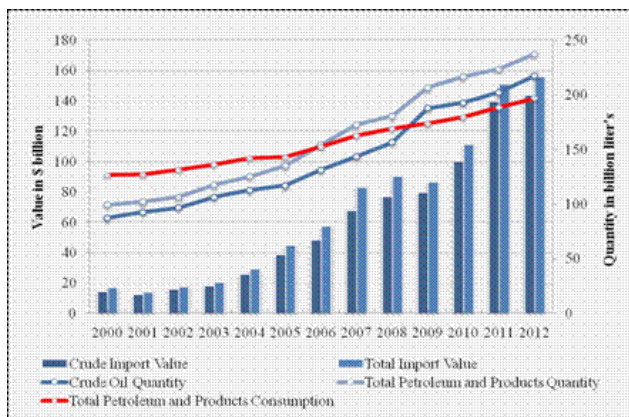
*Systematic flow chart showing the different stages of bio ethanol production*



*Distribution system used to for transportation of bio fuel.*

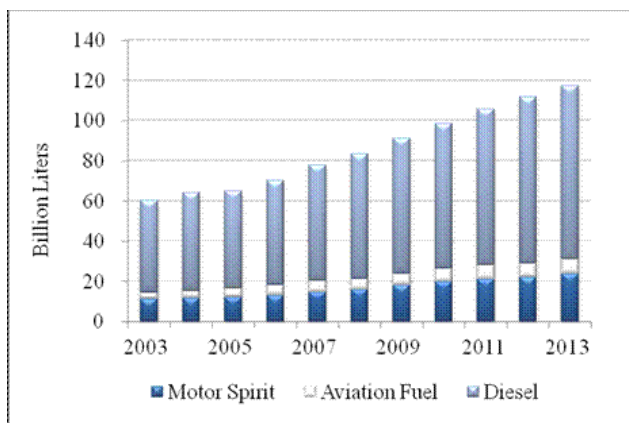
#### V. INDIAN SCENARIO

The Indian economy is expected to grow modestly at about 5 percent over the coming years. India's economic growth is driving its energy consumption across all major sectors, inevitably making it the fourth largest primary energy and petroleum consumers besides being the sixth largest liquefied natural gas importer in the world. With the gradual strengthening of the world economy, developing and emerging economies are expected to grow modestly due to expectation of robust domestic demand, growth in international trade, and easier macro-economic policies.



*Chart showing the increase in import of crude oil and its value in the following years*

Import of gasoline and petroleum products were 40 percent short of total consumption, as early as Indian Fiscal Year 2000. However, with growing reliance on imports, the gap reduced to 5 percent by fiscal 2005 and outgrew consumption in the following year. Since then, imports have been growing at more than 7 percent and were expected to reach 238 billion liters in fiscal 2012, up 40 billion liters over estimated consumption for the same period. While India's domestic energy base is substantial, India continues to rely on imports for a considerable amount of its energy use, consequently accelerating India's oil import expenditure to over \$144 billion in fiscal 2012, up 3 percent over previous year.



*Chart presenting the usage of motor spirit, aviation fuel and diesel in following years.*

## VI. INDIAN BIOFUEL POLICIES

- Derive biofuel from non-feed stock that would be grown on degraded soils or wastelands not otherwise suited to agriculture, thus avoiding a possible conflict of fuel versus food security.
- Strengthen India's energy security by encouraging use of renewable energy resources to supplement motor transport fuels. An indicative 20-percent target for blending of biofuel for both biodiesel and

bioethanol is proposed by end of 12th Five-Year Plan.

- Minimum Support Price (MSP) mechanism for inedible oilseeds to provide fair price to oilseed growers but subject to periodic revision.
- Oil Marketing Companies propose to purchase bioethanol at Minimum Purchase Price (MPP) based on the actual cost of production and import price of bioethanol. In the case of biodiesel, the MPP should be linked to the prevailing retail diesel price.
- If necessary, GOI proposes to consider creating a National Biofuel Fund for providing financial incentives, including subsidies and grants, for new and second generation feed stocks, advanced technologies and conversion processes, and production units based on new and second generation feedstock.
- Thrust for innovation, (multi-institutional, indigenous and time bound) research and development on biofuel feedstock (*utilization of indigenous biomass feedstock included*) production including second generation biofuels.
- Meet the energy needs of India's vast rural population by stimulating rural development and creating employment opportunities and addressing global concerns about containment of carbon emissions through use of environment friendly biofuels.
- Bring biofuels under the ambit of "Declared Goods" by the GOI so as to ensure their unrestricted interstate and intrastate movement. Except for a concessional excise duty of 16 percent on bioethanol, no other central taxes and duties are proposed to be levied on biodiesel and bioethanol.
- Biofuel technologies and projects would be allowed 100 percent foreign equity through automatic approval to attract foreign direct investment (FDI), provided the biofuel is for domestic use only, and not for export. Plantations of inedible oil bearing plants would not be open for FDI participation.
- Setting up of National Biofuel Steering Committee (NBSC) under Prime Minister to provide policy guidelines.

## VII. REFERENCES

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