Journal of Basic and Applied Engineering Research
Print ISSN: 2350-0077; Online ISSN: 2350-0255; Volume 1, Number 9; October, 2014 pp. 67-70

http://www.krishisanskriti.org/jbaer.html

Bio-fuels in Modern Era as an Alternative Fuel Option in India: A Review

Pramit Kumar Mishra[1], Mohd. Mizan Ali[2], Alisha Agarwal[3]

[1,2,3]B.Tech-IVth Year(M.E.), Rajshree Institute of Management & Technology, Labara, Bareilly-243001

Abstract: **The requirement of Motor Spirit is expected to grow from little over approximately 7 million metric ton in 2001 –02 to over 12 million metric ton in 2006-07 and 14 million metric ton in 2011-12 and that of diesel (High Speed Diesel) from 40 million metric ton in 2001-02 to 54.423 million metric ton in 2006-07 and just over 67.256 million metric ton in 2011-12. The present status shows that we are so dependent on these fossil fuels. That's why it is more important to have an alternative option of fossil fuels. Oil provides energy for 94% of transportation and the demand of transport fuel continues to rise. There are several socio-economic and environmental benefits from bio-fuels which are the motivating factors behind policies promoting these fuels in both developed and developing countries like-economic, environmental and as well as for social. Economic saving foreign exchange by reducing import dependence for petroleum products, contributing to nation's energy security. Environmental addressing the problem of local air pollution and reducing CO2 emissions causing climate change as they are considered to be carbon neutral. Social helps in developing of employment opportunities and focus on rural development. In the present paper, we are discussing about current bio-fuel position in India. We also discussing about the impact of this bio-fuels on transportation.**

Keywords - Bio-fuels; Indian and global scenario; Potential and Future Challenges; Policy Framework

1. INTRODUCTION

Bio-fuels are defined here as organic primary and/or secondary fuels derived from biomass which can be used for the generation of thermal energy by combustion or by using other technology. They comprise both purpose - grown energy crops, as well as multipurpose plantations and by-products (residues and wastes).In other words if we want to describe it than we can say that, Bio-fuels are liquid or gaseous fuels produced from biomass resources and used in place of, or in addition to, diesel, petrol or other fossil fuels for transport, stationary, portable and other applications. Bio-fuels are categories in three different parts-

a. **First generation bio-fuels-** Bio-alcohols, Biodiesel, Vegetable oil, Bio-ethers, Biogas

b. **Bio-ethanol** – It is obtained from sugar or starch crops (e.g. sugar beet, sugar cane or corn) by fermentation. Wood, grasses and waste crops can also be converted into bio-ethanol with the help of a process but it is only done at experimental laboratory. Ethanol can be used in either neat form in specially designed combustion engines, or blended with petroleum fuel. India is globally one of the largest producers of sugarcane and ethanol made from sugarcane molasses.

For producing ethanol, India has about 330 distilleries with the annual production capacity of over 4.0 billion liters. In the year 2010, the country produced nearly 1.43 billion liters of ethanol, of which an estimated 50 million liters of ethanol were blended with petrol. Ethanol production is highly volatile in India due to the cyclical nature of sugarcane production and therefore, the blending of ethanol with petrol is also volatile.

For instance, India produced around 2.15 billion liters of ethanol in 2008, of which 280 million liters were used for blended. In 2009, ethanol production went down to 1.07 billion liters and blending to 100 million liters. Blending was further down to 50 million liters in the subsequent year. Ethanol is primarily produced by the fermentation of molasses, and it is estimated that, from one tone of sugarcane.

b. **Bio-diesel**– It is obtained from vegetable oils (e.g. rapeseed oil, jatropha, soy or palm oil) by reaction of the oil with methanol. Waste cooking fat can also be converted into biodiesel. Biodiesel can either burnt directly in diesel engines or blended with diesel derived from fossil fuels. In India, biodiesel is produced mostly from the non-edible oils extracted from the seeds of plants like *jatropha* and *pongamia.*

2. **Second generation bio-fuels-**Advanced Bio-fuels (like Bio-Hydrogen, Bio-methanol)

3. **Third generation bio-fuels-**Micro-Organisms (like algae) - After application of second generation bio-fuel,

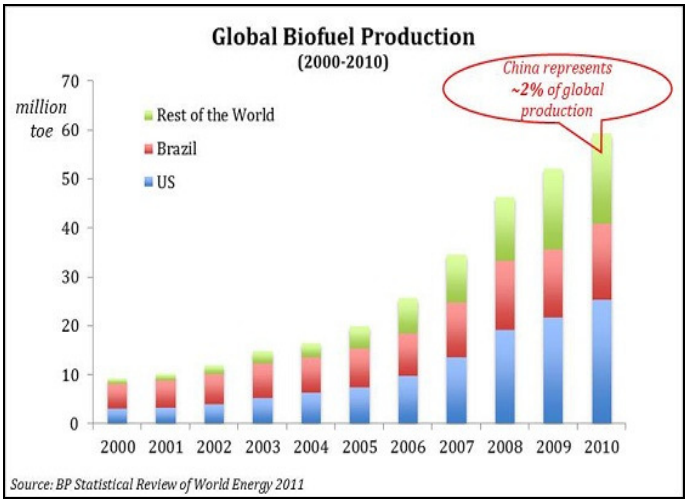
the scientists and researchers came together to find a new idea to generate bio-fuels while the use of crops, food is lesser.

They find algae as key component of bio-fuel. Algae becomes as a new biomass source for the production of renewable energy. The main characteristics of algae which apart it from other biomass sources are that algae (can) have a high biomass yield per unit of light and area, can have a high oil or starch content, do not require agricultural land, fresh water is not essential and nutrients can be supplied by waste water and CO2 by combustion gas.

2. INDIAN & GLOBAL SCENARIO

Present status-

- USA & Brazil account for 80% of total bio-fuel production, mainly bio-ethanol
- EU accounts for about 90% of world's bio-diesel output.
- USA is the world's largest consumer of bio-fuels
- Bio-fuels provide 2.7% of worlds' fuels for road transport
- 31 countries mandate blending bio-fuels

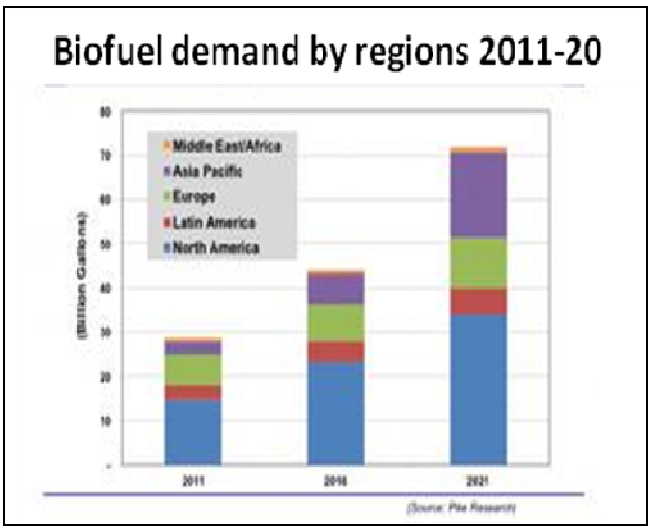


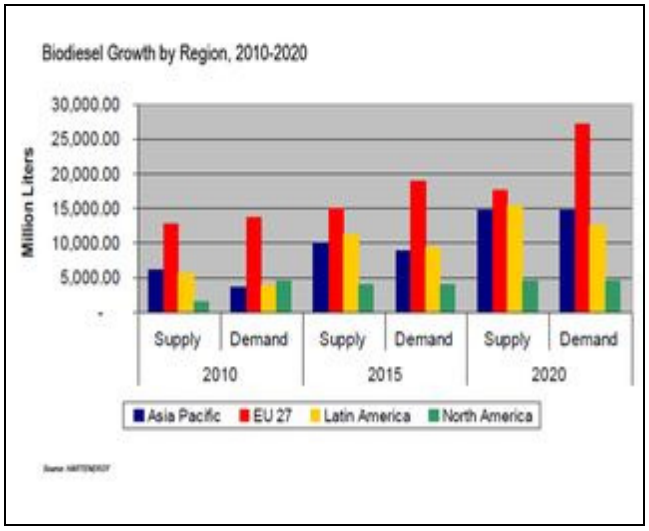
The above figure shows the global production of bio-fuels which gives a overview about how much quantity is produced across the world.

The graph shows comparison b/w Brazil, US, & Rest of the world. In 2011, China contribute 2% of 60 millon toe.

Estimated-

- IEA –potential to meet 5% of total road transport fuel demand by 2030
- IEA – to meet 13% of total transport fuel demand and contributes to about 6% of global emission reductions by 2050.
- Emerging markets – India, China, Indonesia, Malaysia, and Argentina.





****Both the figure is taken from survey of IEO***

3. GLOBAL SCENARIO

In the year 2009-10 the world bio-fuel production touched 113 billion tones which is 66 million tones oil equivalent (mtoe). Currently, around 82 per cent of the global production of liquid bio-fuels is in the form of ethanol.

The two largest ethanol producing countries, Brazil and the USA, accounted for almost 87 per cent of the total production, the rest being contributed by China, Canada, France, India, Russia, South Africa, UK, etc. (Figure 1).

Figure 1: Ethanol production by country: 2010

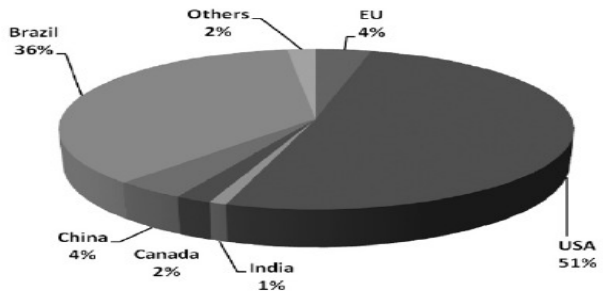


Figure 2: Biodiesel production by country: 2010

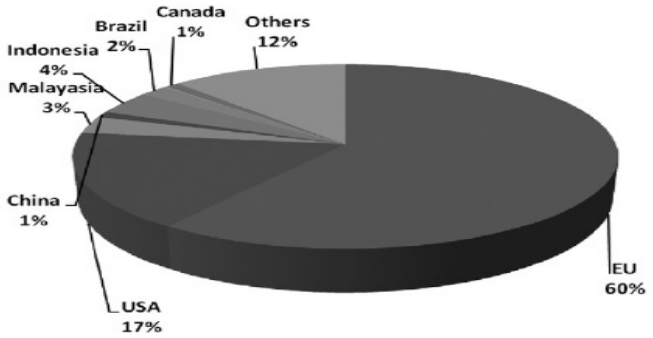


Table 1: Biofuel feedstocks and blending targets in some selected countries

Country	Feedstock		Production forecast 2010 (million litres)		Blending targets (percent)	
	Ethanol	Biodiesel	Ethanol	Biodiesel	Ethanol	Biodiesel
USA	Corn	Soybean	46017	2707	3	1
Brazil	Sugarcane	Rapeseed, castor seed	28950	2162	25	2
EU	Wheat, corn, barley, sugar beet	Rapeseed, sunflower, soybean	6465	9888	5.75	5.75
Canada	Corn, wheat	Vegetable oils	1572	360	5	2
China	Corn, wheat, cassava, sweet sorghum	Palm oil, *jatropha*	2083	-	10	5
India	Sugarcane molasses, sweet sorghum	*Jatropha*, pongomia	1550	95	5	5
Indonesia	Sugarcane, cassava	Palm oil, *jatropha*	425	348	10	10
Malaysia	None	Palm oil	-	647	-	5

Source: F.O.Licht (2009); FAPRI (2010)

Biodiesel -increased from 0.01 million tonnes in 1991 to 21.0 million tonnes by 2010.[a]European Union is the major producer of biodiesel (above 47 per cent), with a significantly smaller contribution coming from the USA (13 per cent). Other major biodiesel producers include China, India, Indonesia and Malaysia (Figure 2). Table 2 shows the extent of diversion of food grains to biofuel production by the countries like United States, European Union, Canada, China, etc. in recent years. In the year 2008, around 95 million tonnes of corn was diverted for bio-fuel production, which is around 12 per cent of the global corn production.

Table 2: Diversion of cereals for ethanol production: 2005-06 to 2008-09

Country	2005-06	2006-07	2007-081	2008-092
	Million tonnes			
USA				
(a) All	41.3	54.5	76.8	101.7
(b) Corn	40.7	53.8	76.2	100.4
(c) Sorghum	0.6	0.7	0.6	1.3
EU-27	3.2	3.4	2.9	5.2
Canada	0.7	1.5	1.8	2.5
China	9.5	11.0	11.5	12.0
Other countries	1.1	1.4	1.9	2.4
Total	55.8	71.8	94.9	123.8

1 Estimates, 2 Projections
Source : von Braun (2008)

4. INDIAN SCENARIO

The domestic production of crude oil from fossil fuels has been more or less stagnant over the years and meets only 38 per cent of the national requirement, while the balance is met through imports of nearly 149 million tonnes of crude petroleum products that cost the country close to US $ 90 billion in 2008-09 (Figure 3).

Figure 3: Domestic production and import of crude oil in India: 1974-75 to 2008-09

Such high reliance on imported crude oil is impacting the country's foreign exchange reserves in a big way (Ethanol India, 2009).

Over the past eight years, the consumption of motor spirit (gasoline) has increased by 6.64 per cent from 7.01 million tones in 2001-02 to 11.26 million tonnes in 2008-09. For high speed diesel (HSD), this growth has been 5.10 per cent from 36.55 million tones to 51.67 million tonnes (MoPNG, 2009). This growth is expected to continue over the next several years since it is projected that the motor vehicle population in India will grow by 10-12 per cent that would further increase the demand for petroleum products. Due to this rapid increase in demand, India's dependence on oil import is expected to rise to 92 per cent by the year of 2030 (IEA, 2009). This growing dependence on fossil fuels for powering the transport sector is the key reason for the country to embrace bio-fuel production on its own. In addition to, various other socio-economic and environmental concerns have also encouraged the shift.

5. POTENTIAL & FUTURE CHALLENGES

Food security is an primary national priority for India due to its one billion plus population rising domestic demand for food, stagnating agricultural productivity, and limited scope for expansion in area under crop cultivation.

6. POLICY FRAMEWORK

A **National Policy on Bio-fuels** was announced in December 2009. The policy is aimed at mainstreaming the use of bio-fuels – bio ethanol and bio diesel, for Indian transport sector. A target of 20 per cent blending of bio-fuels has been set for the country by 2017 (GOI, 2009). Further, the policy has approved the setting up of **National Bio-fuel Coordination Committee** under the Chairmanship of Prime Minister and **Bio-fuel Steering Committee**, in line with the recommendation of the Committee on Development of Bio-fuels.

The Indian policy toward bio-fuels aims to resolve the food versus fuel conflict by promoting non-food feed stocks and cultivation of oilseeds using wasteland and The use of wasteland for cultivating non edible plant borne oilseeds such as jatropha curcas is encouraged for biodiesel production.

In case of bio-ethanol production, sugarcane molasses - a byproduct from the process of producing sugar from sugarcane juice is being used. However, the Commission for Agricultural Costs and Prices recommends the use of excess sugarcane for direct bio-ethanol production from cane juice, in a situation where there is excess supply of sugarcane. 20 per cent blending for both bio-ethanol and biodiesel has been proposed, to be achieved by 2017. A 10 percent ethanol blending for motor gasoline is supposed to be mandatory from October 2008. The pricing of bio-ethanol (produced from molasses) is still a contentious issue, acting as a deterrent in uptake of bio-ethanol for blending. Till date, biodiesel blending is not mandatory in India. The policy grants permission to sugar industry for producing ethanol directly from sugarcane juice, in case it does not affect the sugar production and availability of ethanol for industrial use. Minimum Purchase Price (MPP) will be announced for both – bio ethanol and bio diesel. MPP for bio-ethanol will be based on its production cost and import parity price. MMP for biodiesel will be linked to retail diesel price. It appears from the policy document that even if edible oilseeds are to be used for biodiesel production, they are to be cultivated developing wastelands. Since this may involve higher cost, the policy aims to support such plantations through a separate minimum support price mechanism other than the one currently in place for oilseeds used for edible oil production.

A concessional excise duty of 16 per cent is already being waived in case of bio-ethanol. Biodiesel is exempted from excise duty. Further, the policy promises concessions in Custom and Excise duty for imported plant and machinery for bio-fuel production, bio-fuel compatible vehicle engines, and other applications which are not manufactured indigenously.

In case need arises, import of bio-fuels will be allowed subject to the approval of "National Bio-fuel Coordination Committee". No permission will be granted for importing Free Fatty Acid (FFA) oils. Foreign Direct Investment in plantations for bio-fuels is not allowed. FDI in bio-refinery industry would be allowed upto 100 per cent, in case biofuel produced is for domestic use only.The policy aims to declare biofuel industry as a priority sector for lending purpose by financial institutions and banks in the country. National Bank of Agriculture and Rural Development (NABARD) will be the lending institution for farmers for plantations.

Table 3: Ministries involved with the development of biofuels in India

Ministry	Role
Ministry of New and Renewable Energy (MNRE)	Overall policy making, supporting research and technology development.
Ministry of Petroleum and Natural Gas (MoPNG)	Marketing, development of pricing and procurement policy.
Ministry of Agriculture (MoA)	Research and development on feedstock crops.
Ministry of Rural Development (MoRD)	Identification of wastelands; promotion of biofuel plantations.
Ministry of Science and Technology (MoS&T)	Biotechnological research on feedstock crops.
Ministry of Environment and Forests (MoEF)	Ensuring implementation of Tree-Brone Oilseeds (TBO) crop plantations in forest wastelands; and monitoring health and environmental effects of biofuels.

Source: GoI (2009)

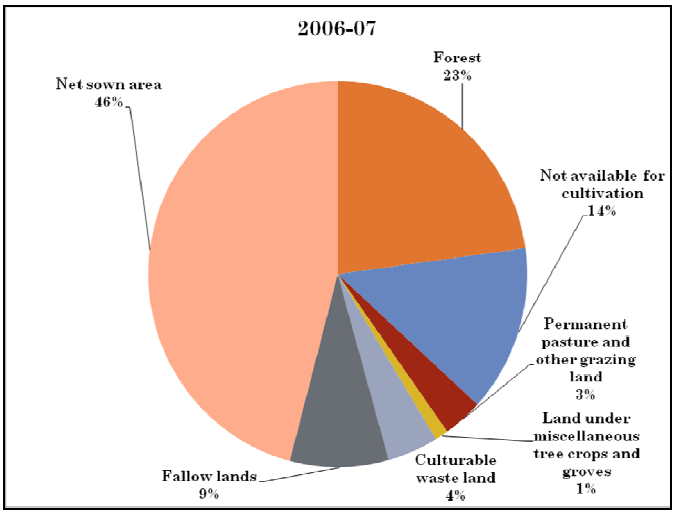
7. FUTURE RECOMMENDATION

In light of the above discussion some alternative options for production of liquid bio-fuels and for re-generation of wastelands are discussed below.

1. **Short duration, multipurpose bio-fuel crops on private farmlands**
   There is lots of short duration crops are presented which is normally used for bio-fuel generation. These crops can be sow on private farmlands.
   There are two important crops which is commonly produced for same purpose are : Sweet Sorghum and Castor

2. **Alternative Plantation Option for Wastelands** The most important thing is earlier a forestation of wastelands either with existing natural root stock or using specially adapted crops like *Acacia Nilotica*, *Prosopis Juliflora*, *Casuarina Equisetifolia*, *Sesbania Egyptia*, and various *Eucalyptus* species can deliver large net benefits even without accounting the positive environmental impact . Hence if the goal of public policy is the rehabilitation of wastelands, there is little evidence to suggest biodiesel crops are the best alternative.

The figure which is given below shows waste land availability in India.



Land use classification and estimates for India (in million hectares)			
	1950-51	**1990-91**	**2006-07**
Forests	40.48	67.81	69.81
Not available for cultivation	47.52	40.48	42.63
Permanent pastures and other grazing land	6.68	11.4	10.36
Land under miscellaneous tree crops and groves	19.83	3.82	3.45
Culturable waste land	22.94	15	13.24
Fallow lands	28.12	23.37	25.72
Net sown area	118.75	143	140.3
Reporting area for land utilisation statistics	284.32	304.88	305.51
Total Geographical Area	328.73	328.73	328.73
Source: Agricultural Statistics at a Glance			

REFERENCES

[1] "Biofuels in India:Potential, Policy and Emerging
[2] Paradigms" by "S S Raju, Shinoj Parappurathu, Ramesh Chand, P K Joshi, Praduman Kumar, Siwa Msangi".
[3] ADB (Asian Development Bank) (2011) Cross-*Sectoral Implications of Biofuel production and Use in India*, Report submitted to Department of Economic Affairs, Ministry of Finance and Government of India, New Delhi.
[4] Altenburg, T., Hildegard D., Matthias H., Nikos N., Christina R. and Kathrin S. (2009) *Biodiesel Policies for Rural Development in India*. Report of German Development Institute.
[5] Ariza-Montobio, P., and Lele, S. (2010) *Jatropha* plantations for biodiesel in Tamil Nadu, India: Viability, livelihood tradeoffs, and latent conflict. *Ecological Economics*, **70**: 189-195.
[6] "BIOFUELS AND ENERGY SECURITY OF INDIA" by "Ramprasad Sengupta & Robin Singhal". Centre for Economic Studies and Planning, School of Social Sciences, Jawaharlal Nehru University, New Delhi