

Analysis of current scenario of Biofuels in India specifically Bio-diesel and Bio-ethanol

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Abstract:- Growth demands energy. India is the world's fifth largest consumer of energy, and by 2030 it is expected to become the third largest, overtaking Japan and Russia. India has only 0.4 percent of the world's proven oil reserves. It is also projected to run out of coal, its primary source of energy, in forty years. Its domestic natural gas reserves are limited as well. Fossil fuels will continue to play a dominant role in the energy scenario in our country in the next few decades. India's energy security would remain vulnerable until alternative fuels to substitute/supplement petro-based fuels are developed based on indigenously produced renewable feedstocks. In biofuels, the country has a ray of hope in providing energy security. The Indian approach to biofuels, in particular, is somewhat different to the current international approaches and is discussed in this paper. It is based solely on non-food feedstocks to be raised on degraded or wastelands that are not suited to agriculture, thus avoiding a possible conflict of fuel vs. food security. An indicative target of 20% blending of biofuels, both for bio-diesel and bio-ethanol, by 2017 is proposed.

Index terms: Biofuel, Energy, Policy, Biodiesel, Ethanol

I. INTRODUCTION

In the context of shrinking crude oil reserves, rising demand and the resultant rise in prices of petroleum, as well as the concerns about global climate change and energy security, bioenergy is becoming increasingly relevant as a possible and potential alternative to fossil fuels. 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. Biofuels are derived from renewable bio-mass resources and, therefore, provide a strategic advantage to promote sustainable development and to supplement conventional energy sources in meeting the rapidly increasing requirements for transportation fuels associated with high economic growth, as well as in meeting the energy needs of India's vast rural population. There are two types of bio-fuels:

(i) *First generation biofuels:* First generation biofuels are made from biomass consisting of sugars, starch, vegetable oils, animal starch or biodegradable output wastes from agriculture, industry, forestry and households using

and meets only 30% of national requirement, while the balance is met through imports of nearly 146 million metric

conventional technologies. Bio-diesel and bio-ethanol comes under first generation bio-fuels.[9],[10].

(ii) *Second generation biofuels:* Second generation biofuel technologies are gaining importance because first generation biofuels manufacture has got major limitations. The primary one is that, they cannot be produced beyond a threshold level without threatening food security. They are also not cost-competitive with existing fossil fuels. The second generation fuels are more sustainable, affordable and have greater environmental benefits. However, they have not become popular because the technology for producing these is not yet standardized. Further;

Lignocellulosic materials can be converted to alcohol. Organic waste material converted into energy forms which can be used as an automotive fuel: waste oil (e g, cooking oil) into biodiesel; animal manure and organic household wastes into biogas; and special strains of algae, agricultural and forestry-waste products into ethanol. It also helps to diminish waste management problems [1].

(iii) *Third and Fourth generation bio-fuels:* The third generation biofuels include Algal biodiesel, Algal hydrogen and conversion of biomass to hydrogen whereas the fourth generation biofuels include biofuels from high solar efficiency cultivations. However, these are still at a nascent stage.

Biofuels offer a number of environmental, social and economic advantages. The use of biofuels may lead to reduction in vehicular pollution and greenhouse gas emissions as it is established that the emission of sulphur dioxide (SO₂), particulate matter and carbon monoxide (CO), etc. are less from biofuels. The economic and social benefits arising out of the development of biofuel sector through increased income and employment opportunities for the rural communities is also highlighted. The greening of wastelands and regeneration of degraded forest lands through cultivation of biofuel crops is another added advantage.

II. CURRENT SCENARIO OF BIOFUELS IN INDIA

The domestic production of crude oil from fossil fuels remains more or less stagnant over the years tonnes of crude petroleum products that cost the country close to \$90 billion in 2008-09.

In 2010, India registered the highest change in bio-fuel production from the previous year. With the addition of 0.151 million tonnes of oil equivalent, India registered an 85% increase in production over its 2009 production. India holds only 0.3% share of the global of production in 2010. However, this is likely to increase as India prepares for a change in its bio-fuel mandate from its current E5 (5% ethanol content in the fuel supply) to E10 (10% ethanol content in the fuel supply) and ultimately E20 by 2017. Present estimates indicate India’s bio-fuel demand at 0.5 billion gallons in 2012 which will grow to 6.8 billion gallons by 2022. According to India’s Planning Commission, the demand for diesel in India is five times higher than petrol. But while the ethanol industry is mature, the biodiesel industry is in its infancy. India’s ambitious National Biodiesel Mission will aid in the technological research, production and trade of biodiesel in order to meet 20% of the country’s diesel requirements by 2012 and drive production levels upwards for the subsequent years[1].

III. BIODIESEL AND BIOETHANOL : INDIA’S CURIOUS CASE

India’s biofuel production accounts for only 1% of the global production. This includes 380 million litres of fuel ethanol and 45 million litres of biodiesel. It is worth noticing that India is the second largest producer of sugarcane in the world but accounts for only about 1% of global ethanol production. This can be attributed to the fact that 70-80% of the cane produced in the country is utilized for production of sugar and the remaining 20-30 % for alternate sweeteners like jaggery and khandsari.

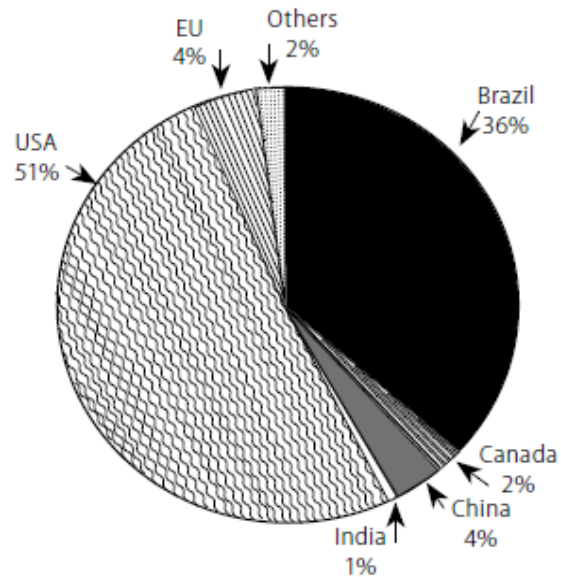


Fig 1. Ethanol production by country, 2008

Ethanol is produced from fermentation of molasses which is a by-product in the manufacture of sugar from sugarcane. It is estimated that, out of one tonne of sugarcane, 85-100 kg of sugar and 40 kg of molasses can be recovered. The processing industry experience periodic market gluts of sugarcane, sugar and molasses due to cyclical nature of sugarcane and sugar production in India. Out of the total alcohol produced, 25% is being used for industrial purposes, 30-35% is used for potable purposes and 3-4% for other uses. The surplus available alcohol is being diverted for fuel.[1],[5]

TABLE 1: PROJECTED DEMAND FOR PETROL AND DIESEL AND BIOFUEL REQUIREMENTS[2],[3]

Year	Petrol Demand in Mt	Ethanol blending requirement in Mt			Diesel Demand in Mt	Diesel blending requirement in Mt		
		@5%	@10%	@20%		@5%	@10%	@20%
2006-2007	10.07	0.50	1.01	2.01	52.32	2.62	5.23	10.46
2011-2012	12.85	0.64	1.29	2.57	66.91	3.35	6.69	13.38
2016-2017	16.4	0.82	1.64	3.82	83.58	4.18	8.36	16.72

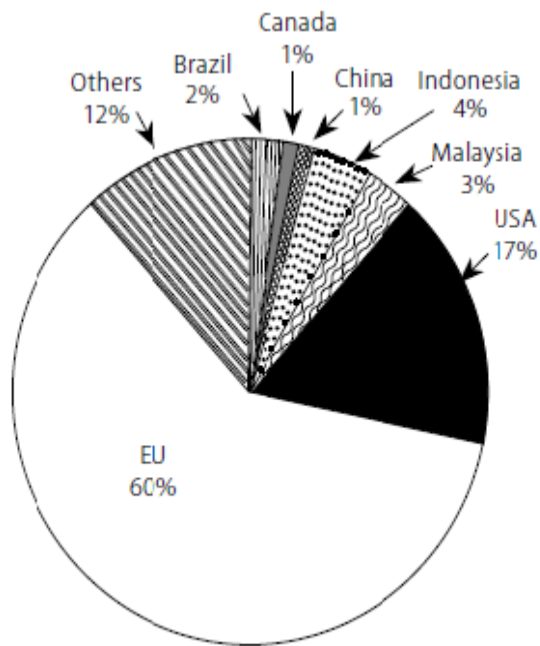


Fig 2. Biodiesel production by country, 2008

India is not self-sufficient in edible oil production and depends upon large quantities of import of palm oil and other vegetable oils to meet the domestic demand. So India does not use vegetable oils derived from rapeseed, mustard or palm oil for production of biodiesel. Biodiesel in India is mostly produced from oils extracted from non-edible seeds of shrubs like jatropha and pongamia[1],[13]-[15]. But the cultivation practices are not backed by adequate research. Cultivation of jatropha and pongamia needs intercropping standard spacing of 2 x 2 m irrespective of soil conditions. They also require proper irrigation for better fruiting and seeding. High production cost and overemphasis on one feedstock also contributes to low production of biodiesel in India. Getting adequate quantity of wastelands is difficult because of its impact on forest conservation.[11],[12].

V. DEVELOPMENTS UNDER THE BIOFUEL POLICY

The Government of India approved the “National Policy of Biofuels” on December 24, 2009. Since then, considerable advancements have taken place in the direction of cultivation, production and use of biofuels.

The policy and the developments following it have strengthened India’s energy security by encouraging the use of renewable energy resources to supplement transport fuels. It has stimulated rural development and has also created employment opportunities. It has addressed the global concern about containment of carbon emission through use of environmentally friendly biofuels.

Biofuels is derived from non-feed stock that is being raised on degraded land or wasteland that are not suited to agriculture. This has avoided a possible conflict of fuel verses food security. The policy has also facilitated and brought

about the development and utilization of indigenous feedstock for production of biofuels.

Minimum Support Price (MSP) has ensured a fair price for biodiesel oil-seed growers. Oil marketing companies purchase bioethanol at Minimum Purchase Price (MPP) based on actual cost of production and import price of bioethanol. In the case of biodiesel, MPP is linked to prevailing retail diesel price. National Biofuel Fund provides financial incentives, including subsidies and grants, for new and second generation feed stocks, advanced technologies and conversion processes and production units.

Except for concessional excise duty of 16 percent on bioethanol, no other central taxes and duties are levied /imposed on biodiesel and bioethanol. Biodiesel technologies and projects are allowed 100 percent foreign equity through automatic approval routes to attract Foreign Direct Investments (FDI), provided biofuels is for domestic use only, and not for export. The Prime Minister is the head of the National Biofuels Coordination Committee (NBCC).

Some development works have been carried out with regards to the production of trans-esterified non-edible oil and its use in biodiesel by units such as Indian Institute of Science, Bengaluru and Tamil Nadu. Generally a blend of 5% to 20% of biodiesel (B5 to B2) is used in India. Indian Oil Corporation (IOC) has taken up research and development work to establish the parameters of the production of trans-esterified Jatropha vegetable oil & use of biodiesel in its research and development center at Faridabad.

The Indian Railways has started to use the oil (blended with diesel fuel in various ratios) from the Jatropha plant to power its diesel engines with great success. Currently the diesel locomotives that run from Thanjavur to Nagore section and Tiruchirapalli to Lalgudi, Dindigul and Karur sections run on a blend of Jatropha and diesel oil. In one of the biggest initiatives for bio-fuel production in the country, Indian Railways is poised to set up four bio-diesel plants costing about Rs. 120 crore. While two bio-diesel esterification plants are going to be commissioned at Raipur and Chennai during the next two years, the other two units will be set up subsequently. Each plant, estimated to cost around Rs 30 crore, will produce 30 tons bio-diesel per day, which means more than 9,000 tons a year[4],[6]-[8].

V. CONCLUSIONS AND FUTURE PROSPECTIVES

Currently, India’s position in global biofuel map is not very prominent. However, the country has ambitious plans to expand the biofuel sector. After analyzing the ‘National Policy on Biofuels’ of the Government of India (Ministry of New & Renewable Energy), we would like to make the following recommendations:

- 1.The Government should take steps in the direction of setting up regulating nurseries for certification of seeds and planting materials and to regulate the mechanism of cultivation.

2. An up-to-date technology policy is central to bring in efficiency in production which is also cost-effective so that the industry would survive on its own without any subsidies or support.
3. The focus on research has to be sustained to explore the feasibility of environment-friendly and economically sustainable feed stocks.
4. Offer opportunities for promoting local level entrepreneurship and enhancement of women's participation.
5. Ambiguity in land rights is also considered as an issue in development of wastelands for biofuel. Therefore, the facts regarding such arguments also need to be verified before opting for a full-fledged expansion of biofuels in the country.
6. Modification in the engines of the vehicles so that it can run on hybrid fuels.
7. The Government should adopt some of the measures from the success of biofuels in countries like Brazil.

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